

Consumer Knowledge and Perception of Wine Certifications: A Regional Analysis in Italy

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Abstract

Italian wine consumers encounter multiple certification labels, yet their self-reported understanding and perceived importance of these labels vary across certification categories and consumer groups. This study examined self-reported knowledge and perceived importance of three certification categories among Italian wine consumers: Protected Designation of Origin/Protected Geographical Indication (PDO/PGI, assessed jointly), organic certification, and sustainability certification (represented by the VIVA, Equalitas and SOStain schemes, assessed jointly). Data were collected through online surveys conducted in the first quarter of 2023, 2024, and 2025 (N = 3,550). Regional differences were examined using Kruskal–Wallis tests with post hoc comparisons, while cumulative-link proportional-odds logistic regression models were used to assess associations with age, gender, income, macro-region, survey wave, and, for importance outcomes, self-reported knowledge. The PDO/PGI category showed the highest self-reported knowledge and the sustainability category the lowest, although comparisons between categories are limited by the different numbers of logos presented for each. Self-reported knowledge was positively associated with perceived importance for all three certification categories and significantly improved model fit. Moving from Level 1 to Level 3 of self-reported knowledge was associated with an increase of 8.4 to 12.8 percentage points in the predicted probability of rating certification importance as high (≥ 4). Sociodemographic and regional associations varied by certification category: macro-region was associated with Organic and Sustainability importance but not PDO/PGI importance. The findings indicate that self-reported certification knowledge and valuation are related but category-specific, highlighting the importance of clear communication about the meaning and requirements of different certification schemes.

Keywords: Wine certifications; PDO/PGI; Organic wine; Sustainability; Consumer perception

1 Introduction

Consumer preferences in the agri-food sector have increasingly moved toward products that provide information about their origin, production methods, and environmental impact. Growing concerns about sustainability, food quality, and transparency have encouraged consumers to pay greater attention to labels and certification schemes when making purchasing decisions [1, 2]. Within this broader trend, wine purchasing decisions present a unique challenge to consumer behavior research: unlike most fast-moving consumer goods, the quality of wine cannot be assessed before consumption, making it a type of

credence goods, and certification labels become the main communication bridge between producers and buyers [3].

This evolution has elevated the wine label from an ordinary packaging element to a primary point of contact between producer and consumer, where certifications like Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), organic and voluntary sustainability labels are starting to play an important role in consumers' purchasing decisions [4, 5]. These three types of certifications differ in terms of their objects of certification, regulatory bodies, and the uniformity of information communication, and the distinction is central to this study. PDO and PGI are forms of origin-based certification; operating under the EU public legal framework (Regulation (EU) No 1308/2013), they guarantee that a wine's characteristics derive from a specific geographical area and comply with product specifications [6]. Organic certification, by contrast, is a process-based certification focusing on the production environment. It verifies that vineyard management and winemaking processes adhere to the input restrictions and permitted practices stipulated in Regulation (EU) No 2018/848, subject to verification by accredited bodies and marked with a mandatory, uniform EU logo [7]. The term "sustainability certification" in this paper refers to various voluntary systems that evaluate wine producers or products across environmental, social, and economic dimensions based on multiple criteria. Unlike organic certification, these systems typically base their assessments on outcomes or indicators rather than specific inputs (covering aspects such as carbon and water footprints, biodiversity, energy use, labor conditions, and territorial relationships). Furthermore, unlike PDO/PGI and organic certifications, sustainability certifications lack a unified EU legal definition or logo. In Italy, relevant certification systems range from public-private or private standards, such as VIVA, Equalitas, and SOSStain, to the national certification framework for the wine supply chain launched in 2022 [8].

Therefore, while organic certification and sustainability certification are related, they are not coextensive. Organic production practices contribute to sustainability goals and are sometimes recognized in sustainability assessments. However, a wine with sustainability certification is not necessarily organic, nor does an organic wine necessarily meet social or economic sustainability standards. Significant differences also exist regarding the maturity of regulatory frameworks and the consistency of information communication with the former featuring a unified EU logo with a clear legal definition, whereas the latter involve a multitude of logos linked to specific certification schemes, each with varying scopes. This disparity represents more than just a difference in definitions, and it is a key issue addressed in this study, as the proliferation and overlap of various certification schemes have been shown to confuse consumers and trigger the phenomenon of "attribute neglect" [9, 10]. In this paper, "sustainability

certification” denotes a category of voluntary schemes rather than any individual scheme; in the survey, this category was represented by three schemes operating in the Italian wine sector (VIVA, Equalitas and SOSTain). Likewise, PDO and PGI are treated as a single origin-certification category, while “organic” specifically denotes certification that complies with EU organic regulations. The study therefore examines consumers’ self-reported knowledge and perceived importance of certification categories, not of individual certification schemes (see Section 3.2).

However, simply labeling products does not guarantee that consumers understand their meaning, nor does it guarantee that this understanding will translate into purchasing behavior. For instance, a study by Stanco et al. [5] found that geographical indications and grape variety ranked among the most important purchase drivers for Italian consumers, but that “eco-packaging” and “sustainability” were often conceptually misunderstood. A recurring finding in the literature on wine economics is that consumers may value certification systems, but they cannot clearly articulate what these certifications actually certify [9]. This gap between symbol recognition and substantive knowledge is serious. Specifically, if certification labels primarily function as emotional cues rather than informational signals, their ability to correct information asymmetry is fundamentally compromised, even though it is their core regulatory rationale [11].

Italy offers a particularly suitable setting for analyzing consumer perceptions of wine certifications in the EU context. Two of the three certifications categories examined here are based on EU-wide regulatory instruments. PDO and PGI wines are governed by the common market organization regulation (Regulation (EU) No 1308/2013), while organic production is standardized under Regulation (EU) 2018/848. Consequently, consumers across member states encounter identical labels and benefit from the same legal protections. In contrast, sustainability certification remains voluntary and fragmented across a range of competing national and private schemes. These three certification categories represent distinct stages of regulatory maturity and integration in information communication, which is not unique to Italy but is prevalent across all European wine markets. Furthermore, Italy serves as a “conservative” case study for assessing consumer awareness of labels. The country is among the largest wine producers in the European Union and holds one of the highest numbers of registered geographical indications [12]. If consumer understanding of the certification system remains superficial and uneven even in such an environment, one can hardly expect deeper awareness in markets where certified products are less prevalent or where geographical indications lack deep cultural roots. Consequently, the findings of this study can be viewed as an “upper-bound” reference for consumer label awareness within similar European markets. Finally, the internal heterogeneity of Italy itself offers significant value for

comparative research. Northern Italy differs markedly from the South and the islands in terms of economic development, retail structure, and wine culture, and these differences parallel, on multiple levels, the contrasts observed between Northern and Southern European member states [12]. Consequently, a macro-regional analysis allows us to examine how specific mechanisms (such as local market structure and exposure to certifications) influence consumer perceptions within a single country. While these mechanisms are also present in cross-national comparisons across Europe, their effects in such studies are often confounded by differences in language, regulation, and retail systems. Therefore, certification knowledge levels may vary not only across different population groups but also between Italy's four main regions—North, Centre, South, and Islands—and these differences have not yet been systematically analyzed. This study examines how regional location and sociodemographic characteristics are associated with Italian consumers' self-reported knowledge of, and the importance they attach to, three certification categories (PDO/PGI, organic certification, and a sustainability certification category comprising several voluntary schemes). Using a large-scale online survey spanning several years ($N = 3,550$), combined with nonparametric regional comparisons, Spearman correlation analysis, and ordered logistic regression, we explored the following four research questions:

- (i) What are the prevailing levels of self-reported knowledge of the PDO/PGI, organic, and sustainability certification categories among Italian wine consumers?
- (ii) Is the macro-region of residence within Italy associated with consumers' self-reported knowledge of, and the importance attributed to, these certification categories (PDO/PGI, Organic, and Sustainability)?
- (iii) Is consumer self-reported knowledge positively associated with the perceived importance of each certification category?
- (iv) Which sociodemographic and knowledge-related variables are associated with the importance that consumers assign to each certification category?

This study makes four contributions to the literature on consumer behavior. First, to our knowledge, it is the first to simultaneously assess the relationship between self-reported knowledge and perceived importance for three certification categories using a unified measurement tool applied to the same group of respondents. The study draws on a large-scale, multi-wave survey sample ($N = 3,550$) covering all four macro-regions of Italy. Although the sample is non-probabilistic and thus not statistically representative of the Italian population as a whole (see Section 6), its size and geographic coverage permit adjusted comparisons across certification categories and regions that single-certification or single-region studies cannot support, although comparisons between categories must take into account that the categories were represented by different numbers of logos (see Sections 3.2 and 6). Second, it documents

systematic differences between traditional geographical indication labels and value-based environmental labels in the sociodemographic correlates of perceived certification importance, with implications for marketing strategies and public policy. Third, by integrating regional, sociodemographic, and self-reported knowledge variables into a single model framework, this study deepens our understanding of how the information environment relates to consumers' responses to credence claims. Fourth, because the certification categories analyzed differ systematically in their degree of regulatory harmonization, and because territorial variation is modelled explicitly rather than treated as noise, the findings may provide a useful comparative reference for other European wine-producing countries with similar regulatory and market characteristics.

