# Consumer Susceptibility to Sustainable Wine Signals: Putting an Artificial Intelligence-Generated Label on It Comes Naturally

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**Abstract**

Climate change and the advent of artificial intelligence-generated content are reshaping wine marketing. The interplay between consumer focus on naturalness and sustainable farming practices and the proliferation of artificial intelligence-generated content represents a particularly salient area of research. However, the extent to which the presence of fictitious artificial intelligence-generated labels and backgrounds impacts consumers' willingness to buy and pay for wine has yet to be addressed. This research contributes to the growing body of literature on consumer susceptibility to sustainability signaling and artificial intelligence greenwashing, focusing on the impact of backgrounds and labels with different degrees of perceived naturalness. Three experiments demonstrate that wines bearing artificial intelligence-generated sustainability labels and third-party accredited sustainability labels reliably exhibit an increased willingness to buy and pay compared to those without sustainability labels. These findings indicate that fictitious, artificial intelligence-generated, and accredited labels are equally effective in influencing consumer wine choices. Customer susceptibility to food labels and wine knowledge and involvement also significantly predict willingness to buy across studies, validating the Customer Susceptibility to Front-of-Package Food Labeling scale. These findings highlight the necessity for future studies to investigate the role of responsible labelling, the susceptibility of customers to such labels, and the potential hazards associated with greenwashing practices involving artificial intelligence-generated labels.

**Keywords:** Naturalness, sustainable wine, certifications, backgrounds, signaling theory, willingness to buy, willingness to pay, sustainability labeling, artificial intelligence.

## 1. Introduction

In the context of a global increase in demand for sustainably farmed food products, evaluating credence attributes such as products´ environmental credentials becomes an essential issue for consumers worldwide. Consumers cannot evaluate extrinsic quality cues of credence goods (Darby & Karni, 1973), such as growing techniques or production choices, without relying on signaling. This situation exemplifies a significant information asymmetry between sellers and buyers (Akerlof, 1970). It may allow companies to market their products more environmentally friendly than in reality (greenwashing) to induce consumers to buy and pay more.

It is a legal requirement for food products to display a list of ingredients and a nutritional table on their packaging. The obligatory display of this information can assist consumers in evaluating the product's naturalness. However, certain product categories have historically been exempted from this obligation, thereby exacerbating the information asymmetry to the consumer's detriment. In some regions, the public authorities are taking steps to suggest that this situation may not persist. Accordingly, as of the forthcoming harvest (2024), all wines produced and sold within the European Union will be legally obliged to display a list of ingredients and a nutrition declaration (Sánchez-Ortiz et al. 2024). The new regulation aims to reduce information asymmetry between sellers and buyers by providing European wine consumers with the same level of information as that available for other food products.

Although there is no direct equivalence between the regulatory frameworks of the two principal wine-consuming regions of the globe, namely the European Union and the United States of America, the latter could potentially implement a comparable policy in the near future (Lease & Sommerlad-Rogers, 2022). In 2022, the United States accounted for one-sixth of global wine consumption. As reported by the International Organization of Vine and

Wine (OIV, 2023), in 2023 the United States was the world's largest market in terms of volume and value. Despite a considerable domestic production capacity, particularly in California, the United States also is the world's leading importer of wine. France is the primary supplier of imported wine to the United States, with $2.8 billion of wine imported from France in 2022. Academic literature frequently refers to wine as a model product category for food and beverages due to its inherent complexity and the multitude of intrinsic and extrinsic quality cues that influence consumer choice (Bruwer et al., 2017). Consequently, wine represents an appropriate product category for the study of signal theory (Boulding & Kirmani, 1993). Among the various quality cues wine consumers employ in their selection process, the country of origin is a prominent factor. However, other extrinsic cues, including those related to sustainability, are becoming increasingly significant for wine consumers in the United States. The front and back labels of wine customarily exhibit credence characteristics, such as environmental friendliness, through the incorporation of accredited or private eco-certifications. Visual labels, such as seals or logos, serve as tangible endorsements, providing evidence of a product’s adherence to predetermined standards (Majer et al., 2022). One such standard is the United States Department of Agriculture's organic (USDA) certification. In 2023, organic wines accounted for 10% of the $107 billion in sales generated by the American wine industry (Bank of Montreal Wine Market Report, 2024).

A notable shift is occurring in the wine industry, with a growing adoption of natural wine and sustainability practices, particularly among Millennials (Pink, 2015; Moscovici et al., 2020) and environmentally and socially conscious consumers (Galati et al., 2019; Migliore et al., 2020). This shift has brought to the forefront the challenges posed by the industry's varied and sometimes ambiguous labeling practices. While the term "organic wine" and "biodynamic wine" can be officially labeled and certified based on their agricultural and

oenological practices (Fanasch & Frick, 2020), the United States restricts the term "natural wine" on wine labels. The wine industry has voiced concerns regarding the potential for consumer misinterpretation and the overall perception of wine authenticity (Wine News, 2020). One concern is that the term "natural" could indicate superior quality, potentially conferring an unfair advantage on certain producers over others. In the absence of a “natural wine” label, producers of natural wine must identify the most effective means of communicating the wine’s naturalness, primarily through the evocating use of signals and codes. Bazzani et al. (2023) reveal that when consumers perceived wine as natural, there is a significant increase in its consumption frequency. Furthermore, they demonstrate that consumers are willing to pay a price premium for wine with signals of naturalness, such as sustainability labels and references to natural wine-making techniques (for example, spontaneous fermentation and the absence of added sulfites). However, this willingness to pay a premium is not consistently observed for wine with a "natural wine" claim, as indicated by a tag on the neck of the bottle. In light of these findings, Bazzani et al. (2023, p.9) “encourage producers to communicate the features of their products in a way that consumers perceive them as natural.” The present work aims to investigate further the effects of naturalness signaling on consumer choice.

In this respect, retail stores can create an atmosphere that elicits emotional responses and enhances consumers’ likelihood of purchasing. Atmospheric cues, including layout, design, graphics, and colors, can convey information about the brand and influence consumer responses throughout the shopping journey. The sale of wine online frequently employs atmospherics with attractive backgrounds and sustainability labels (for example, Vinatis.com - An online wine shop). Nevertheless, the academic literature on the signaling of naturalness as an atmospheric cue is limited (see, for instance, Bazzani et al., 2023; Dominici et al., 2019; Folwarczny et al., 2023).

The lack of uniform standards and the variability of definitions pose significant challenges for consumers in understanding the true essence of many labels, which will likely result in confusion and misinformed choices (Castellini et al., 2017; Mariani & Vastola, 2015). A recent study reveals that 51% of American consumers are more likely to buy wines bearing a sustainability label (Moscovici et al., 2020). However, 21% of respondents indicate being uncertain whether they had ever purchased a certified wine, underscoring pervasive confusion among consumers. Considering the growing number of signals related to health and sustainability in the retail landscape, along with the proliferation of numerous certifications and claims Sigurdsson et al. (2022, 2023); Sigurdsson, Folwarczny et al. (2024) and Sigurdsson et al. (2024) observe that consumers prefer and are willing to pay more for products bearing signals (certificates/tags or health/sustainability indicators). This finding has been replicated and extended in the current research on wine. Additionally, Sigurdsson et al. (2024) demonstrate no discernible difference in label equity between fictitious and genuine labels. The researchers conclude that consumers do not perceive a significant difference between labels and that any label is perceived as potentially beneficial. They recommend conducting further tests and comparing more made-up label designs. The current research follows this advice for future studies on made-up labels and the dangers of greenwashing by testing labels generated with artificial intelligence.

The use of artificial intelligence assists in detecting greenwashing practices, as evidenced by its ability to facilitate the rapid analysis of sustainability reports (Moodaley & Telukdarie, 2023). However, in instances where artificial intelligence is employed in generating labels, it can potentially contribute to greenwashing through content creation. In this context, it can be conceptualized as the antithesis of the notion of naturalness, encompassing machinewashing (Seele & Schultz, 2022). In other words, it can craft highly persuasive and tailored marketing content that signals sustainability without providing

substantive evidence (Marken et al., 2024). Such visual representations may inaccurately portray sustainable practices, such as lush vineyards and eco-friendly production processes, which may not align with the actual wine production process. Our research tests the effectiveness of labels that convey a high degree of naturalness and were designed with artificial intelligence. The use of artificial intelligence by wine companies to create the illusion of environmental responsibility, without corresponding changes to actual business practices, may lead consumers to perceive product as more environmentally friendly than it is and ascribe them greater value than is merited. By employing artificial intelligence in this manner, wine companies can, at a relatively low cost, create the illusion of environmental responsibility that does not align with their actual practices. Such misleading practices deceive consumers and undermine genuine sustainability efforts within the wine industry.

As evidenced in the literature, consumers exhibit a higher willingness to buy and pay for eco-certified wines, despite the confusion that arises from the proliferation of sustainable labels. However, to date, no empirical investigation has been conducted into the influence exerted by the perceived naturality and by the authenticity of sustainable signals on consumer purchasing decisions. Our research examines the impact of diverse sustainable signals on consumers' willingness to buy and pay for wine. It focuses on the impact of different labels and backgrounds with varying degrees of perceived naturalness on consumer choice. The central research question that informs this research is: How do different labels (genuine accredited and fictitious artificial intelligence-generated labels) impact consumers' willingness to buy and pay for wine? Our research aims to ascertain whether signaling naturalness can benefit wine in a retail environment, specifically to receivers (consumers) who are differentially susceptible to such signals (labels). In three experiments, we test the combined effects of three background types (plain, natural, concrete) and different labeling types (artificial intelligence-generated natural and vintage labels, Demeter (biodynamic),

United States Department of Agriculture organic, or no sustainability label) on three types of wine (red, white, rosé). Our study corroborates the significance of general labeling by demonstrating that sustainability labels (accredited or fictitious) enhance consumer valuation of wines, operationalized as an increased willingness to buy and pay.