2 Literature Review

2.1 Information asymmetry issues in consumer knowledge and certification

Credence goods are defined by the persistent inability of consumers to evaluate quality even after consumption [13]. In such markets, third-party certification schemes are designed to compress information asymmetry by providing verifiable quality signals [14]. A recurring theme in the wine economics literature is that consumers frequently value certifications without fully understanding what they guarantee. Corduas et al. [15], surveying attendees at Italian wine fairs, found region of origin and grape variety to be more trusted purchase cues than certifications or packaging even when consumers were unclear about what PDO or PGI actually entailed. This pattern has been reinforced by neuromarketing evidence – Sapienza et al. [16] demonstrated that emotional engagement with labels, measured through EEG and eye-tracking, often precedes cognitive processing, implying that even well-intentioned educational messaging competes with subconscious visual cues. Complementarily, Annunziata et al. [17] found that two-thirds of Italian Gen Y wine consumers could not recall any health-related message from labels, suggesting that shallow engagement with label content is the norm rather than the exception.

On the producer side, the picture is equally sobering. Giacomarra et al. [18] found that Sicilian wineries often lacked familiarity with the international standards underlying their own voluntary certifications, while Pierli et al. [19] reported that firms in the Marche region viewed PDO/PGI as export-enabling credentials whose domestic signaling value had eroded. If both producers and consumers have an incomplete grasp of what labels mean, the resulting information asymmetry limits the ability of certification systems to fulfil their core function of signaling quality and authenticity.

2.2 Consumer knowledge of wine certifications: objective and subjective dimensions

Consumer knowledge is a multidimensional concept, and relevant literature distinguishes between at least two components that are interrelated yet not interchangeable [20, 21]: objective knowledge refers to accurate information stored in memory, typically measured via scored factual questions, such as whether a respondent can correctly identify what a specific label certifies; subjective knowledge, in contrast, refers to the knowledge consumers believe they possess, specifically, their self-assessed familiarity with a label and their perceived understanding of its meaning [22, 23]. The two are only moderately correlated [24] and exhibit predictable discrepancies: consumers may feel familiar with a label without truly grasping its regulatory implications, or they may answer factual questions correctly yet lack confidence in their knowledge. This distinction is widely recognized in the wine sector, and research indicates that these two dimensions are associated with different outcomes: objective knowledge is a better predictor of information-seeking behavior and the accuracy of cue usage, whereas subjective knowledge is more closely linked to confidence, evaluative judgments, and the weight consumers assign to product cues when making choices [25, 26].

This study examines the concept of “subjective knowledge”, operationalizing it as consumers' self-reported familiarity with three certification categories and their perceived understanding of what those categories signify (see Section 3.2). This choice stems from the specific research questions addressed here. The study focuses on the perceived importance consumers attach to a certification when purchasing wine which is an evaluative judgment regarding an informational cue, rather than a test of the accuracy of their understanding. Relevant theoretical and empirical research indicates that such judgments depend more on the knowledge consumers believe they possess than on the information they can accurately recall [21, 23]. In other words, if consumers believe they understand a label, they are more likely to base decisions on it, regardless of whether that understanding is factually correct. Consequently, “subjective knowledge” serves not only as a potential mechanism through which certification labels influence product valuation but also as an appropriate predictor for analyzing the relationships in this study. Furthermore, this metric directly captures the study's underlying premise that consumers may value labels they do not truly understand [10, 27]. The limitations associated with this choice, specifically, the inability to assess the accuracy of perceived understanding or to determine the extent to which the link between self-reported knowledge and perceived importance reflects actual cognitive knowledge of the label. These are discussed in Section 6, which also identifies objective measurement as a key direction for future research.

Consumer interest in environment- and quality-certified wines has grown considerably, though awareness remains shallow and unevenly distributed. Sgroi et al. [27] found that 88% of surveyed Italian

consumers expressed interest in buying sustainability-certified wines, yet only 35% recognized the SOStain label, suggesting that stated preferences often outpace verified label literacy. The Organic label fares somewhat better – Moscovici et al. [28] showed in a global analysis that belief in the value of organic certification was the strongest driver of willingness to pay, though the effect was moderated by country-specific market expectations. In experimental settings, Scozzafava et al. [29] reported that organic wine commanded the highest average bid in auction experiments, but only after participants received explicit information about production methods, indicating that sensory experience alone is insufficient to activate the organic price premium.

These results point to a fundamental paradox that sustainability and organic labels carry symbolic power even when consumers cannot articulate what they certify. Boncinelli et al. [10] documented that 72% of Italian consumers exhibit “attribute non-attendance” toward sustainability labels during purchasing decisions, partly due to cognitive overload from overlapping certification schemes. It was found that many consumers conflate the meanings of organic, natural, and biodynamic wines, creating confusion that undermines trust in all three categories [11]. Capanna Piscè et al. [9], employing semiotic analysis, showed that organic symbols elicit positive emotional engagement and quality attributions without necessarily activating awareness of the underlying regulatory framework. Together, these findings suggest that the persuasive function of sustainability labels partially decouples from their informational function, with important implications for both regulatory design and consumer education strategy.

2.3 Sociodemographic moderators of certification knowledge and valuation

Consumer awareness of food labeling is not uniformly distributed. In the wine sector, sociodemographic characteristics have been shown to predict consumers' awareness of labels and their subjective emphasis on certifications. Gender differences are well-documented: women tend to place greater emphasis on environmental and health-related labels [30], a finding validated in multiple countries. The effects of age are more nuanced; older consumers tend to be more familiar with traditional geographical indications, potentially reflecting their longer market experience while younger generations show a stronger inclination towards sustainability and organic certifications, even if they don't necessarily have a deeper understanding of specific certification systems [31]. Higher incomes correlate with a greater willingness to purchase organic and premium certified wines [28], consistent with the typically higher price premiums in these categories.

Education level is another relevant sociodemographic factor worth exploring. In the broader literature on food labeling, education level is positively correlated with consumers' objective awareness of certification systems [32]. However, evidence within the wine sector remains relatively weak and

inconsistent. This is likely because wine knowledge constitutes domain-specific expertise acquired primarily through consumption experiences rather than formal schooling. Furthermore, the concept of “subjective knowledge” examined in this study reflects consumers' perceived familiarity rather than objectively verified accuracy. Data on education level were not collected in this survey; the implications of this omission for the interpretation of results are discussed in Section 6. Finally, although subjective awareness (i.e., consumers' self-assessed familiarity) is directly related to purchasing behavior, the relationship between subjective awareness (i.e., consumers' self-assessed familiarity) and their emphasis on certification remains insufficiently studied compared to objective awareness [33].

2.4 Territorial variation in certification perception: the Italian case in comparative perspective

The phenomenon of regional disparities in the perception of certification labels is not unique to the Italian market. Comparative studies across European nations indicate that consumer willingness to pay for organic and geographical indication (GI) wines is primarily moderated by country-specific market expectations rather than solely by the label design itself [28]; similar patterns of internal variation emerge in other wine-producing countries where there are regional differences in the prevalence of certification and the level of market development. Italy offers an excellent setting for analyzing and isolating this mechanism, as its four macro-areas exhibit significant differences in these respects while sharing a unified regulatory framework, language, and retail system. Consequently, this regional diversity is not merely a factor to be considered during sampling but an analytically relevant factor in the perception of certification. It was found that Southern Italian consumers placed greater emotional trust in traditional products, while Northern consumers relied more on formal certification evidence [34]. [35], surveying 1,200 respondents, showed that motivations for choosing quality wines shifted along a regional and socio-economic spectrum, with PDO preference concentrated among educated, affluent consumers in the North. Ceccacci et al. [36] documented how wine producers in Emilia-Romagna used territorial sustainability certifications to simultaneously enhance regional reputation and demonstrate environmental commitment as a dynamic largely absent in Southern regions. Dominici et al. [2] added nuance by demonstrating that organic labels increased perceived quality and willingness to pay only when associated with lower-equity geographical indications, suggesting that strong regional brands may already signal the sustainability attributes that a separate label would otherwise communicate.

These studies collectively demonstrate that regional wine cultures shape consumers' cognitive and evaluative frameworks for interpreting certification information. For example, consumers living in the north, surrounded by a high concentration of PDO and PGI products, may have a significantly different understanding of geographical indication labels compared to those living in island regions. In island

regions, regional branding is less saturated than in the north, but environmental values may play a more significant role in quality judgments. To date, no research has systematically tested this assertion simultaneously across Italy's four main regions and various certification categories. To fill this gap, this study, after controlling for standard socio-demographic covariates, examines whether regional location is a significant independent predictor of consumers' awareness and perceived importance of certification categories. Because the regulatory framework is common to all macro-areas, residual regional differences are unlikely to reflect institutional differences and may instead be related to local market structures, wine cultures, or differences in population composition (see Section 6). It is precisely this characteristic of isolation that makes the research findings valuable for understanding the situation in other parts of the EU. Given the disparities across regions (i.e., within individual countries like Spain, Portugal, and Greece, or among the member states) regarding the prevalence of certification and the level of market development, corresponding differences in consumer awareness and value assessment should be expected. Therefore, a unified EU-wide communication strategy should not be assumed to produce uniform effects.