## 2. Conceptual framework and hypotheses

### 2.1 Signaling theory

Signaling theory posits that individuals and organizations convey value and intentions through signals, which can be observable actions or attributes that provide information to others (Bergh et al., 2014; Connelly et al., 2011). In order to provide guidance to consumers in their decision-making processes, wine marketing makes use of a variety of signals that are employed to communicate the different attributes that consumers value and which ultimately serve as quality indicators. Such signals may include, among others, the weight of the bottle, type of closure, production region, grape variety, and classification (for instance, Grand Cru and Reserva). Signaling serves as a mechanism for the transmission of valuable information whereby producers, such as wineries, possess superior knowledge compared to consumers (Boulding & Kirmani, 1993). Consequently, producers bridge the information gap by sending signals that convey valuable information to consumers who may otherwise lack access. This is particularly pertinent in the context of sustainability practices, where consumer comprehension and awareness may be constrained by the nature of the attribute in question as a credence attribute (de Boer, 2003).

As sustainability labels provide insights into aspects of production and processing that are not directly observable in the final product (Coderre et al., 2022), they enable consumers to make more informed product choices (Majer et al., 2022). Labels can facilitate consumer decision-making by providing a fast and convenient method for identifying sustainable products. If the information provided is deemed to be credible, the label can also serve as a

trusted source of information, allowing consumers to rely on a pre-established standard (Crosetto et al., 2020). In the case of wine, a sustainability label can, for instance, engender a multi-faceted halo effect (Amos et al., 2019), whereby the label leads consumers to perceive the product as healthier, safer to consume, better for the environment, and of higher quality due to its perceived naturalness (Sgroi et al., 2023; Boncinelli et al., 2019; Larceneux et al., 2012).

The use of atmospheric signals, such as the incorporation of a natural background when displaying or advertising wine, can also serve as an effective means of communicating the product's naturalness. The literature indicates that consumers associate naturalness with wine produced from hand-picked grapes (Dominici et al., 2019) aged in oak barrels and closed with natural cork (Staub et al., 2020), with tradition (Siegrist & Sütterlin, 2017), with spontaneous fermentations, the absence of added sulfites, and artisanal winemaking process (Bazzani et al., 2023). The utilization of backgrounds characterized by a high degree of naturalness may result in consumers perceiving the wine in question to be more natural and sustainable. Figure 1 depicts our conceptual model (see Appendix for a literature review table).

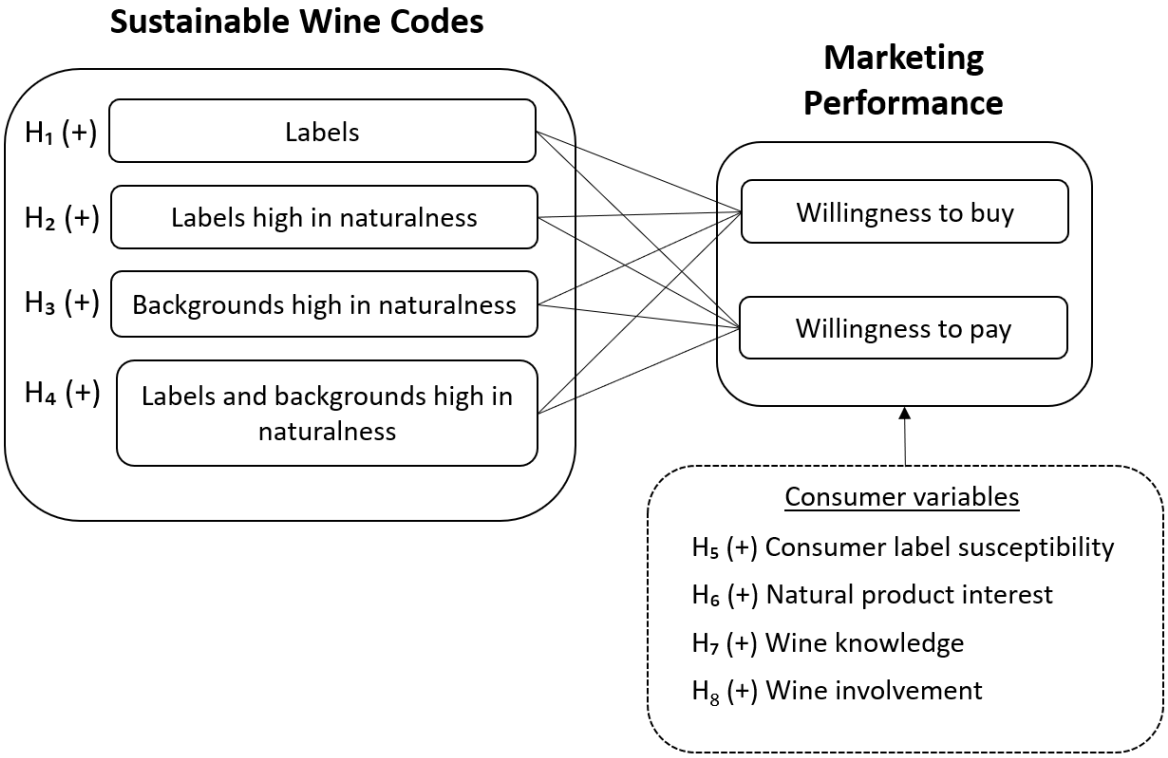



**Figure 1** Conceptual Model for Sustainable Wine Codes, Consumer Variables, and Marketing Performance

### 2.2 Sustainable Wine Codes and Label Performance

A comprehensive review by Majer et al. (2022) on the impact of visual sustainability labels on consumer perception and behavior reveals consistent empirical evidence of the positive influence of sustainability labels on willingness to buy and pay across products and contexts. This also applies to sustainable wine (Vecchio et al., 2023; Bazzani et al., 2023). Therefore:

**H1:** Consumers exhibit a higher willingness to buy (H1a) and willingness to pay (H1b) for wines with sustainability labels than wines without sustainability labels

Many food producers deploy visual rhetoric in images, photos, and/or colors on packaging, websites, and/or advertisements to evoke perceptions of naturalness regarding their products and production processes. In market communication, they can express/signal nature through the use of various shades of green and natural elements that are readily associated with naturalness by the general public. Such elements are integral to a firm's emotional communication strategy (Binninger, 2017), as evidenced by the Norwegian dairy

producer Tine’s consistent portrayal of its cows in idyllic natural settings (Borkfelt et al., 2015).

Prior research demonstrates that the use of background images to signal naturalness has a significant positive influence on consumer product evaluations. For instance, Folwarczny et al. (2023) reports that subjects who were exposed to a natural (as opposed to urban) food evaluation background (an image showing green vegetation against a background image of a city in grey-blue tones) estimated the calorie content of foods perceived as relatively unhealthy to be lower. One potential explanation is that evoking naturalness (which is associated with healthiness) results in a phenomenon known as a health halo, which leads consumers to estimate fewer calories for unhealthy foods (Folwarczny et al., 2023).

A substantial body of research indicates that consumers have predominantly positive associations with the term "natural." This phenomenon has been described in the literature as "natural preference" (Rozin, 2005). Consumers perceive a close connection between “natural” and “healthy” with respect to food (Román et al., 2017). Furthermore, they often believe that natural entities/things are better for their health, well-being, and the planet (Rozin, 2005). Bazzani et al. (2023) observe significant willingness to pay price premiums for wines that exhibit clear naturalness signals, such as the absence of added sulfites and spontaneous fermentation. Furthermore, the results of the study align with the findings of Etale and Siegrist (2021), indicating the influence of perceived naturalness on wine consumption frequency. In light of the aforementioned evidence, we put forth the following hypothesis:

**H2:** Consumers exhibit a higher willingness to buy (H2a) and willingness to pay (H2b) for wines with labels conveying high perceived naturalness than for those with low perceived naturalness

**H3:** Consumers exhibit a higher willingness to buy (H3a) and willingness to pay (H3b) for wines depicted in front of a background with high perceived naturalness than for those depicted in front of a background with low perceived naturalness

Twum & Yalley (2021) acknowledge the influence of green-integrated marketing communication on consumer behavior as results-driven consumer-focused creative content. They advocate further investigation to ascertain the efficacy of green integrated marketing communication, particularly with respect to the combined impact of diverse stimuli or signals, such as backgrounds and labels, as explored in the present study. As an integrated approach, it can serve to reinforce the signaling of natural wine codes. In a study of French food, Binninger (2017) uncovers that the products are perceived as being more natural when functional communication elements (like labels, sustainable claims, and product origin) are combined with or dominated by emotional communication elements (for example, pictures or different shades of green). Similarly, Hartmann et al. (2005) observe that a combination of functional environmental attributes and emotional elements of green brand associations (the product embedded in pleasant imagery of nature scenery aimed to evoke feelings experienced in the actual situation) have the highest perceptual effect on brand attitudes. In light of the above:

**H4:** Consumers exhibit a higher willingness to buy (H4a) and willingness to pay (H4b) for wines with a label and a background with high perceived naturalness than for those with low perceived naturalness