3 Materials and Methods

3.1 Data collection and sample

The data were collected through a Computer-Assisted Web Interview (CAWI) administered by a professional market research agency specializing in national consumer panels. Data collection was conducted in three survey waves, during the first quarter of three consecutive years: 2023, 2024, and 2025. The same questionnaire, response options, and recruitment procedure were used in all three waves. Stratified quota sampling was applied on the basis of official statistics from the Italian National Institute of Statistics (ISTAT), with quotas established for age, gender, and macro-regional distribution to approximate the demographic composition of the target population. Nevertheless, the realized age and gender composition differed across waves (Supplementary Table S1), and the sample remains non-probabilistic (see Section 6). The multi-year data collection strategy was implemented to obtain a large and stable sample and to reduce the influence of short-term market changes on consumer opinions, while fielding all waves in the same quarter kept seasonal conditions constant. A total of 3,550 valid responses were obtained ($n_{2023} = 1,250$; $n_{2024} = 1,300$; $n_{2025} = 1,000$). Prior to participation, respondents provided informed consent after reading a project disclosure sheet outlining the objectives of the survey. Participation was voluntary and anonymous, and no sensitive personal information was collected. The

participants were required to be at least 18 years old and participation was additionally restricted to individuals currently residing in Italy who regularly purchase wine.

The repeated cross-sectional design employed in this study is well established in survey methodology: by pooling data from successive survey waves, it enhances the precision of estimates for subgroups that single-wave surveys cannot adequately support, while also avoiding biases that might arise if conclusions were based solely on conditions during a specific data-collection period [37, 38]. As a new sample is drawn for each wave, this design also circumvents issues such as sample attrition and panel-conditioning bias associated with repeatedly interviewing the same group. This approach is also widely used in research on food and wine consumers. For instance, the Geisenheim Wine Consumer Report has relied for over a decade on periodic, representative surveys of German wine consumers [39], and similar annual survey data have underpinned analyses regarding front-of-pack food labelling [40].

To analyze geographic differences in consumer behavior while maintaining adequate subsample sizes, the 20 administrative regions of Italy were grouped into four macro-areas: North, Centre, South, and Islands. The classification was based on the official territorial framework of the Italian National Institute of Statistics (ISTAT), which is aligned with the European NUTS 1 classification [41]. Although the ISTAT framework distinguishes North-West and North-East, these two sub-areas were combined into a single “North” category in the present study to ensure adequate sample sizes and facilitate comparisons across macro-areas.

3.2 Questionnaire structure and variables

This study used a structured questionnaire to capture a wide range of variables related to socio-demographics, consumer behavior, and perceptions of wine certifications. Participants were asked to report their knowledge of and the importance they attributed to the three wine certification categories considered in this study, i.e., PDO/PGI, Organic and Sustainability certifications, which were presented as separate categories in the questionnaire, along with their demographic information (age, gender, region of residence, and income). For each certification category, respondents were asked to assess their level of knowledge and the importance they attributed to the corresponding certification category when purchasing wine. Table 1 provides a detailed description of the questions and variables included in the analysis. Each certification category was presented as a separate question accompanied by the corresponding logos (the EU organic logo for organic certification; the VIVA, Equalitas, and SOSStain logos for sustainability certification). The VIVA, Equalitas, and SOSStain schemes are existing sustainability certification schemes operating in the Italian wine sector, each involving verification by independent bodies; no fictitious label was used. The three sustainability logos were shown together, and

respondents gave a single answer for the sustainability category as a whole. The resulting measures therefore refer to the category and cannot distinguish respondents' familiarity with, or evaluation of, VIVA, Equalitas or SOStain individually: a respondent may have recognized one scheme but not the others, or attributed different scopes to them. By contrast, the organic category was represented by a single logo, so the categories differed in the number of logos presented, which may affect their comparability (see Section 6). Respondents were thus asked about the three categories separately and could report different levels of knowledge and importance for each. For knowledge, respondents were asked: "Which of the following statements best describes your knowledge of [PDO/PGI / organic / sustainability] certification for wine?", with response options (1) "I don't know this label/certification"; (2) "I recognize this label/certification, but I do not know what it means"; (3) "I recognize this label/certification and understand what it means." For perceived importance, respondents were asked: "How important is the presence of a [PDO/PGI / organic / sustainability] certification when you choose a wine to purchase?", with responses on a 5-point Likert scale from 1 = Not important at all to 5 = Extremely important.

PDO and PGI were assessed jointly as a single PDO/PGI category in the questionnaire. Although they represent distinct EU geographical indication schemes, they were grouped in the survey because both communicate a certified geographical link between the product and its place of origin and were presented to respondents within the same geographical-indication category. Accordingly, the present analysis reflects respondents' self-reported knowledge and perceived importance of the combined PDO/PGI category rather than separate evaluations of PDO and PGI. Throughout the paper, "PDO/PGI", "Organic" and "Sustainability" therefore refer to the three certification categories as presented in the questionnaire, rather than to individual certification schemes.

All three levels of knowledge reflect the respondent's own assessment; no factual item was administered to verify the accuracy of reported understanding. The measure therefore captures subjective knowledge and not objectively scored knowledge of the regulatory content of the certifications in each category. The format corresponds to the aided-awareness scales used in prior certification research [27] and to single-item subjective-knowledge measures widely employed in wine consumer studies [25, 26].

Table 1 Overview of key survey variables and thematic categories

Variable Category	Variable	Measurement Description
Sociodemographic	Age	Age at the year respondents were surveyed, calculated from self-reported year of birth
	Gender	Self-identified gender
	Region of Residence	Reported region, later grouped into four macro-areas (i.e., North, Centre, South and Islands)
	Monthly Income Bracket	Self-reported income ranges
Self-reported Knowledge of Certification Categories	Knowledge of PDO/PGI Category	Respondents were shown the relevant PDO/PGI wine certification marks (PDO and PGI assessed jointly as one category) and asked: “Which of the following statements best describes your knowledge of PDO/PGI certification for wine?” Response options: (1) “I don’t know this label/certification”; (2) “I recognize this label/certification, but I do not know what it means”; (3) “I recognize this label/certification and understand what it means.”
	Knowledge of Organic Certification Category	Respondents were shown the EU Organic logo and asked: “Which of the following statements best describes your knowledge of organic certification for wine?” Response options: (1) “I don’t know this label/certification”; (2) “I recognize this label/certification, but I do not know what it means”; (3) “I recognize this label/certification and understand what it means.”
	Knowledge of Sustainability Certification Category	Respondents were shown sustainability certification logos (VIVA, Equalitas, and SOSTain, shown together; one answer for the whole category) and asked: “Which of the following statements best describes your knowledge of sustainability certification for wine?” Response options: (1) “I don’t know these labels/certifications”; (2) “I recognize these labels/certifications, but I do not know what they mean”; (3) “I recognize these labels/certifications and understand what they mean.”
Perceived Importance of Certification Categories	Importance of PDO/PGI Category	Respondents were asked: “How important is the presence of a PDO/PGI certification when you choose a wine to purchase?” Measured on a 5-point Likert scale from 1 = Not important at all to 5 = Extremely important.
	Importance of Organic Certification Category	Respondents were asked: “How important is the presence of EU Organic certification when you choose a wine to purchase?” Measured on a 5-point Likert scale from 1 = Not important at all to 5 = Extremely important.
	Importance of Sustainability Certification Category	Respondents were asked: “How important is the presence of a sustainability certification when you choose a wine to purchase?” Measured on a 5-point Likert scale from 1 = Not important at all to 5 = Extremely important.

3.3 Data analysis

Descriptive analysis was performed to characterize the overall composition of the sample and to provide a preliminary overview of self-reported knowledge and perceived importance of wine certifications. Self-reported knowledge of each of the three certification categories relevant to the European wine sector (PDO/PGI, Organic, and Sustainability, as defined in Section 1 and 3.2) was measured with a single question.

Responses to each knowledge question were coded on a three-level ordinal scale of self-reported knowledge: Level 1 – the respondent indicated complete unfamiliarity with the label (“I don’t know”); Level 2 – the respondent recognized the label but reported not understanding its meaning; Level 3 – the respondent both recognized the label and reported understanding it. This coding was applied independently to PDO/PGI, Organic, and Sustainability categories. Perceived importance of each certification category in wine purchasing decisions was measured with a single question per category on a 5-point Likert scale, ranging from 1 – “Not important at all” to 5 – “Extremely important”. All measures were checked for coding accuracy and missingness. As each construct was measured with a single question, no weighting or dimensionality reduction was applied. The resulting six measures (knowledge and importance for each of the three certification categories) were analyzed separately as outcome variables, and the knowledge measures were also used as explanatory variables in the importance models. To examine regional differences in self-reported knowledge and perceived importance, regional comparisons were conducted across four Italian macro-areas: North, Centre, South, and Islands. Analysis was performed on six dependent variables representing knowledge and importance for each certification category (PDO/PGI, Organic, and Sustainability). Because the outcome variables were ordinal, regional differences were examined using the Kruskal–Wallis H test. In instances where the omnibus test indicated significance ($p < 0.05$), Dunn’s post hoc test was conducted to identify specific pairwise differences. To control for the risk of Type I errors during multiple comparisons, a Bonferroni correction was applied. Effect sizes for the Kruskal–Wallis tests were computed as $\varepsilon^2 = H / (N - 1)$.