### 2.3 Consumer variables

#### 2.3.1 Consumer Susceptibility to Labeling

Prior studies suggest that some consumers are more inclined than others to rely on labels when making food choices (Folwarczny et al., 2024). By developing and applying a psychometric scale to assess the Consumer Susceptibility to front-of-package Food Labeling

scale, Folwarczny et al. (2024) demonstrate that inconsistent findings regarding the effectiveness of labeling may be attributed to a failure to consider individual-level differences in susceptibility to labeling in the first place. Current research has neglected to consider how individual differences impact a consumer's responsiveness to labeling. The extent to which consumers pay attention to label information varies considerably across studies (Sgroi et al., 2023; Boncinelli et al., 2021; Vecchio et al., 2018). Aside from Galati et al. (2019), who establish a positive link between willingness to pay for natural wine and the importance attributed to label information, and Boncinelli et al. (2021), there has been a scant focus on individual-level predictors of the propensity to use labels in food-related decision-making contexts. The newly developed Consumer Susceptibility to Front-of-Package Food Labeling scale is designed to capture consumers' propensity to buy based on labels. Folwarczny et al. (2024) show that the scale can effectively predict consumer's willingness to buy labeled fish fillets. However, the scale has yet to be tested beyond the initial research publication. In this study, we extend the scale to encompass the context of wine and willingness to pay, thereby expanding its applications. Folwarczny et al. (2024) state that the Consumer Susceptibility to Front-of-Package Food Labeling scale positively correlates with consumers' willingness to buy food items with genuine, certified labels but not products lacking or with fictitious labels. Therefore:

**H5:** Consumers' susceptibility to labeling is positively related to willingness to buy (H5a) and willingness to pay (H5b) for wine

### 2.3.2 Natural Product Interest

In examining signaling theory from the perspective of the receiver, it is necessary to take consumers' varying interests in natural products into account. This consideration is particularly important given the existence of heterogeneous preferences within the consumer population with regard to naturalness. For instance, Boncinelli et al. (2021) identify a sizeable

niche within the market where consumers derive value from purchasing organic wine. Consumer interest in natural products, driven by a desire for health benefits and high-quality goods (Rana & Pauls, 2020), encompasses a preference for unprocessed foods free of additives (Roininen et al., 1999).

Research shows that an increased interest in natural products is associated with a heightened willingness to pay for natural, organic, and biodynamic wines (Galati et al., 2019; Migliore et al., 2020; Vecchio et al., 2021, 2023). We, therefore, propose:

**H6:** There is a positive relationship between natural product interest and willingness to buy (H6a) and willingness to pay (H6b) for wine

### 2.3.3 Consumers' wine knowledge and involvement

As consumers gain more experience and knowledge about wine and winemaking practices, they become better equipped to appreciate the significance of sustainable practices in grape cultivation and wine production. As consumers' interest and knowledge in wine deepen and their purchase frequency increases, their decision-making process becomes more nuanced, often placing more weight on a broader spectrum of factors, including the manufacturing process (Pickering, 2023). As their involvement with wine increases, consumers are better able to differentiate between wines and more effectively process and interpret sustainability signals (Capitello & Sirieix, 2019). Furthermore, knowledge is a primary determinant of attitudes toward quality (Schäufele & Hamm, 2017). Despite the absence of a positive correlation between knowledge and attitudes toward sustainable wine in some previous studies (e.g., Rojas-Méndez et al., 2015; Sellers-Rubio & Nicolau-Gonzalbez, 2016), a growing body of recent research suggests that both knowledge and involvement are positively associated with a preference for sustainable wines and a willingness to pay a price premium for them (Bazzani et al., 2023; Gow et al., 2022; Valenzuela et al., 2022; Scozzafa et al., 2021). In view of the foregoing, we propose:

**H7:** There is a positive relationship between wine knowledge and willingness to buy (H7a) and willingness to pay (H7b) for wine

**H8:** There is a positive relationship between wine involvement and willingness to buy (H8a) and willingness to pay (H8b) for wine

## 3. Empirical Experiments

In three studies, we test the combined effects of three background types (plain, natural, concrete) and different labeling types (artificial intelligence-generated natural label; artificial intelligence-generated vintage label; Demeter; United States Department of Agriculture organic; no sustainability label at all) on participants' willingness to buy and pay for wine. To ensure the reliability of the results and enhance their ecological validity, we ask participants to rate a variety of wine types, including red, white, and rosé. Consequently, we designed all three studies as a between-within-subjects experiment, with the background type serving as the between-subjects factor and the labeling type as the within-subjects factor. We coded all the studies using PsyToolkit (Stoet, 2010, 2017), analyzed data using R version 4.2.2 (R Core Team, 2022).

### 3.1 Pretest

We recruited a total of 52 US participants through Prolific Academic to rate 13 backgrounds and 8 labels. We undertook this process to ensure that the selected backgrounds and labels for the main studies differed substantially in their perceived naturalness. In line with the demand for more knowledge of artificial intelligence in content creation (Murár & Kubovics, 2023), we obtained the backgrounds using Canva, and used either actual sustainability labels from the wine market or fictitious labels generated using OpenAI's image generator. Participants indicate their level of agreement with the statement "This background depicts nature" while viewing various backgrounds on a scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). The mean rating of naturalness for the selected natural background (M = 5.87)

differed substantially from the mean ratings of naturalness for the other two backgrounds: one depicting a concrete wall (M = 1.94) and another being a plain white background, akin to that found on most websites (M = 1.85). Using the same response format, we asked participants to indicate their level of agreement with the statement: "This label communicates the product's naturalness." As was the case with the backgrounds, the selected labels exhibited considerable variation in their perceived naturalness, with means ranging from 5.48 for the United States Department of Agriculture organic label to 2.77 for the Demeter (biodynamic) label.

### 3.2 Study 1

The use of artificial intelligence in image generation is becoming increasingly prevalent across various domains. In some instances, these images have been selected as winners in art contests, potentially posing a challenge to even the most highly creative individuals (Roose, 2022). Study 1 aims to assess the influence of artificial intelligence-generated food labels indicating naturalness in comparison to other artificial intelligence-generated signals or the absence of such signals on wine labels. In addition, we investigate the potential for a synergistic effect of a natural background type in conjunction with a natural label type on willingness to buy and pay for wines.

#### *Participants*

The sample consists of 409 American participants (mean age = 43.8, SD = 13.7; gender: 49.9% female, 48.7% male, 1.5% other). We recruited the participants via Prolific Academic, all of them had an approval rate of 99% or higher, with at least five prior submissions. Participants were pre-screened to ensure that they drank wine at least occasionally. We required each participant to provide informed consent prior to engaging in the study. Regardless of whether or not they completed it in its entirety, we compensated all participants

for their partaking un the study.

***Procedure***

The participants are first randomly assigned to one of three experimental conditions. The first condition is a control group that evaluates wines presented against a plain white background. The second condition is a treatment group that evaluates wines presented against a natural background, while the third group is presented with a concrete (non-natural) background. The participants evaluate three wine bottles, each containing a different type of wine (red, white, rosé), for each background type. The bottles are presented in a manner analogous to that observed in numerous online wine shops, with information such as alcohol by volume and grape varieties displayed. In this phase of the experiment, we introduce the within-subjects variable, namely, the labeling type. Specifically, participants evaluate each of the three wines with no sustainable label, an artificial intelligence-generated natural label, and an artificial intelligence-generated vintage label (yielding a total of nine evaluations per outcome variable: willingness to buy and pay). We randomize the presentation orders of these labeling types and the dependent measures.

The literature provides evidence to support this research design, which makes use of multiple measures per participant. The collection of multiple measures of an outcome variable increases the power of a study to detect effects, should they exist (Meyvis & Van Osselaer, 2018). Furthermore, varying dimensions other than the independent factor within multiple replications of a stimulus, counterbalanced across participants, can substantially reduce demand effects in such research designs (Meyvis & Van Osselaer, 2018). The current research design is also suitable for analysis using mixed-effects modeling. Mixed-effects modeling provides additional advantages over classical between-subjects designs by accounting for variation within participants and stimuli (Brown, 2021).

***Dependent Variables***

The first dependent variable is willingness to pay, captured on a scale ranging from $0 to $50, with $0.10 intervals ("Seeing this information makes me want to pay $... [indicate on a slider below] for the wine."). The second dependent variable is willingness to buy, captured on a scale ranging from 0 (Very unlikely) to 100 (Very likely). We asked participants: "How likely would you be to buy this bottle of wine if you saw it priced at $11?" (We selected this price value based on the rationale that it corresponds to the minimum average retail price of wine across the United States; Beauchamp, 2023).

***Covariates***

Following the presentation of the willingness-to-pay and buy measures, participants complete several scales. Specifically, they complete the 7-item Consumer Susceptibility to Front-of-Package Food Labeling scale (Folwarczny et al., 2024), with responses ranging from 1 (Strongly disagree) to 9 (Strongly agree). Items include statements such as "I prefer grocery stores with a vast selection of labeled products." We average the responses to form the Consumer Susceptibility to Front-of-Package Labeling index (alpha = .95, M = 6.84, SD = 1.73). Additionally, participants complete the 6-item Natural Product Interest Scale (Roininen et al., 1999), with responses ranging from 1 (Disagree strongly) to 7 (Agree strongly) on items such as "I would like to eat only organically grown vegetables." We average the items to create the Natural Product Interest index (alpha = .84, M = 4.66, SD = 1.34). Furthermore, participants complete the 3-item Wine Knowledge Scale (Vecchio et al., 2023), responding to a scale from 1 (Very poorly informed) to 5 (Very well informed) for items inquiring about their knowledge of organic, biodynamic, and natural wine. We average these responses to form the Wine Knowledge index (alpha = .86, M = 2.34, SD = 0.94). The final scale participants complete is the 4-item Wine Involvement Scale (Vecchio et al., 2021), with responses ranging from 1 (Disagree strongly) to 7 (Agree strongly). Items include statements such as "I select the wines I purchase very carefully." Similar to the previous scales, we

average these items to form the Wine Involvement index (alpha = .67, M = 5.23, SD = 1.10). Participants were also asked to provide demographic data, including information on their gender, age, and income.