Analyses were conducted in RStudio. Spearman’s rank correlation coefficient was used to examine the association between self-reported knowledge and perceived importance separately for PDO/PGI, Organic, and Sustainability categories. In addition, cumulative-link proportional-odds logistic regression models were estimated for each certification category. First, three models examined self-reported knowledge as an ordinal outcome (Level 1 = unfamiliar with the certification; Level 2 = recognition without understanding; Level 3 = recognition and understanding). Second, three models examined

perceived importance, measured on the five-point Likert scale, as an ordinal outcome. The importance models included the corresponding self-reported knowledge measure as a categorical predictor. All regression models were adjusted for age, gender, monthly income, macro-region of residence, and survey wave. Age was entered as a continuous variable and scaled so that the reported odds ratios represent a 10-year increase. Gender, income, macro-region, survey wave, and self-reported knowledge in the importance models were treated as categorical variables. The reference categories were Male for gender, Low for income, North for macro-region, 2023 for survey wave, and Level 1 for self-reported knowledge. Respondents who did not report their income were retained as a separate “Not reported” category, allowing the full analytical sample ($N = 3,550$) to be retained. The same questionnaire, response options, and recruitment approach were used across the three survey waves, and survey wave was included in the regression models to account for differences between data-collection periods. Regression results are reported as odds ratios (ORs) with 95% confidence intervals. Type III Wald tests were used to evaluate the joint significance of categorical predictors. The proportional-odds assumption was assessed using nominal-effects tests. Where the proportional-odds assumption was violated, two robustness checks were conducted: partial proportional-odds models, in which the violating predictors were allowed to vary across thresholds, and binary logistic models of the dichotomised outcome. For the importance models, likelihood-ratio tests were additionally used to evaluate the contribution of self-reported knowledge by comparing models with and without the knowledge factor. Models treating self-reported knowledge as a categorical factor were also compared with models treating knowledge as a linear ordinal score using likelihood-ratio tests. McFadden’s pseudo- R^2 was calculated as an additional measure of model fit. To facilitate interpretation of the importance models, average marginal effects were calculated for the predicted probability of assigning an importance rating of 4 or 5. Contrasts were estimated for self-reported knowledge Levels 2 and 3 relative to Level 1; Centre, South, and Islands relative to North; High relative to Low income; Female relative to Male; and a 10-year increase in age. Estimates are reported as percentage-point changes with 95% confidence intervals. Predicted probabilities of assigning an importance rating of at least 4 were also estimated across the three levels of self-reported knowledge for each certification category and are presented graphically with 95% confidence intervals. Finally, a sensitivity analysis was conducted among respondents who reported their income ($N = 3,230$), re-estimating the three importance models after excluding the “Not reported” income category.

4 Results

4.1 Sample characteristics

Table 2 summarizes the sociodemographic composition of the sample. The descriptive analysis is based on a sample of 3,550 Italian wine consumers, with a relatively balanced gender distribution (53.6% female). Respondents are distributed across all age groups, with the largest share between 36 and 45 years old (42.1%). Among respondents who reported their income, the largest group was the medium-income group (53.0%). In terms of geographic distribution, the largest proportion of respondents comes from Northern Italy (45.2%), followed by Southern regions (23.4%), the Centre (19.7%), and the Islands (11.7%).

Table 2 Sociodemographic characteristics of the sample and mean self-reported knowledge and perceived importance by group

Variable	Category	%	Knowledge		Importance	
			Mean	SD	Mean	SD
Gender	Female	53.6	2.24	0.54	4.08	0.64
	Male	46.4	2.20	0.57	4.03	0.67
Age	18–25	3.7	2.13	0.61	3.97	0.67
	26–35	26.5	2.29	0.55	3.98	0.63
	36–45	42.1	2.23	0.56	4.02	0.65
	46–55	16.5	2.18	0.55	4.18	0.62
	56+	11.2	2.11	0.54	4.22	0.71
Income ^a	Low	32.1	2.16	0.57	4.00	0.67
	Medium	53.0	2.26	0.54	4.07	0.65
	High	14.9	2.34	0.56	4.17	0.62
Region	North	45.2	2.23	0.54	4.03	0.65
	Central	19.7	2.21	0.55	4.07	0.67
	South	23.4	2.23	0.60	4.08	0.62
	Islands	11.7	2.22	0.58	4.11	0.68

Note: N = 3,550. Knowledge and importance are each respondent's mean score across the three certification categories (PDO/PGI, Organic, Sustainability). Self-reported knowledge is measured on a 1–3 scale and perceived importance on a 1–5 scale. Values are unadjusted descriptive statistics.

^a Percentages for the income category refer only to the 3,230 respondents who answered the income question; 320 respondents (9.0%) did not report their income.

The knowledge and importance values in Table 2 are unadjusted descriptive statistics, and most differences between groups are small. Mean self-reported knowledge was slightly higher among respondents aged 26–35 and in the high-income group, and lowest among those aged 56 and over. Mean perceived importance rose with age, from 3.97 among respondents aged 18–25 to 4.22 among those aged 56 and over, and was slightly higher in the high-income group. Differences by gender and macro-region were minimal (0.08 points or less on either scale). Because these values average across certification categories and do not control for other characteristics, they are not interpreted as evidence of sociodemographic associations. Adjusted associations, estimated separately for each certification category, are reported in Section 4.4 (Tables 6a and 6b).

The composition of the four macro-regional subsamples was broadly comparable: macro-region was not significantly associated with gender ($\chi^2(3) = 2.77$, $p = .428$) or age group ($\chi^2(12) = 12.67$, $p = .393$). Composition did differ across survey waves, most notably in age and gender (Supplementary Table S1). Survey wave was therefore included as a covariate in all regression models.

Across the full sample, mean self-reported knowledge was highest for PDO/PGI, followed by Organic and Sustainability. Mean perceived importance followed a different ordering: PDO/PGI, Sustainability, and Organic. The Sustainability category thus had the lowest reported knowledge of the three but the second-highest rated importance. These between-category comparisons should be interpreted with caution, because the categories were represented by different numbers of logos (a single logo for Organic and several for PDO/PGI and Sustainability; see Section 3.2). Regional breakdowns of these scores and tests of regional differences are reported in Section 4.2.

4.2 Regional disparities in consumer self-reported knowledge and perceived importance

Kruskal–Wallis H tests were employed to evaluate the significance of these regional differences in self-reported knowledge of and importance attributed to wine certification categories; the results are shown in Table 3 below.

Table 3 Results of Kruskal–Wallis H tests assessing regional differences in self-reported knowledge and perceived importance across certification categories

Outcome	North Mean ± SD	Centre Mean ± SD	South Mean ± SD	Islands Mean ± SD	H	p	ϵ^2
<i>Self-reported knowledge</i>							
PDO/PGI	2.62 ± 0.67	2.63 ± 0.67	2.62 ± 0.66	2.58 ± 0.68	3.01	.390	0.001
Organic	2.39 ± 0.76	2.37 ± 0.78	2.24 ± 0.82	2.30 ± 0.79	20.71	< .001	0.006
Sustainability	1.68 ± 0.85	1.66 ± 0.85	1.83 ± 0.88	1.79 ± 0.86	23.51	< .001	0.007
<i>Perceived importance</i>							
PDO/PGI	4.22 ± 0.79	4.25 ± 0.76	4.22 ± 0.80	4.19 ± 0.80	1.49	.684	< 0.001

Organic	3.88 ± 0.90	3.94 ± 0.89	3.97 ± 0.84	4.04 ± 0.85	11.57	.009	0.003
Sustainability	4.00 ± 0.81	4.02 ± 0.88	4.07 ± 0.76	4.10 ± 0.82	8.54	.036	0.002

Note: df = 3 for all tests; N = 3,550. Self-reported knowledge was measured on a three-level scale (1–3) and perceived importance on a five-point scale (1–5). Effect size $\varepsilon^2 = H / (N - 1)$. PDO/PGI = combined PDO/PGI category; Organic = organic certification (EU organic logo); Sustainability = sustainability certification category (VIVA, Equalitas and SOSain logos shown together).

For self-reported knowledge, no statistically significant regional variation was found within the sample for PDO/PGI, whereas significant differences were observed for Organic and Sustainability categories. The two categories showed opposite patterns that mean Organic knowledge was highest in the North and Centre and lowest in the South, whereas mean Sustainability knowledge was higher in the South and Islands than in the North and Centre. For perceived importance, significant regional differences were likewise observed for Organic and Sustainability, but not for PDO/PGI ($H = 1.49$, $p = .684$). In all cases, however, effect sizes were small ($\varepsilon^2 \leq 0.007$), indicating that regional differences, although statistically detectable in a sample of this size, were modest in magnitude. Pairwise comparisons were conducted for the four outcomes with a significant omnibus test (Table 4).

Table 4 Post hoc pairwise comparisons (Dunn's test) for regional differences in self-reported knowledge and perceived importance of the Organic and Sustainability certification categories

Region comparison	Organic			Sustainability		
	Mean rank difference	z	Adj. p	Mean rank difference	z	Adj. p
<i>Self-reported knowledge</i>						
North – Centre	30.98	0.737	1.000	28.39	0.678	1.000
North – South	171.77	4.334	< .001***	–159.29	–4.032	< .001***
Centre – South	140.79	2.960	.018*	–187.68	–3.958	< .001***
North – Islands	110.69	2.160	.184	–188.23	–2.315	.124
Centre – Islands	79.70	1.384	.998	–146.63	–2.554	.064†
South – Islands	–61.08	–1.093	1.000	41.05	0.736	1.000
<i>Perceived importance</i>						
North – Centre	–68.60	–1.583	.680	–55.00	–1.286	1.000
North – South	–84.17	–2.060	.237	–77.77	–1.927	.324
Centre – South	–15.57	–0.317	1.000	–22.77	–0.470	1.000
North – Islands	–164.28	–3.108	.011*	–135.86	–2.604	.055†
Centre – Islands	–95.68	–1.610	.643	–80.86	–1.380	1.000

South – Islands	–80.11	–1.390	.987	–58.09	–1.020	1.000
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Note: Mean rank difference = mean rank of the first region minus mean rank of the second region of the pair; a positive difference (and z) indicates higher mean ranks in the first region, a negative difference indicates higher mean ranks in the second. p-values are Bonferroni-adjusted for six comparisons within each outcome. † $p < .10$; * $p < .05$; *** $p < .001$. PDO/PGI is omitted because neither omnibus test was significant. Category labels as defined in Table 3.