We provide an overview of participants' willingness to buy and willingness to pay tasks in Figure 2. The figure displays the three background types used (plain, natural, concrete), the three types of wines evaluated (red, white, rosé), and the artificial intelligence-generated natural label (here on white wine), the artificial intelligence-generated vintage label (here on rosé wine), as well as the no sustainability label condition (here on red wine).

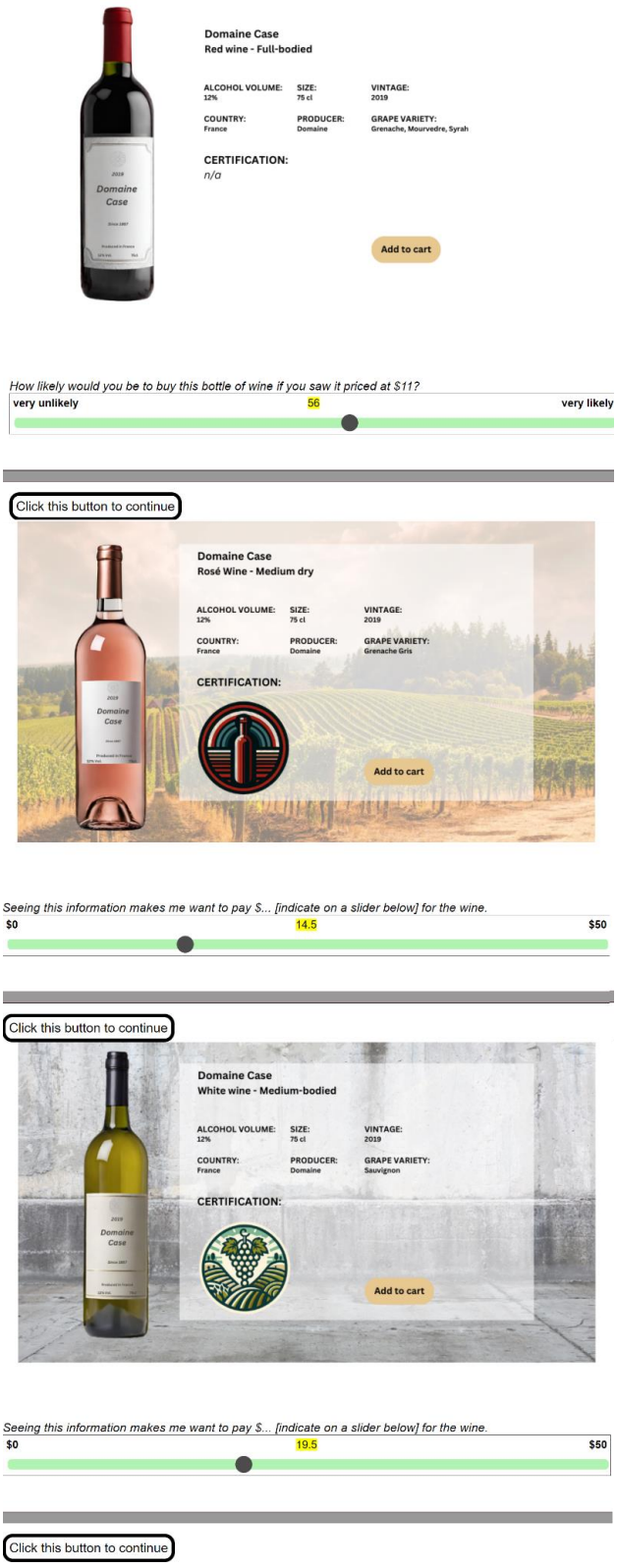



**Figure 2** Main Tasks in Studies 1-3

### *Results and Discussion*

**Analytic Approach.** Given that our data are nested, and participants provide multiple measures of willingness to buy and pay, we fit linear mixed models to our data using the *lme4* package for R (Bates et al., 2015). We generate all tables, including the estimated significance levels, using the *Stargazer* package for R (Hlavac, 2022). In the regression models we present below, we employ the natural background and the artificial intelligence-generated natural label as a reference category. With regard to random effects, we allow random slopes for participants, and measures accommodate the possibility that some of the effects might be measure-specific (i.e., contingent upon the wine bottle type). As fixed effects, we include wine evaluation background, wine label, interaction terms between these two predictors, and the remaining covariates described in the Participants and Procedure subsection.

**Results.** As the regression coefficients in Table 1 show (for a visual representation of the distribution of responses, see Figure 3), Study 1 examines the effects of different labeling types and backgrounds on consumers' willingness to buy and pay for wine. The results support hypotheses H1a and H1b, indicating that consumers have a significantly higher willingness to buy and pay for wines with sustainability labels signaling naturalness compared to those without any labels. However, we refute hypotheses H2a and H2b, as wines with sustainability labels signaling naturalness do not increase willingness to buy or pay relative to wines with sustainability labels that did not signal naturalness. We also refute H3a, H3b, H4a, and H4b, as there is no significant effect of background naturalness on either dependent variable, nor is there an interaction between background naturalness and label naturalness.

Hypotheses H5a and H5b are supported, as consumer susceptibility to front-of-package food labeling is positively associated with willingness to buy and pay. Hypotheses

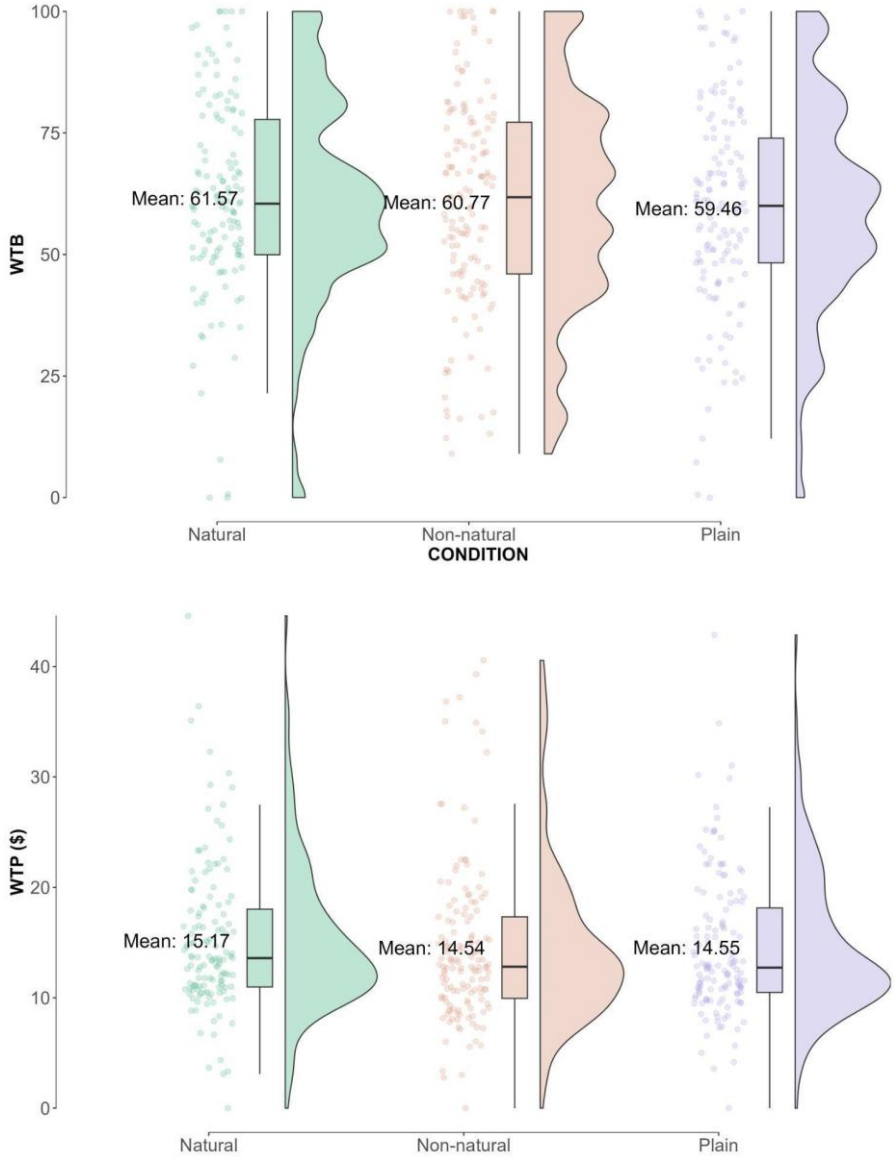
H6a and H6b, predicting an effect of natural product interest, are not supported. Finally, H7a and H7b are supported, with wine knowledge related to both willingness to buy and pay. H8a and H8b are partially supported, as wine involvement predicts willingness to buy but not willingness to pay.

**Discussion.** The results of Study 1 suggest that bottles with artificial intelligence-generated natural labels are more effective than bottles with no sustainability labels in wine selection scenarios. However, artificial intelligence-generated labels that signal naturalness are not necessarily more effective than other artificial intelligence-generated labels that do not signal naturalness. Among consumer variables, wine knowledge and susceptibility to front-of-package food labeling are the most consistently and positively related to willingness to buy and pay for wine.

| | WTB | WTP |
|---|---|---|
| **Sustainable wine codes** | | |
| Intercept | 31.88 (19.41, 44.35)*** | 7.93 (4.07, 11.80)*** |
| Label: No sustainability labels | -8.46 (-14.98, -1.93)* | -1.85 (-3.33, -0.36)* |
| Label: AI-vintage | -1.43 (-7.96, 5.10) | -0.27 (-1.76, 1.21) |
| Background: Concrete | -2.76 (-8.17, 2.64) | -0.94 (-2.55, 0.66) |
| Background: Plain | -2.66 (-8.11, 2.80) | -0.48 (-2.10, 1.14) |
| Background: Concrete × Label: AI-vintage | 0.63 (-3.60, 4.86) | 0.50 (-0.30, 1.29) |
| Background: Plain × Label: AI-vintage | 0.29 (-3.99, 4.56) | 0.03 (-0.77, 0.83) |
| Background: Concrete × Label: No sustainability labels | 3.37 (-0.86, 7.60) | 0.44 (-0.36, 1.23) |
| Background: Plain × Label: No sustainability labels | -0.65 (-4.92, 3.63) | -0.64 (-1.45, 0.16) |
| **Consumer variables** | | |
| Customer Susceptibility to FOP Labeling | 2.50 (1.22, 3.78)*** | 0.50 (0.09, 0.91)* |
| Natural Product Interest | -1.65 (-3.31, 0.01) | -0.45 (-0.98, 0.08) |
| Wine Knowledge | 2.96 (0.64, 5.28)* | 2.29 (1.54, 3.03)*** |
| Wine Involvement | 3.27 (1.25, 5.28)** | 0.25 (-0.40, 0.89) |

*Note*: *p<0.05; **p<0.01; ***p<0.001. Brackets show 95% Cis.
Reference categories: Natural background and AI-natural label

**Table 1** Study 1 results




*Note:* The vertical lines in the centers of the boxplots indicate the medians. The shaded areas on the right-hand side of the boxplots show the distributions of the data points depicted on the left-hand side of the individual segments of the figure.

**Figure 3** Distribution of Data in Study 1. Willingness to Buy (WTB) and Willingness to Pay (WTP) under Natural, Non-Natural (concrete), and Plain Conditions

### 3.3 Study 2

Study 1 reveals that, compared to wines without sustainability labels, products with artificial intelligence-generated natural labels yield a higher willingness to buy and pay. However, the artificial intelligence-generated natural label is statistically indistinguishable from another artificial intelligence-generated label that does not signal naturalness. In Study 2, we aim to

extend these findings by comparing the artificial intelligence-generated label against a genuine accredited label (certifying biodynamic agriculture) that scored low in naturalness in the pretest study. For this purpose, we use the Demeter (biodynamic) certificate.

***Participants and procedure***

The sample consists of 331 American participants (mean age = 45.8, SD = 13.2; gender: 58.6% female, 40.5% male, 0.9% other). All participants were recruited via Prolific Academic and had an approval rate of 99% or higher, with at least five prior submissions. Participants were pre-screened to ensure that they drank wine at least occasionally. Each participant were required to provide informed consent prior to engaging in the study. Regardless of whether or not they completed the study in its entirety, all participants were compensated for their participation.

The procedure in Study 2 closely mirrors that used in Study 1, with one exception: we replace the vintage label generated by artificial intelligence with the Demeter label.

***Results and Discussion***

**Analytic Approach.** Our analytic approach corresponds to that used in the earlier study. Table 2 summarizes the key findings (Figure 4 depicts the distribution of responses).

| | WTB | WTP |
|---|---|---|
| **Sustainable wine codes** | | |
| Intercept | 21.33 (7.42, 35.24)** | 6.72 (2.54, 10.90)** |
| Label: No sustainability labels | -9.71 (-17.13, -2.30)* | -2.96 (-4.41, -1.51)*** |
| Label: Demeter | -5.37 (-12.79, 2.05) | -1.27 (-2.72, 0.17) |
| Background: Concrete | 5.70 (-0.09, 11.49) | 0.31 (-1.40, 2.02) |
| Background: Plain | -1.19 (-6.88, 4.49) | -0.07 (-1.75, 1.61) |
| Background: Concrete × Label: Demeter | 1.33 (-3.20, 5.86) | 0.65 (-0.29, 1.59) |
| Background: Plain × Label: Demeter | 1.19 (-3.27, 5.65) | 0.24 (-0.68, 1.17) |
| Background: Concrete × Label: No sustainability labels | 0.36 (-4.17, 4.89) | 0.52 (-0.42, 1.46) |
| Background: Plain × Label: No sustainability labels | 2.37 (-2.09, 6.83) | 1.06 (0.14, 1.98)* |
| **Consumer variables** | | |

| | | |
|---|---|---|
| Customer Susceptibility to FOP Labeling | 2.80 (1.40, 4.19)*** | 0.92 (0.48, 1.36)*** |
| Natural Product Interest | -0.26 (-2.07, 1.55) | -0.73 (-1.30, -0.16)* |
| Wine Knowledge | 1.91 (-0.79, 4.60) | 2.33 (1.48, 3.18)*** |
| Wine Involvement | 3.68 (1.44, 5.91)** | 0.15 (-0.55, 0.85) |

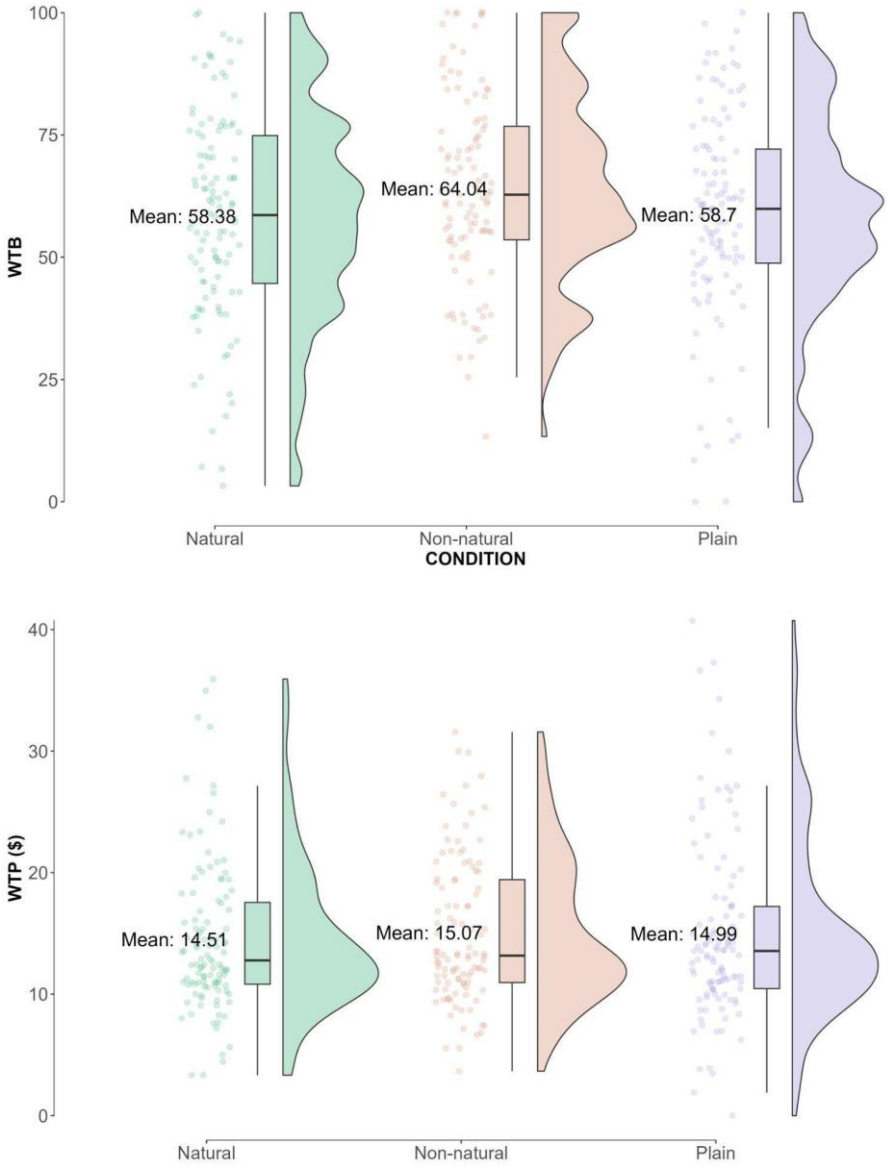
*Note*: *p<0.05; **p<0.01; ***p<0.001. Brackets show 95% Cis.
Reference categories: Natural background and AI-natural label

**Table 2** Study 2 results

**Results.** Experiment 2 follows a similar design and replicates many findings from Experiment 1. Hypotheses H1a and H1b are again supported, confirming the positive impact of sustainability labels with naturalness cues on willingness to buy and pay for wines compared to those without any labeling. However, as in Experiment 1, we refute hypotheses H2a, H2b, H3a, H3b, H4a, and H4b: wines with sustainability labels signaling naturalness do not significantly influence willingness to buy or willingness to pay compared to wines with labels lacking strong naturalness cues. Additionally, the effect of these labels does not interact with background naturalness, and the natural background itself does not affect willingness to buy or willingness to pay compared to other backgrounds. We do not observe a statistically significant interaction between predictor variables ($p = 0.100$) in the analysis of variance (ANOVA) test.

Consumer susceptibility to front-of-package food labeling (H5a and H5b) remains a significant predictor of both willingness to buy and pay. Given that natural product interest is negatively correlated to willingness to pay (an outcome we had not anticipated), H6b is not supported. Natural product interest is also unrelated to willingness to buy, so we refute hypothesis H6a. Wine knowledge is positively associated with willingness to pay (supporting H7b) but is not related to willingness to buy, thus we do not confirm hypothesis H7a. Finally, wine involvement is positively linked to willingness to buy (supporting H8a) but does not significantly influence willingness to pay, so we do not corroborate H8b.

**Discussion.** In summary, the results of Study 2 are largely consistent with those of Study 1, with no main effect of background type and with the artificial intelligence-generated natural label performing better than no label in terms of willingness to buy and pay for wine. There are some positive, albeit largely inconsistent links between consumer variables and willingness to buy and pay for labeled wine. The only consistent predictor of both of these outcome variables is customer susceptibility to front-of-package labeling, a result similar to Experiment 1.