For self-reported knowledge, the pairwise comparisons showed that regional differences were concentrated in the South, but in opposite directions for the two categories. Respondents in the South reported significantly lower Organic knowledge than those in the North and the Centre, whereas they reported significantly higher Sustainability knowledge than those in the North and the Centre. The Islands did not differ significantly from any other macro-area on either knowledge outcome. The Centre–Islands contrast for Sustainability knowledge approached significance, with higher knowledge in the Islands. No significant difference was found between the North and the Centre for either category.

For perceived importance, the regional difference in Organic importance was attributable to the contrast between the North and the Islands. Respondents in the Islands attributed greater importance to Organic category than those in the North, and no other pairwise comparison was significant. For Sustainability importance, although the omnibus test was significant, no pairwise comparison remained significant after Bonferroni correction. The largest difference was again between the North and the Islands, in the same direction. This pattern, in which the omnibus effect is spread across several small differences rather than concentrated in one pair, is consistent with the conservative nature of the Bonferroni adjustment.

Taken together, the unadjusted comparisons suggest that regional differences in self-reported knowledge and in perceived importance did not follow the same geographic pattern. Knowledge differences were centred on the South, where respondents reported lower familiarity with Organic category but higher familiarity with Sustainability category than respondents in the North and Centre. Importance differences, by contrast, were centred on the Islands, where both Organic and Sustainability categories tended to be rated as more important than in the North. PDO/PGI category showed no regional differences in either knowledge or importance. Because these comparisons do not account for differences in sociodemographic composition, survey wave, or self-reported knowledge across macro-areas, adjusted associations are examined in Section 4.4.

4.3 Relationship between self-reported knowledge and perceived importance

To examine whether self-reported knowledge of certification categories is associated with the importance assigned to them, Spearman's rank correlation coefficients were computed. The results, summarized in

Table 5, show a positive and statistically significant association for all three certification categories. The associations were weak ($\rho = 0.13\text{--}0.15$), but consistently positive: higher self-reported knowledge was associated with higher perceived importance.

Table 5 Association between self-reported knowledge and importance scores for each wine certification category

Certification category	Sample Size(N)	Spearman's ρ (rho)	p -value ^a
PDO/PGI	3,550	0.134	<.001***
Organic	3,550	0.144	<.001***
Sustainability	3,550	0.145	<.001***

^a Significant at the *** $p < .001$. Category labels as defined in Table 3.

The correlation coefficients were similar in magnitude across certification categories ($\rho = 0.134$ for PDO/PGI, 0.144 for Organic, and 0.145 for Sustainability). Given these small differences, the unadjusted correlations are not interpreted as evidence that self-reported knowledge plays a larger role for one certification category than for another. Associations adjusted for sociodemographic characteristics, macro-region, and survey wave are reported in Section 4.4.

4.4 Adjusted associations with self-reported knowledge and perceived importance

Six cumulative-link ordinal logistic regression models were estimated to examine two questions: how sociodemographic and regional characteristics relate to self-reported knowledge when considered jointly, and how self-reported knowledge relates to perceived importance. Three models used self-reported knowledge as the outcome (Table 6a) and three used perceived importance as the outcome (Table 6b). All models were adjusted for age, gender, income, macro-region, and survey wave, and the importance models additionally included the corresponding self-reported knowledge measure. Macro-region was entered as a categorical predictor with North as the reference category, so separate odds ratios were estimated for the Centre, South, and Islands. Predictors are measured on different scales, so average marginal effects on the predicted probability of rating importance ≥ 4 are also reported to allow comparison (Table 7 and Figure 1).

Table 6a. Ordinal logistic regression models of self-reported knowledge of PDO/PGI, Organic, and Sustainability certification categories.

Predictor	PDO/PGI OR (95% CI)	p	Organic OR (95% CI)	p	Sustainability OR (95% CI)	p
Age (per 10 years)	0.99 (0.91–1.07)	.77	0.87 (0.81–0.94)	<.001	0.76 (0.71–0.82)	<.001

Female (ref. Male)	0.96 (0.82–1.11)	.56	1.60 (1.40–1.82)	<.001	0.95 (0.83–1.08)	.40
<i>Income (ref. Low)</i>						
Medium	1.41 (1.18–1.67)	<.001	1.50 (1.29–1.74)	<.001	1.17 (1.00–1.36)	.04
High	1.81 (1.39–2.34)	<.001	1.78 (1.43–2.22)	<.001	1.70 (1.38–2.11)	<.001
Not reported	0.74 (0.57–0.96)	.02	0.87 (0.69–1.11)	.26	0.61 (0.47–0.80)	<.001
<i>Macro-region (ref. North)</i>						
Centre	1.10 (0.90–1.34)	.36	0.95 (0.80–1.13)	.54	0.97 (0.81–1.15)	.70
South	1.10 (0.91–1.33)	.33	0.74 (0.63–0.87)	<.001	1.43 (1.21–1.68)	<.001
Islands	0.95 (0.75–1.20)	.67	0.86 (0.70–1.06)	.17	1.36 (1.10–1.67)	.004
<i>Wave (ref. 2023)</i>						
2024	1.08 (0.90–1.31)	.39	1.13 (0.96–1.32)	.15	1.00 (0.85–1.17)	> .99
2025	0.80 (0.65–0.99)	.04	0.85 (0.71–1.03)	.09	0.83 (0.69–0.99)	.04
<i>Joint tests</i>						
Income, $\chi^2(3)$	45.73	<.001	52.47	<.001	51.33	<.001
Macro-region, $\chi^2(3)$	2.13	.55	13.94	.003	25.95	<.001
Wave, $\chi^2(2)$	10.21	.006	11.11	.004	6.06	.048
McFadden pseudo- R^2	0.011		0.019		0.019	
N	3,550		3,550		3,550	

Note. Odds ratios (ORs) and 95% confidence intervals are reported. Reference categories are Male, Low income, North, and Wave 2023. Joint significance of categorical predictors was assessed with Type III Wald tests. Nominal-effects tests indicated no departures from the proportional-odds assumption in the PDO/PGI and Sustainability models; departures were detected for gender and income in the Organic model. Results were robust to partial proportional-odds and binary logistic specifications. Category labels as defined in Table 3.

Income was associated with self-reported knowledge for all three certification categories (joint tests, all $p < .001$). Compared with low-income respondents, high-income respondents had higher odds of reporting greater knowledge, whereas respondents who did not report their income had lower odds for PDO/PGI and Sustainability. Age was negatively associated with Organic and Sustainability knowledge, but not with PDO/PGI knowledge. Female respondents had higher odds of greater Organic knowledge, with no gender association for PDO/PGI or Sustainability.

Macro-region was jointly associated with Organic and Sustainability knowledge, but not with PDO/PGI knowledge. These adjusted estimates are consistent with the unadjusted comparisons in Section 4.2. Relative to the North, respondents in the South had lower odds of greater Organic knowledge and higher odds of greater Sustainability knowledge. After adjustment, respondents in the Islands also had higher

odds of greater Sustainability knowledge than those in the North, a difference that did not reach significance in the unadjusted pairwise comparisons. Survey wave was jointly associated with knowledge in all three models, and respondents in the 2025 wave had lower odds of greater PDO/PGI and Sustainability knowledge than those in 2023.

Table 6b Ordinal logistic regression results for importance attributed to PDO/PGI, Organic and Sustainability certification categories.