*Note:* The vertical lines in the centers of the boxplots indicate the medians. The shaded areas on the right-hand side of the boxplots show the distributions of the data points depicted on the left-hand side of the individual segments of the figure.

**Figure 4** Distribution of Data in Study 2. Willingness to Buy (WTB) and Willingness to Pay (WTP) under Natural, Non-Natural, and Plain Conditions

### 3.4 Study 3

In Studies 1 and 2, we did not observe a positive effect of background and label naturalness in our outcome measures. Therefore, in Study 3, instead of using an artificial intelligence-generated natural label, we use the widely recognized United States Department of Agriculture organic label (Stanton & Cook, 2019). Descriptive statistics from the pretest suggest that this label is likely perceived as more natural ($M$ = 5.48) than the artificial intelligence-generated alternative ($M$ = 4.79).

#### *Participants and procedure*

The sample consist of 365 American participants (mean age = 42.1, SD = 13.5; gender: 60.8% female, 38.4% male, 0.8% other). All participants were recruited via Prolific Academic and had an approval rate of 99% or higher, with at least five prior submissions. Participants were pre-screened to ensure that they drank wine at least occasionally. Each participant was required to provide informed consent prior to engaging in the study. Regardless of whether or not they completed the study in its entirety, all participants were compensated for their participation.

Study 3 follows the same procedure as the earlier studies with one exception: we replace the artificial intelligence-generated natural label with the United States Department of Agriculture organic label.

#### *Results and discussion*

**Analytic Approach.** In Study 3, we use the same analytic approach as in the previous experiments. Since we substitute the artificial intelligence-generated natural label with the United States Department of Agriculture organic label, the latter label serves as a reference category for analyses. Table 3 summarizes the key findings, and Figure 5 depicts the distribution of responses.

| | WTB | WTP |
|---|---|---|
| **Sustainable wine codes** | | |
| Intercept | 33.49 (20.31, 46.66)*** | 7.78 (3.74, 11.83)*** |
| Label: No sustainability labels | -8.98 (-14.13, -3.84)*** | -3.21 (-4.52, -1.90)*** |
| Label: Demeter | -3.95 (-9.09, 1.20) | -1.46 (-2.77, -0.15)* |
| Background: Concrete | -4.56 (-10.27, 1.16) | -0.01 (-1.68, 1.66) |
| Background: Plain | -5.16 (-10.75, 0.44) | -0.88 (-2.52, 0.76) |
| Background: Concrete × Label: Demeter | 0.27 (-3.99, 4.52) | 0.14 (-0.97, 0.68) |
| Background: Plain × Label: Demeter | 1.38 (-2.79, 5.54) | 0.18 (-0.64, 0.99) |
| Background: Concrete × Label: No sustainability labels | -0.36 (-4.62, 3.89) | 0.07 (-0.76, 0.90) |
| Background: Plain × Label: No sustainability labels | 0.86 (-3.30, 5.02) | 0.95 (0.14, 1.76)* |
| **Consumer variables** | | |
| Customer Susceptibility to FOP Labeling | 1.64 (0.17, 3.11)* | 0.25 (-0.20, 0.71) |
| Natural Product Interest | 0.29 (-0.28, 0.85) | -0.46 (-2.27, 1.36) |
| Wine Knowledge | 5.23 (2.54, 7.92)*** | 2.23 (1.39, 3.06)*** |
| Wine Involvement | 2.60 (0.49, 4.71)* | 0.19 (-0.47, 0.84) |

*Note*: *p<0.05; **p<0.01; ***p<0.001. Brackets show 95% Cis.
Reference categories: Natural background and AI-natural label

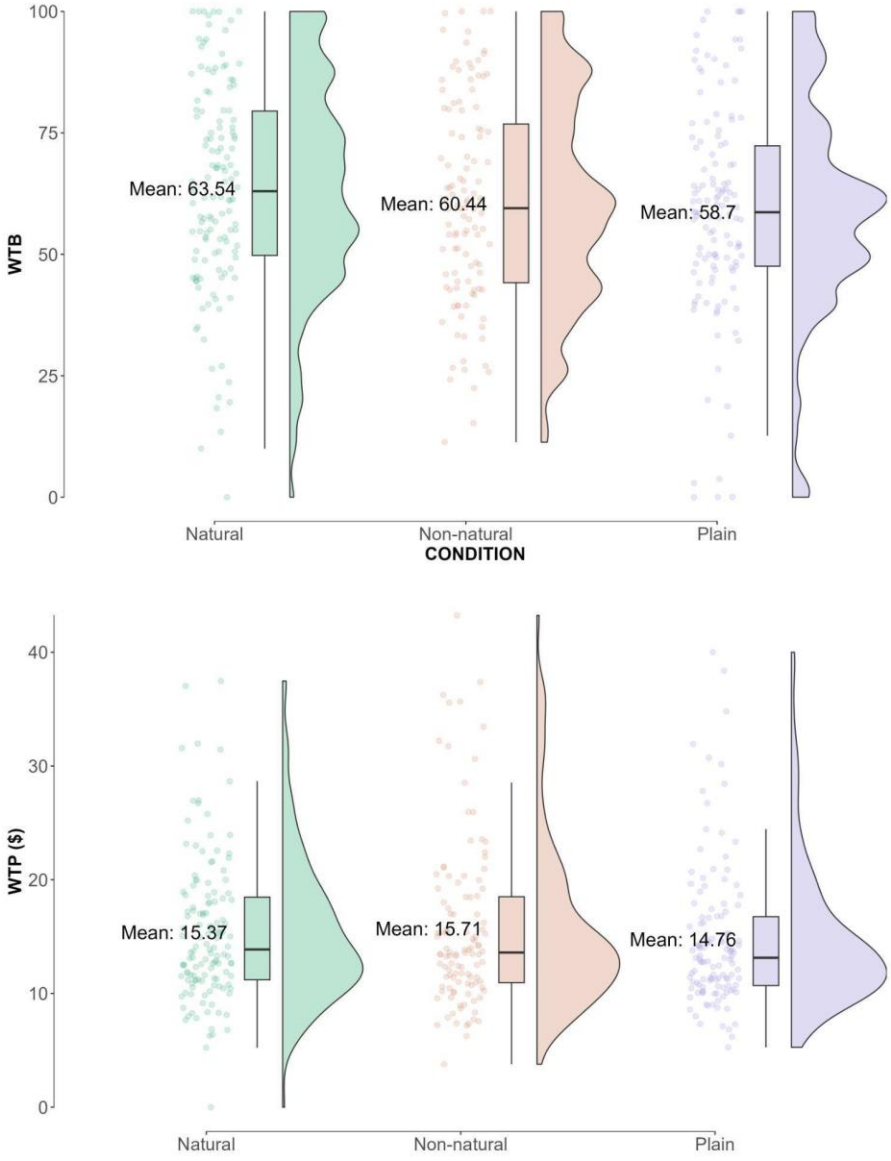
**Table 3** Study 3 results

**Results.** Experiment 3 replaces the artificial intelligence-generated label with the United States Department of Agriculture organic label, which is perceived as having higher naturalness in the pilot study. Consistent with the earlier studies, hypotheses H1a and H1b are again supported, as the sustainability label communicating naturalness leads to higher willingness to buy and pay compared to the condition where participants are not exposed to any labels. However, hypotheses H2a and H2b, which predict a positive effect of the high-naturalness label compared to the label low in naturalness, are only partially supported. Consumers show marginally higher willingness to pay for wine with the natural sustainability label compared to the Demeter label, which lacks cues to naturalness. The naturalness of the background (H3a and H3b) and its interaction with label naturalness (H4a and H4b) again show no significant and consistent effects. Although, similar to Study 2, we identify one

significant interaction, we do not observe this interaction ($p = 0.131$) in the analysis of variance (ANOVA) performed on the model.

Hypotheses regarding susceptibility to front-of-package food labeling (H5a and H5b) are partially supported, particularly for willingness to buy, although there is no such effect for willingness to pay. Natural product interest (H6a and H6b) is not a significant predictor in this study. Wine knowledge (H7a and H7b) consistently show a positive effect, while wine involvement (H8a and H8b) predicts willingness to buy but not willingness to pay.

**Discussion.** Overall, the nature and significance of the results from Study 3 are largely overlapping with those from the earlier experiments. Although the United States Department of Agriculture organic performs statistically better than Demeter in the willingness to pay measure, the difference is minor, as evidenced by one of the confidence intervals being close to zero and the absence of such an effect for the second outcome variable: willingness to buy. The relationships between the outcome variables and consumer variables are less consistent, especially when considering the relatively stable links between willingness to buy and pay for wine and consumer susceptibility to front-of-package food labeling in Studies 1-2. In contrast to the earlier studies, wine knowledge is positively associated with both willingness to buy and pay for wine.




*Note:* The vertical lines in the centers of the boxplots indicate the medians. The shaded areas on the right-hand side of the boxplots show the distributions of the data points depicted on the left-hand side of the individual segments of the figure.

**Figure 5** Distribution of Data in Study 3. Willingness to Buy (WTB) and Willingness to Pay (WTP) under Natural, Non-Natural (concrete), and Plain Conditions

## 4. General Discussion

We explored the joint effects of background types (plain versus natural versus concrete) and labeling types on willingness to buy and pay for red, white, and rosé wines in a pretest and three studies, with over 1,100 participants. Table 4 summarizes the findings. We observe reliable support for hypotheses 1, 5, and 7.

| Hypotheses | Expected | Study 1 | | Study 2 | | Study 3 | |
|---|---|---|---|---|---|---|---|
| | | WTB | WTP | WTB | WTP | WTB | WTP |
| **Natural Wine Codes** | | | | | | | |
| H1 | (+) | Supported | Supported | Supported | Supported | Supported | Supported |
| H2 | (+) | Not supported | Not supported | Not supported | Not supported | Not supported | Not supported |
| H3 | (+) | Not supported | Not supported | Not supported | Not supported | Not supported | Not supported |
| H4 | (+) | Not supported | Not supported | Not supported | Not supported | Not supported | Not supported |
| **Consumer Variables** | | | | | | | |
| H5 | (+) | Supported | Supported | Supported | Supported | Supported | Not supported |
| H6 | (+) | Not supported | Not supported | Not supported | Not supported | Not supported | Not supported |
| H7 | (+) | Supported | Supported | Not supported | Supported | Supported | Supported |
| H8 | (+) | Supported | Not supported | Supported | Not supported | Supported | Not supported |

**Table 4.** Summary of results in relation to hypotheses and control variables

Consumers are more willing to buy and pay for wines with sustainability labels than for those without (supporting H1a,b). Thus, labels signaling naturalness outperform wines with no sustainability label, but so do all other labels. This finding is consistent with recent studies showing no differences in willingness to buy based on different labeling types (Sigurdsson et al., 2024). However, it is higher for labeled products than for wines without sustainability labels. This is in line with our general findings that consumers' susceptibility to labeling (as assessed with the Customer Susceptibility to Front-of-Package Food Labeling scale) is positively related to willingness to buy and to pay for wine (supporting H5a,b). The current results suggest that whether retailers use fictitious artificial intelligence-generated or genuine accredited labels and whether these labels signal naturalness, consumers' willingness to buy and pay remains unchanged (rejecting H2a,b). Although we expected that labels signaling naturalness (artificial intelligence-generated natural label and United States Department of Agriculture organic) would outperform labels not signaling such qualities in wine (artificial intelligence-generated vintage label and Demeter), we did not observe such a main effect. Consumers do not exhibit a higher willingness to buy (H2a) and to pay (H2b) for wine with high perceived naturalness labels than for wines with low perceived naturalness labels. Unlike previous studies on the effects of labels (for example, see the reviews by Majer et al.,

2022 and Schäufele & Hamm, 2017), we also manipulate background type, including its naturalness, but we find no effect from this treatment. Consumers do not exhibit a higher willingness to buy and pay for wine with a background perceived as high in naturalness than those perceived as low in naturalness (rejecting H3a,b). To some extent, these null results are consistent with studies showing rather weak effects of manipulating food evaluation background on consumers' food evaluations (Folwarczny et al., 2023). In addition, there is no synergistic effect of a natural background paired with natural labels. Consumers do not exhibit a higher willingness to buy and pay for wine with a label and a background perceived to contain high naturalness compared to those perceived to contain low naturalness (rejecting H4a,b). In line with these findings, there is no relationship between natural product interest and willingness to buy and willingness to pay for wine (rejecting H6a,b). Higher wine knowledge tends to be positively related to willingness to buy and willingness to pay for wine (supporting H7a,b), except for willingness to buy in Study 2, and higher wine involvement is positively related to willingness to buy (supporting H8a) but not to willingness to pay (rejecting H8b). This supports the notion that wine knowledge and involvement predict willingness to buy and pay for wine.

### 4.1 Theoretical Implications

This study makes a number of theoretical contributions to the existing literature by extending signaling theory in the wine context. The present research highlights the challenges retailers and manufacturers face when attempting to sway consumers' preferences using various natural codes as value-enhancing signals for wine. Increased wine knowledge and involvement tend to be associated with willingness to buy. However, this does not seem to be due to a better understanding of the importance of sustainable practices in grape growing and wine production. Sustainability labeling is a value driver, but naturalness is not. In general, labels may be effective because they are used by consumers as a heuristic (Stanton & Cook,

2019). Consumers have not had nearly as much experience with different backgrounds, so such signaling has not been learned. In some situations, senders can exploit receivers by using dishonest signals. Signaling can remain stable with dishonest signaling, provided that signals are generally honest on average (Johnstone and Grafen 1993). Consequently, this study highlights the significance of exploring pathways to signal reliability and developing anti-deception strategies.

Differently to the existing literature which focused mainly on direct signals, our study underscores the significance of a more abstract and peripheral (indirect) representation of naturalness. The results indicate that consumers exposed to a background perceived as high in naturalness do not exhibit a higher willingness to buy or pay for wine than those exposed to a background perceived as low in naturalness. Similarly, the labels perceived as high in naturalness do not outperform those perceived to be low in naturalness. These findings are counterintuitive, as one might assume that increased consumer environmental awareness and interest in sustainability would suggest a preference for wines perceived as natural. Moreover, prior research indicates that the perception of the naturalness of food positively influences its perceived quality (Petty, 2015; Román et al., 2017; Staub et al., 2020); and that that choice behavior can be influenced by whether a wine is perceived as natural (Bazzani et al., 2023). We infer that, at the very least, in the case of background images, these may be too abstract representations of naturalness (a peripheral signal). As a considerable proportion of consumers perceive winemaking from grapes as a natural process and strongly associate it with traditional methods (Etale & Siegrist, 2021), background images evoking naturalness may have a limited impact on their decision-making. A more direct approach involving signaling more concrete attributes representative of sustainable practices may prove to be a more effective strategy. This aligns with the findings of Bazzani et al. (2023), which demonstrate that consumers are willing to pay a price premium for signals linked to natural

wine production, such as ecological certifications and wine-making techniques ("no added sulfites" and "spontaneous fermentation").

This is also one of the first studies to look at the impact of artificial intelligence-generated labels on willingness to buy and pay for wine. In signaling games a major question is whether the market has the ability to separate in a way that all signals correctly reflect the underlying conditions (Mailath et al., 1993). Conversely there are occasions where equilibrium is not separating in the sense that signals can be of any type irrespective of the underlying conditions. In such cases the signal is not informative and is usually not sufficiently punished to claim more or less that what happens in reality. Similar as with the case of prices strategically used as signals of quality, our results seem to indicate that the wine market is not mature or knowledgeable enough to mitigate the incentives to producers for strategic and even manipulative sustainable signaling. The noise in the signal carried by certifications can also be discouraging for those intrinsically and sincerely motivated towards sustainable production and certification.

### 4.2 Practical Implications

Our research yields significant findings that are particularly pertinent for practitioners engaged in the integration of nature-themed elements into marketing strategies, the utilization of certified labels, and the mitigation of greenwashing practices.

The results of all three studies demonstrate that consumers exhibit a greater willingness to buy and a willingness to pay a premium for red, white, and rosé wine bottles bearing sustainable labels, regardless of the specific label type. Moreover, existing studies indicate that consumers are inclined to pay a higher price for other products with a sustainable label (Sigurdsson et al., 2024). These findings reinforce the importance of comprehensive labeling strategies for wine and substantiate the validity of the Customer Susceptibility to Front-of-Package Food Labeling scale. We have tested and validated this

scale for the first time beyond its initial publication. Consumers who exhibit greater susceptibility to labeling exhibit a higher willingness to buy and pay for wine. Prior research indicated the existence of disparate consumer segments with regard to both labeling segmentation and susceptibility to sustainability labeling (Clonan et al., 2012; Sigurdsson et al., 2020). However, further research is required to identify, profile, and enhance consumer susceptibility to labeling.

Our findings indicate that wine consumers are inclined to buy and pay a premium for any sustainability label, whether the signal is fictitious (in this case, artificial intelligence-generated) or genuinely accredited. Although this study has primarily focused on wine, recent findings from studies on label equity involving other product categories also demonstrate minimal to no difference in willingness to buy based on different labels (Sigurdsson et al., 2024). Such circumstances provide an incentive for the practice of unsubstantiated marketing. As previously discussed by de Freitas Netto et al. (2020), such labeling practices may culminate in greenwashing. By many accounts, the aim of accredited sustainability labels is to protect consumers. We emphasize the need to communicate the benefits of certification to consumers better to combat greenwashing and avoid misleading advertising.

Our findings indicate wine consumers are not influenced by the naturalness of the background. The evidence indicates that the presentation of wines against a background with a high level of perceived naturalness does not result in an increase in consumers' willingness to buy or willingness to pay. We infer that the strategy of incorporating natural-looking backgrounds is not an effective marketing investment for wine sellers. One potential explanation is that consumers lack sufficient knowledge about sustainability issues in the wine industry. Consequently, they may perceive wine as a natural product due to its primary ingredient, grapes (Etale & Siegrist, 2021). As a result of information asymmetry and the lack of ingredient labeling, consumers cannot ascertain the extent to which wine can be

manipulated. It is also possible that the participants came to understand that backgrounds can be readily manipulated, which would limit their signaling power.

### 4.3 Limitations and Future Research

Our study employs background pictures of nature and vineyards and determines that these images had no effect on the dependent variables. Future research may wish to consider other background images that resonate with consumers' perceptions of naturalness, such as images of grapes being hand-picked in a vineyard (see Dominici et al. 2019). Such images also signal craftsmanship (Lin & Mao, 2015) and may also examine the influence of background images and sustainability labels when combined with tags such as "no added sulfites," "spontaneous fermentation," and "hand-picked." These attributes elicit the highest marginal willingness to pay premium prices in the study conducted by Bazzani et al. (2023)**.**

It would be beneficial to conduct further experiments using different product categories and scales. Our willingness to pay measure was set at a starting point of $11 (in line with the average price of wine in the United States, as outlined in section 3.2) and ranged from $0 to $50. It is important to investigate alternative assessment methods to enhance the precision and applicability of future studies on the economic evaluation of wines against different backgrounds and with different labeling systems. It is also important to consider the abstract nature of the willingness to buy scale.