Predictor	PDO/PGI OR (95% CI)	p	Organic OR (95% CI)	p	Sustainability OR (95% CI)	p
Age (per 10 years)	1.37 (1.27–1.47)	<.001	1.12 (1.04–1.20)	.003	1.19 (1.11–1.28)	<.001
Female (ref. Male)	1.29 (1.13–1.46)	<.001	1.02 (0.90–1.15)	.79	1.13 (0.99–1.28)	.06
<i>Income (ref. Low)</i>						
Medium	1.19 (1.03–1.39)	.020	1.13 (0.97–1.30)	.11	1.17 (1.01–1.36)	.039
High	1.23 (1.00–1.52)	.051	1.60 (1.30–1.97)	<.001	1.58 (1.28–1.95)	<.001
Not reported	1.10 (0.86–1.40)	.44	0.83 (0.66–1.05)	.12	0.98 (0.78–1.24)	.88
<i>Macro-region (ref. North)</i>						
Centre	1.06 (0.90–1.26)	.50	1.18 (0.99–1.39)	.057	1.14 (0.97–1.36)	.12
South	1.07 (0.91–1.26)	.41	1.34 (1.14–1.56)	<.001	1.19 (1.02–1.40)	.030
Islands	1.00 (0.81–1.23)	.97	1.54 (1.25–1.90)	<.001	1.36 (1.11–1.68)	.004
<i>Wave (ref. 2023)</i>						
2024	1.05 (0.90–1.23)	.52	0.93 (0.80–1.08)	.34	0.91 (0.78–1.06)	.22
2025	0.94 (0.79–1.13)	.53	0.73 (0.61–0.86)	<.001	0.68 (0.57–0.81)	<.001
<i>Self-reported knowledge (ref. Level 1)</i>						
Level 2	1.09 (0.85–1.39)	.50	1.23 (1.02–1.47)	.030	1.30 (1.10–1.54)	.002
Level 3	1.83 (1.49–2.24)	<.001	1.91 (1.62–2.26)	<.001	1.97 (1.69–2.29)	<.001
<i>Joint tests</i>						
Income, $\chi^2(3)$	6.46	.091	28.07	<.001	19.98	<.001
Macro-region, $\chi^2(3)$	1.00	.801	23.17	<.001	10.60	.014
Wave, $\chi^2(2)$	1.80	.407	14.25	<.001	19.78	<.001
Knowledge, $\chi^2(2)$	58.71	<.001	72.24	<.001	77.51	<.001
LR χ^2 , knowledge contribution	58.94	<.001	72.87	<.001	78.47	<.001
McFadden pseudo- R^2	0.024		0.019		0.023	
N	3,550		3,550		3,550	

Note: Odds ratios (ORs) and 95% confidence intervals are reported. Reference categories are Male, Low income, North, Wave 2023, and self-reported knowledge Level 1. Joint significance of categorical

583 predictors was assessed with Type III Wald tests. The knowledge contribution is the likelihood-ratio test
584 comparing each model with and without the knowledge factor. Nominal-effects tests indicated no
585 departures from the proportional-odds assumption in the PDO/PGI and Organic models; departures were
586 detected for age ($p = .015$), macro-region ($p = .027$), and self-reported knowledge ($p = .014$) in the
587 Sustainability model. Results were robust to partial proportional-odds and binary logistic specifications.
588 Category labels as defined in Table 3.

590 Self-reported knowledge was associated with perceived importance for all three certification categories.
591 Compared with respondents at Level 1, those at Level 3 had higher odds of assigning greater importance
592 to PDO/PGI, Organic, and Sustainability certification categories. Adding knowledge significantly
593 improved model fit in all three models. The Level 2 contrast was significant for Organic and
594 Sustainability but not for PDO/PGI. For PDO/PGI, therefore, higher importance was associated with
595 reported understanding of the label rather than with recognition alone. Consistent with this non-linear
596 pattern, categorical coding of knowledge improved model fit over a linear specification for PDO/PGI,
597 but not for Organic or Sustainability.

598 Sociodemographic associations differed across certification categories. Age was positively associated
599 with perceived importance in all three models. Female respondents had higher odds of assigning greater
600 importance to PDO/PGI, with no significant gender association for Organic or Sustainability. Income
601 was jointly associated with importance for Organic and Sustainability, mainly through higher odds
602 among high-income respondents, but not for PDO/PGI.

603 Macro-region was jointly associated with the importance of Organic and Sustainability certification
604 categories, but not PDO/PGI. Relative to the North, respondents in the Islands had higher odds of
605 assigning greater importance to both Organic and Sustainability certification categories, in line with the
606 unadjusted North–Islands contrasts in Section 4.2. After adjustment, respondents in the South also had
607 higher odds than those in the North for Organic and Sustainability. For Organic, this Southern difference
608 emerged alongside lower self-reported Organic knowledge in the South (Table 6a), which suggests that
609 the unadjusted comparison may have been attenuated by regional differences in knowledge. Respondents
610 in the 2025 wave had lower odds of assigning greater importance to Organic and Sustainability
611 certification categories than those in 2023, whereas no wave effect was observed for PDO/PGI.

612 Pseudo- R^2 values were low across all models (0.011–0.024). The associations reported here are therefore
613 statistically clear but explain only a small share of the variation in self-reported knowledge and perceived
614 importance.

615 Table 7. Average marginal effects on the predicted probability of rating certification importance ≥ 4

Contrast	PDO/PGI	Organic	Sustainability
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Knowledge Level 3 vs. Level 1	+8.40 (5.10, 11.70)	+12.76 (9.30, 16.23)	+10.38 (8.19, 12.57)
Knowledge Level 2 vs. Level 1	+1.36 (-2.62, 5.34)	+4.37 (0.41, 8.33)	+4.55 (1.77, 7.33)
Islands vs. North	-0.06 (-2.75, 2.63)	+7.94 (4.38, 11.51)	+4.93 (1.76, 8.10)
South vs. North	+0.86 (-1.18, 2.90)	+5.48 (2.54, 8.42)	+2.91 (0.32, 5.50)
Centre vs. North	+0.75 (-1.39, 2.88)	+3.15 (-0.06, 6.35)	+2.25 (-0.55, 5.04)
High vs. Low income	+2.70 (0.05, 5.35)	+8.38 (4.82, 11.94)	+7.05 (3.90, 10.20)
Female vs. Male	+3.21 (1.57, 4.85)	+0.32 (-2.05, 2.70)	+1.98 (-0.10, 4.06)
Age (+10 years)	+3.59 (2.81, 4.37)	+2.03 (0.74, 3.31)	+2.68 (1.61, 3.76)

Note: Average marginal effects are percentage-point changes in the predicted probability of rating certification importance ≥ 4 , with 95% confidence intervals in parentheses, based on the models in Table 6b. The age contrast refers to a 10-year increase. For a continuous predictor, the size of the effect depends on the increment chosen. Category labels as defined in Table 3.

The average marginal effects place the predictors on a common scale (Table 7). Moving from Level 1 to Level 3 of self-reported knowledge was associated with an increase of 8.40 percentage points in the predicted probability of rating PDO/PGI as important, 12.76 points for Organic, and 10.38 points for Sustainability. Among the contrasts examined, this knowledge contrast had the largest point estimate in each model. For Organic, however, its confidence interval overlapped with those of the high- vs low-income and Islands vs North contrasts, so it cannot be distinguished statistically from them. For PDO/PGI, the age effect per decade (+3.59 points) implies a cumulative difference across the age range of the sample that is comparable to the knowledge contrast. The regional and income contrasts were substantively relevant for Organic and Sustainability (up to 8 percentage points) but close to zero for PDO/PGI. Figure 1 shows the predicted probabilities across knowledge levels. Even among respondents who reported not knowing a certification category (Level 1), the predicted probability of rating it as important was about 78% for PDO/PGI, 76% for Sustainability, and 67% for Organic. These levels are not directly comparable across categories, because the categories were represented by different numbers of logos (Section 3.2).

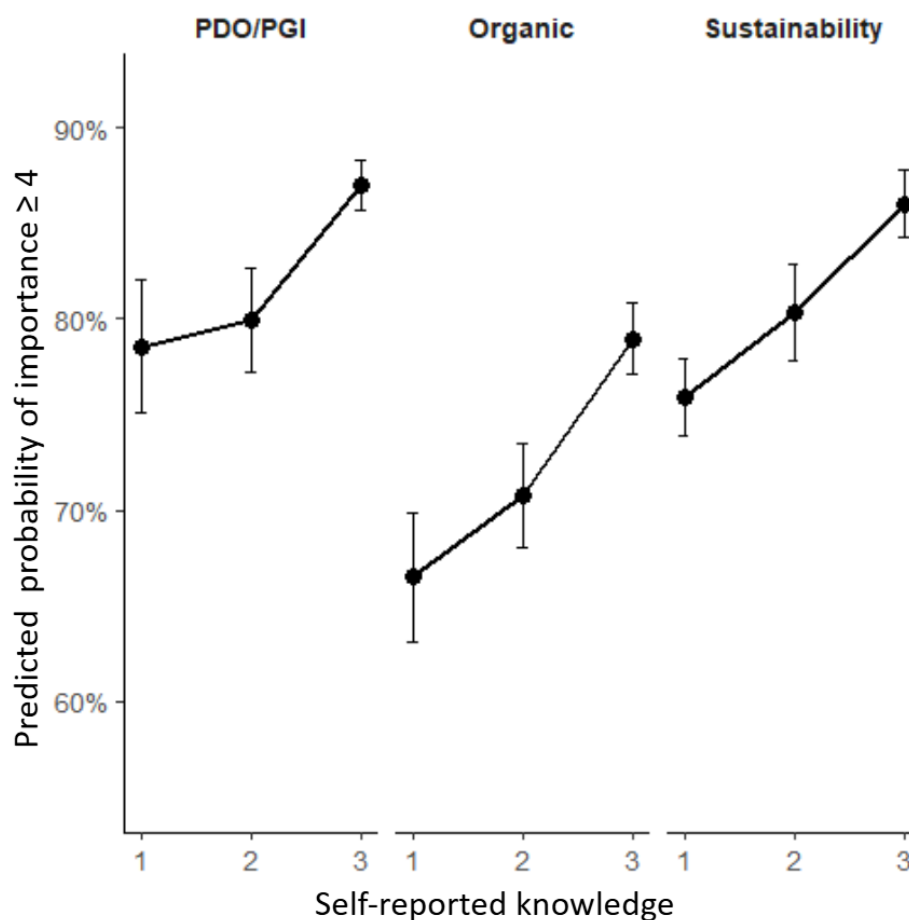


Figure 1. Average predicted probability of rating certification importance ≥ 4 across levels of self-reported knowledge for the PDO/PGI, Organic and Sustainability certification categories, based on the models in Table 6b and averaged over the observed covariate distribution. Error bars indicate 95% confidence intervals. The y-axis does not start at zero.

Two sets of sensitivity analyses supported these results. First, where the proportional-odds assumption was violated (gender and income in the Organic knowledge model; age, macro-region, and self-reported knowledge in the Sustainability importance model), partial proportional-odds models and binary logistic models yielded estimates of the same direction and statistical significance, and the substantive conclusions were unchanged. Second, re-estimating the importance models after excluding respondents who did not report their income ($N = 3,230$) left all substantive estimates materially unchanged (Supplementary Table S2). As both knowledge and importance were self-reported in a cross-sectional survey, all estimates should be interpreted as adjusted associations rather than causal effects.

5 Discussion

This study investigated how Italian consumers understand and evaluate three major wine certification categories by analyzing the associations of self-reported knowledge, sociodemographic characteristics, and regional differences with perceived importance. A central descriptive finding is the coexistence of relatively limited self-reported knowledge and relatively high perceived importance, particularly for the Sustainability category, which received the second-highest importance ratings while showing the lowest level of self-reported knowledge among the three certification categories. This comparison should be interpreted with caution. The Sustainability category was represented by three scheme logos shown together, whereas the Organic category was represented by a single logo, so lower self-reported knowledge for the Sustainability category may partly reflect respondents recognizing only some of the schemes shown, or being less confident in declaring that they understood all of them. The pattern also refers to the category as a whole and cannot be attributed to VIVA, Equalitas or SOSain individually. Because knowledge and importance were measured on different response scales, this pattern should not be interpreted as a directly quantifiable “gap.” The predicted-probability analysis provides additional context. Among respondents at the lowest level of self-reported knowledge (Level 1), the predicted probability of assigning high importance was greater for PDO/PGI than for Sustainability; at the sample level, however, limited self-reported knowledge was substantially more prevalent for Sustainability. For Sustainability category, the pattern is therefore best described as the coexistence of a relatively high prevalence of limited self-reported knowledge and relatively high perceived importance. Because knowledge was self-reported, this pattern concerns perceived rather than verified understanding: stated importance does not appear to be conditional on consumers feeling that they understand a label. Previous studies have similarly reported that positive attitudes toward sustainability may coexist with limited recognition or understanding of sustainability certifications [10], and that positive responses to organic symbols may occur without detailed awareness of the associated regulatory framework [9]. One interpretation, consistent with the semiotic evidence of Capanna Piscè et al. [9], is that such labels operate as heuristic signals of quality or ethical value rather than as carriers of specific information. However, trust, quality, and ethical considerations were not measured in the present study; these mechanisms should therefore be treated as hypotheses for research combining subjective and objective knowledge measures rather than as findings of the analysis. This study extends the literature by examining the relationship between self-reported knowledge and perceived importance across multiple certification categories within the same analytical framework, and the results indicate that self-reported knowledge

682 and perceived importance are related but distinct dimensions of consumers' evaluations of wine
683 certification categories.

684 Another key finding of this study is the consistent positive association between self-reported knowledge
685 and perceived importance across certification categories. In the fully adjusted models, Level 3 self-
686 reported knowledge was associated with higher odds of assigning greater importance to PDO/PGI,
687 Organic, and Sustainability categories compared with Level 1. Likelihood-ratio tests further showed that
688 self-reported knowledge significantly improved model fit for all three certification categories. The
689 corresponding marginal effects were also substantial: moving from Level 1 to Level 3 was associated
690 with increases of 8.40 (PDO/PGI), 12.76 (Organic), and 10.38 (Sustainability) percentage points in the
691 predicted probability of assigning an importance rating of at least 4. This pattern is consistent with
692 previous research reporting that greater awareness of sustainable agri-food certification is associated with
693 greater perceived importance [42] and with findings identifying subjective awareness as an important
694 factor in label-related purchasing behavior [33]. At the same time, the observed associations should not
695 be interpreted as causal, because both knowledge and perceived importance were self-reported and the
696 data were cross-sectional at the respondent level.

697 The adjusted analyses also showed that sociodemographic associations differed across certification
698 categories. Age was positively associated with perceived importance in all three models, whereas gender
699 was significantly associated with PDO/PGI importance but not with Organic or Sustainability importance
700 after adjustment for the other covariates. Income showed significant joint associations with Organic and
701 Sustainability importance, mainly through higher odds among high-income respondents, but not with
702 PDO/PGI importance. These findings are broadly consistent with previous research linking higher
703 income with willingness to purchase organic wine [28] and demand for sustainability-oriented
704 certifications [31], and they indicate that the relationships between sociodemographic characteristics and
705 certification perceptions are not uniform across certification categories. However, the present results do
706 not establish the mechanisms underlying these differences, and explanations related to purchasing power,
707 access to information, or environmental preferences require further investigation. Because the present
708 analysis did not formally test mediation, the role of self-reported knowledge should be interpreted as an
709 independent adjusted association rather than as a mediating mechanism.

710 Regional associations also differed by certification category. Self-reported knowledge showed no
711 regional differences for PDO/PGI but significant differences for Organic and Sustainability, in opposite
712 directions: respondents in the South reported lower Organic knowledge but higher Sustainability
713 knowledge than those in the North. For perceived importance, after adjustment for sociodemographic

characteristics, survey wave, and self-reported knowledge, macro-region was significantly associated with Organic and Sustainability importance but not with PDO/PGI importance, with higher odds of assigning greater importance in the South and Islands than in the North for both certification categories. These findings indicate that geographic variation persists for some certification outcomes after adjustment, but they do not support a general North–South gradient across all three certification categories. Regional differences should therefore be interpreted as category-specific rather than as evidence that one macro-area consistently values certifications more highly than another. As discussed in Section 6, part of this variation may also reflect compositional differences between macro-areas, such as in educational attainment, that were not measured.

Another relevant consideration is whether respondents distinguished between the certification categories. Organic and Sustainability categories showed different patterns of self-reported knowledge: regional differences ran in opposite directions (lower Organic but higher Sustainability knowledge in the South relative to the North), female respondents reported higher Organic but not higher Sustainability knowledge, and the negative association with age was stronger for Sustainability than for Organic knowledge. These divergent patterns are difficult to reconcile with respondents treating the two categories as the same label, and they are consistent with the separate presentation of the two categories, each with its own logos, in the questionnaire. However, because the two categories were represented by different numbers of logos, part of these differences may also reflect the presentation format rather than differences in how consumers perceive organic and sustainability certification, and the results cannot show how respondents perceived the individual sustainability schemes. At the same time, previous research has documented difficulties among consumers in distinguishing related concepts such as organic, natural, and biodynamic wines [11], and Boncinelli et al. [10] linked attribute non-attendance partly to cognitive overload arising from overlapping certification schemes. Clearer differentiation and communication of certification standards may therefore help consumers understand the distinct meanings and requirements associated with different labels.

The regional perspective is particularly relevant because the adjusted analyses indicate that territorial differences are category-specific rather than uniform across certification categories. No significant regional differences emerged for the perceived importance of PDO/PGI category, whereas respondents in the South and Islands reported significantly greater perceived importance of Organic and Sustainability categories than respondents in the North. This suggests that national-level averages may conceal meaningful territorial variation in the way different certification claims are valued. From a practical perspective, these findings indicate that certification bodies, wine-sector organizations, and public

institutions may benefit from considering regional differences when designing consumer-information strategies. Rather than relying exclusively on uniform national communication, initiatives could be adapted to regional patterns of knowledge and perceived importance, with greater emphasis on explaining the meaning and scope of certification-related claims where consumer understanding remains limited. Such territorially adapted communication could strengthen the informational function of certification while responding more closely to differences observed across Italian macro-regions. Taken together, these findings indicate that consumers' evaluations of wine certifications are associated with self-reported knowledge, sociodemographic characteristics, and regional context, with the observed patterns varying across certification categories. The observed associations suggest that certification information may be interpreted differently across consumer groups and certification categories. In particular, the communication of sustainability certification may need to go beyond the visibility of the symbols and include explanatory content if these labels are to fulfill their informational function [42].

6 Limitations and Future Research

Despite its contributions, this study has several limitations that should be acknowledged.

First, although the study spanned three data collection phases, it was essentially a cross-sectional research design: each respondent was surveyed only once, thus making it impossible to infer whether knowledge growth affected their perception of importance over time. To determine the causal direction of the relationship between knowledge and importance, a longitudinal panel research design is needed.

Second, the use of a non-probabilistic sampling method limits the generalizability of the findings. Although efforts were made to ensure diversity across regions and sociodemographic groups, the sample may not fully represent the broader population of Italian wine consumers. Descriptive statistics and regression estimates should accordingly be read as characterizing the sample of regular wine purchasers surveyed, rather than as population estimates, and the regional comparisons are between subsamples, not between the populations of the four macro-areas. In particular, individuals with a pre-existing interest in wine or sustainability may have been more likely to participate, potentially introducing self-selection bias.