Research shows that medium-to-large intention changes result in only small-to-medium behavioral changes. This indicates an intention-behavior gap across diverse fields of research (Sheeran & Webb, 2016; Webb & Sheeran, 2006). It suggests that the effects previously reported, which were based on intentions rather than behaviors, may be attenuated in real-world scenarios. Therefore, some choices captured in front of computer screens may not be entirely generalizable to other ecologically valid settings (Dolinski, 2018; Baumeister et al., 2007). It is important to note, however, that the research settings are highly analogous

to actual customer choices, especially on e-commerce platforms. E-commerce wine sales are projected to nearly double between 2019 and 2029, indicating that online wine purchases are becoming increasingly common and an industry-standard (Statista, n.d.). Moreover, many studies demonstrate that intentions in front of a computer screen can be generalized to field settings (e.g., Bellezza et al., 2014; Moes et al., 2022; Otterbring & Folwarczny, 2024). Meta-analytical evidence supports the assertion that properly designed online experiments can generalize to real-world scenarios, albeit with weaker effect sizes (Sheeran & Webb, 2016; Webb & Sheeran, 2006). In light of the considerable scale of the wine industry, which sells millions of bottles daily, our findings are likely to have significant implications for managerial practice.

We conducted our online experiments in a realistic manner, exposing participants to wine bottles that closely resembled those typically found in actual stores. We presented these bottles with various attributes, including alcohol by volume, grape variety, and country of origin. Nonetheless, future studies should validate these effects in real-world and offline retail environments, where a substantial amount of wine is still purchased. Further progress could be made in the literature by conducting in-store (offline or online) experiments to assess the effectiveness of the interventions on wine purchasing behavior and sales (for an extensive discussion on the experimental analysis of in-store behavior and the challenges in working with retailers, see Sigurdsson et al., 2015). This may be accomplished by employing a repetitive measures reversal experimental design (A-B-C-B-C) structure to reduce unintended effects (or an illustration of this approach, see the in-store experiment (Study 3) in Sigurdsson et al., 2020). Existing sales data can be employed to set a control for the percentage of units sold, which will serve as the baseline (A). The “B” intervention could be a certified label that is perceived as being high in naturalness, while the “C” stimuli could be a certified label that

is perceived as being low in naturalness. This process could also be repeated with treatments such as fictitious labels generated by artificial intelligence.

Our three studies are conducted on the largest wine market in the world, the United States of America. It would be beneficial to replicate or advance our experiment further in a European context, particularly given that all wines obtained from the upcoming harvest (2024) and sold in Europe will be required to display a list of ingredients and a nutrition declaration (Sánchez-Ortiz et al. 2024). The objective of the new regulation is to reduce information asymmetry between sellers and buyers by providing European wine consumers with the same level of information as that available for other food products. Providing European consumers with information regarding the additives used in wines could influence their perception of the product's naturalness and potentially enhance the impact of sustainability labels on consumer choice. A promising avenue for future research would be to investigate the combined impact of ingredient information tables, nutrition declarations, and sustainable certifications on consumer willingness to buy and willingness to pay for wine.

## 5. Conclusions

The objective of our three studies was to examine the influence of naturalness signaling on consumer decision-making processes. We aimed to ascertain whether signaling naturalness can benefit wine in a retail environment, specifically to receivers (consumers) who are differentially susceptible to such signals (labels). We assessed the influence of artificial intelligence-generated food labels indicating naturalness in comparison to other artificial intelligence-generated signals or the absence of such signals on wine labels. We also compared the artificial intelligence-generated label against a genuine accredited label (certifying biodynamic agriculture) that scored low in naturalness in the pretest study. Finally, we investigated the potential for a synergistic effect of a natural background type in conjunction with a natural label type on willingness to buy and pay for wines.

The presence of nature-themed backgrounds does not exert a statistically significant influence on wine purchasing decisions when considered at the aggregate level. However, individual-level differences are pronounced. We found no significant correlations between Natural Product Interest Scale scores and willingness to buy and pay for wine in conditions where nature is depicted. In addition, consumers display considerable heterogeneity in terms of individual-level differences regarding susceptibility to labeling. The Customer Susceptibility to Front-of-Package Food Labeling scale reliably exhibits consistent reliability in predicting increased willingness to buy across studies.

Labels that convey a high degree of naturalness do not demonstrate superior performance relative to other labels, except the United States Department of Agriculture organic label (the label with the highest naturalness rating). A potential avenue for further research could involve a comparison between the United States Department of Agriculture organic label and a series of eco-labels generated using artificial intelligence.

The success of sustainable certification hinges upon consumer engagement and willingness to pay premiums for certified products. As hypothesized, our results indicate that sustainability labels positively influence consumers' willingness to buy and pay a premium for wines. More specifically, wine consumers are more likely to buy and willing to pay a price premium for bottles displaying sustainability labels than for bottles without such labels.

However, contrary to our initial hypothesis, we found no evidence that consumers' general interest in sustainability influences their assessment of the authenticity of labels. Wine consumers regard any label as a valid signal, irrespective of whether it is of a fictitious nature. Accredited sustainability labels do not influence consumer wine purchasing behavior more than other labels tested. Our results demonstrate that fictitious, artificial intelligence-generated, and accredited labels are equally effective in influencing consumer wine choices. A label based on artificial intelligence is as capable of influencing consumer wine choices as

an accredited label. If the proliferation of labels is responsible for diluting the impact and diminishing the value of sustainable certification, the companies may lose their incentive to engage in environmentally responsible behaviors. Certification bodies should therefore consider creating a new, specifically designed monitoring mechanism to assist the market to separate between fake and real signals in order not to render the scope of certifications pointless. Our article prompts an important question: has the time come, as with the advent of meta insurances assuring assurances, to consider the possibility of companies certifying certifications?

## Appendix

| Authors | Country | Purpose | Method | Main findings |
|---|---|---|---|---|
| Galati et al. (2019) | Italy | Identify which consumers are willing to pay for natural wine and understand what information on the label influences their choice | Experiment | Willingness to pay for natural wine increases with the growing importance attributed to label information, drink occasion, and interest in natural products |
| Dominici et al. (2019) | Italy | Examine consumer preferences for wines made from hand-harvested grapes and the interplay between this attribute and organic certification | Experiment | Consumers prefer the wine produced with hand-harvested grapes. Consumer attitudes towards food naturalness differ across segments |
| Migliore et al. (2020) | Italy | Understand which wine quality characteristics, attitudes and socio-demographic characteristics affect consumers' willingness to pay a price premium for natural wine | Experiment | Drink frequency, occasion, organic production method, the content of sulfites, income, attitudes towards healthy eating and the environment are positively associated with a higher willingness to pay for natural wines |
| Moscovici et al. (2020) | United States | Examine consumer knowledge and willingness to pay for eco-certified wine | Survey | Millennials, women, unmarried individuals, eco-conscious consumers, low-income individuals, and those with expert wine knowledge, exhibit a higher willingness to pay for sustainable wines |
| Vecchio et al. (2021) | Italy & Spain | Identify drivers of natural wine consumption and consumers' perception of natural wine | Survey | Key drivers include wine consumption frequency, how informed the consumer is regarding natural wine, and the consumer's natural product interest. While Italian respondents associate natural wine with no additives and wine made in an artisanal way, those from Spain associate it with organic wine containing no additives and no sulfites |
| Scozzafava et al. (2021) | Italy | Examine consumer preferences and willingness to pay for conventional, organic, and biodynamic wine | Experiment | Consumers are willing to pay more for organic wines than for conventional wines, but less so for biodynamic wines. Credence attributes are more important than experience attributes in determining consumer preferences for organic wines |
| Gow et al. (2022) | Australia | Analyze consumers' interest in eco-certifications and their willingness to pay a price premium for wine with eco-certifications | Survey | Most consumers are willing to pay a premium for biodynamic, fairtrade, organic, and natural wines |
| Valenzuela et. al. (2022) | Chile | Examine consumers' attitudes towards and | Survey | More than 75% are willing to pay up to USD 5 more for each bottle of eco-certified wine they purchase. Consumption of eco-certified wines |

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| | | willingness to pay for sustainably produced wines | | is associated with age and knowledge about wine and eco-certifications |
| Bazzani et al. (2023) | Italy | Determine drivers of wine consumption frequency and wine preferences | Experiment | Wine choice behavior can be affected by whether a wine is perceived as natural or not. Respondents are willing to pay a price premium for the attributes linked to natural wine production, such as an eco-certificate and wine-making techniques, but not for a natural wine claim |
| Folwarczny et al. (2023) | United States | Examine whether environmental stimuli that convey naturalness could trigger a "health halo" effect | Experiment | There is a significant interaction between food rating background (natural versus urban) and inferred healthiness of the evaluated food alternatives (calorie judgements) |
| Sgroi et al., (2023) | Italy | Examine how consumers perceive sustainability and their willingness to pay for sustainable wines in comparison to traditional wines | Survey | 88% of respondents are interested in buying wine with sustainable certification. 38% are willing to pay a price premium of between € 1.01 and € 3.00 per bottle, 24% up to € 1.00 and 20% more than € 5.00 price premium per bottle |
| Vecchio et al. (2023) | Italy | Examine consumers' willingness to pay for natural, biodynamic, and organic wines, and drivers of individual preferences for these wines | Survey | Respondents show a higher willingness to pay for organic wine, followed by natural and biodynamic wines, compared to a conventional red wine. Drivers for all wine types are the same and include natural product interest, wine drinking frequency, wine/health concerns, and age |
| Sigurdsson et al. (2024) | United States | Examine the impact of different labels and backgrounds with varying degrees of perceived naturalness on consumers' willingness to buy and pay for wines | Experiment | Fictitious, artificial intelligence-generated, and accredited labels are equally effective in influencing consumer wine choices. The presence of nature-themed backgrounds do not exert a statistically significant influence on wine purchasing decisions. Customer susceptibility to food labels, wine knowledge and involvement significantly predict willingness to buy |

**Appendix.** Literature review

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