Third, the study relies on self-reported measures of knowledge regarding certifications. This indicator reflects respondents' familiarity with various certification labels and their perceived depth of understanding, but it did not include objective test items to verify the accuracy of that understanding. There is only a moderate correlation between subjective and objective knowledge [24], and this study could not determine the specific direction of any discrepancy between the two: some respondents

778 claiming to understand a label might hold misconceptions, while others claiming a lack of understanding
779 might actually grasp its specific implications. Therefore, the association between self-reported
780 knowledge levels and the importance attached to the certifications should not be interpreted as the impact
781 of verified certification knowledge on value assessment. Given that both variables were measured using
782 the same questionnaire, common-method variance may have inflated the correlation between them.
783 Future research should combine self-report measures with objective assessment items (e.g., asking
784 respondents to identify the specific guarantees associated with each certification) to explore the
785 alignment between subjective understanding and actual knowledge, and to examine whether the
786 coexistence of limited self-reported knowledge and high perceived importance persists under objective
787 measurement.

788 Fourth, knowledge and importance were measured at the level of certification categories rather than
789 individual certification schemes. The VIVA, Equalitas and SOSustain logos were presented together, and
790 respondents gave a single answer for the sustainability category; likewise, PDO and PGI were assessed
791 jointly. These responses therefore cannot distinguish respondents' familiarity with, or evaluation of, each
792 scheme: a respondent may have recognized one sustainability scheme but not the others, or attributed
793 different scopes to them, so the category may not have been perceived as a homogeneous certification.
794 In addition, the categories were presented with different numbers of logos (several for PDO/PGI and
795 Sustainability, a single EU logo for Organic). Showing several logos may make it more likely that a
796 respondent recognizes at least one of them, but less likely that the respondent feels able to declare
797 understanding of all of them, so the presentation format may have affected self-reported knowledge in
798 either direction. Comparisons of knowledge and importance between categories should therefore be
799 interpreted with caution. Future research should measure each certification scheme separately, with one
800 logo per question, and use comparable stimuli across categories.

801 Fifth, educational attainment was not measured. Education is an established correlate of objective
802 certification knowledge [42] so the possibility that it acts as a confounder for the associations reported
803 here cannot be ruled out. Three considerations regarding its potential impact are worth considering. First,
804 the models included income and age—variables associated with education among the Italian adult
805 population, which means that some variance attributable to education was indirectly captured, although
806 residual confounding cannot be entirely excluded. Second, existing literature linking education to
807 verified knowledge focuses primarily on objectively measured knowledge, whereas this study measured
808 self-reported familiarity and perceived understanding. Third, the sample is restricted to regular wine
809 purchasers, a group that is more homogeneous in terms of market exposure, which should attenuate

(though not entirely eliminate) compositional differences related to education. Nevertheless, this raises two specific implications. If education is positively correlated with both self-reported knowledge and perceived importance, omitting this variable tends to inflate estimates of the association between knowledge and importance. Furthermore, given the systematic differences in higher education prevalence across Italian macro-regions, some of the regional variation reported in Section 4 may reflect compositional differences in education rather than regional market conditions. Future surveys will incorporate measures of educational attainment to directly test these possibilities.

Sixth, the study does not explicitly account for other potentially relevant factors, such as consumer trust in institutions, environmental attitudes, or prior exposure to certification schemes, which may play an important role in shaping both knowledge and perception. The omission of these variables may limit the explanatory power of the models and suggests the need for a more comprehensive analytical framework. Finally, pooling three independent survey waves assumes sufficient comparability across data-collection periods. Although the same questionnaire, response options, and recruitment procedure were used in all waves, the realized sample composition differed across waves, particularly in age and gender (Supplementary Table S1). Survey wave was also significantly associated with self-reported knowledge in all three models and with the perceived importance of Organic and Sustainability categories, with lower values in 2025 than in 2023. Over the 2023–2025 period, consumers' exposure to certification-related communication, the economic context, and the availability of organic and sustainability-certified wines may have changed, and respondents in different waves may not have used the ordinal response categories in exactly the same way. Survey wave was included as a covariate in all models to account for systematic differences between collection periods, but this adjustment cannot exclude all such temporal changes.

Future research should address these limitations by adopting mixed-method approaches, combining quantitative analysis with qualitative techniques such as interviews or focus groups to better understand how consumers interpret certification labels. Experimental designs, including discrete choice experiments or eye-tracking studies, could provide deeper insights into decision-making processes and the role of certifications in real purchase contexts.

Additionally, longitudinal studies would be valuable for examining how consumer knowledge and perception evolve over time, particularly as sustainability certifications become more widespread. Comparative research across countries or regions could further explore the role of cultural, institutional, and market differences in shaping certification effectiveness, providing a broader perspective on the generalizability of these findings.

7 Conclusions

This study provides a comprehensive analysis of how Italian consumers understand and evaluate wine certification categories, highlighting associations between self-reported knowledge, perceived importance, sociodemographic characteristics, and regional context. Self-reported knowledge was consistently associated with perceived importance across PDO/PGI, Organic, and Sustainability certification categories, and its inclusion significantly improved the fit of all three importance models. At the same time, sociodemographic and regional associations varied across certification categories, indicating that consumer responses to certification cannot be characterized by a single uniform pattern. The findings therefore emphasize the importance of considering category-specific differences when examining how wine labels are understood and valued. Overall, this study contributes to the growing literature on wine certification and consumer behavior by providing a nuanced and empirically grounded perspective on how certification categories are understood and valued in practice. It highlights the value of examining category-specific differences in self-reported knowledge, perceived importance, sociodemographic characteristics, and regional context. For producers, these findings suggest that certification alone may not be sufficient to communicate value effectively; particularly for sustainability category, which comprises several schemes, clearer consumer-oriented information may help connect certification standards with their practical meaning. For policymakers and certification bodies, the variation observed across knowledge levels, regions, and certification categories highlights the value of communication strategies that explain certification requirements clearly while recognizing differences among consumer groups. Because the PDO/PGI and Sustainability categories each combined more than one scheme, and the categories were presented with different numbers of logos, these conclusions apply to certification categories rather than to individual certification schemes, and differences between categories should be read with this in mind.

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1000 Supplementary Table S1. Sample characteristics by survey wave.

Characteristic	2023 (n = 1,250), %	2024 (n = 1,300), %	2025 (n = 1,000), %	p-value
<i>Gender</i>				< .001
Male	40.0	49.8	50.0	
Female	60.0	50.2	50.0	
<i>Age group</i>				< .001
18–25	1.5	2.7	7.8	
26–35	29.6	29.1	19.2	
36–45	46.0	46.1	32.0	
46–55	7.0	14.2	31.4	
56+	15.8	8.0	9.6	
<i>Income</i>				.004
Low	25.5	30.1	32.6	
Medium	51.9	47.8	44.3	
High	14.2	12.6	14.0	
Not reported	8.4	9.5	9.1	
<i>Macro-region</i>				.498
North	45.7	45.6	44.1	
Centre	20.0	20.5	18.5	
South	22.5	23.5	24.6	
Islands	11.8	10.5	12.8	

1001 Note. Values are column percentages. *p*-values are from Pearson chi-square tests comparing distributions
1002 across survey waves
1003

1004 Supplementary Table S2. Sensitivity analysis of ordinal logistic regression models for certification
1005 importance among respondents reporting income

Predictor	PDO/PGI (95% CI)	OR <i>p</i>	Organic (95% CI)	OR <i>p</i>	Sustainability (95% CI)	OR <i>p</i>
Age (per 10 years)	1.38 (1.28–1.49)	< .001	1.10 (1.02–1.19)	.010	1.18 (1.09–1.27)	< .001
Female (ref. Male)	1.30 (1.14–1.48)	< .001	1.03 (0.91–1.18)	.616	1.13 (0.99–1.29)	.068
<i>Income (ref. Low)</i>						
Medium	1.19 (1.02–1.38)	.023	1.13 (0.97–1.31)	.114	1.16 (1.00–1.35)	.045
High	1.23 (1.00–1.52)	.053	1.60 (1.30–1.97)	< .001	1.56 (1.26–1.93)	< .001
<i>Macro-region (ref. North)</i>						
Centre	1.06 (0.88–1.26)	.552	1.16 (0.98–1.38)	.088	1.11 (0.93–1.32)	.266
South	1.05 (0.88–1.24)	.606	1.31 (1.11–1.55)	.001	1.16 (0.98–1.38)	.075
Islands	1.01 (0.81–1.25)	.951	1.53 (1.23–1.90)	< .001	1.33 (1.07–1.66)	.011
<i>Wave (ref. 2023)</i>						
2024	1.06 (0.90–1.25)	.458	0.94 (0.80–1.11)	.458	0.91 (0.77–1.07)	.247
2025	0.93 (0.78–1.13)	.478	0.72 (0.60–0.86)	< .001	0.67 (0.56–0.81)	< .001
<i>Self-reported knowledge (ref. Level 1)</i>						
Level 2	1.23 (0.94–1.59)	.127	1.18 (0.97–1.43)	.098	1.30 (1.10–1.55)	.003
Level 3	1.93 (1.55–2.41)	< .001	1.92 (1.61–2.29)	< .001	1.96 (1.67–2.29)	< .001

1006 Note. Odds ratios (ORs) and 95% confidence intervals are reported. Models were re-estimated among
1007 respondents who reported income, excluding the “Not reported” income category. Reference categories
1008 are Male, Low income, North, Wave 2023, and Self-reported knowledge Level 1.

Just Accepted