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Australian consumers and environmental characteristics of wine: price premium indications

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Abstract

Purpose – There has been increasing consumer interest in recent times in the environmental providence of what they eat and drink. A number of different environmental wine certifications have been created and these include biodynamic, fairtrade, organic, natural and sustainable. The purpose of this study is to survey wine consumers in Australia about their interest in these eco-certifications and their willingness to pay (WTP) a price premium for wine with one of these eco-certifications.

Design/methodology/approach – An online survey was developed to capture the knowledge and attitudes of consumers and their socio-demographic characteristics about their WTP for eco-certified wine. Data from 454 wine consumers in Australia were collected and analysed. Descriptive statistics and Pearson's chi-squared test analysed the significant factors which determine consumers' attitudes towards eco-certified wines. Ordinal logistic regression with marginal effects was used to examine whether the WTP a premium for different certified wines differs significantly based on wine knowledge, attitudes and socio-demographic characteristics.

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Findings – The findings of this study indicate that consumers often buy pro-environmental goods. The majority have a positive (greater than 0) WTP a premium for biodynamic, fairtrade, organic, natural and sustainable-labelled wines. The main factors influencing eco-certified wine purchase decisions by Australian consumers are previously bought eco-certified goods, previously bought eco-certified wine and respondent age. Income, education or previous wine knowledge did not positively influence WTP a price premium for eco-certified wines. Gender was not significant in the ordinal logistic regression.

Research limitations/implications – Most studies in the literature use stated preference experiments to elicit WTP and these are valuable exercises, as they can provide an indication of consumer preferences for potential certifications, before they have been introduced to the market. In this study, we used an ordinal dependent variable in the logistic regression instead of a continuous variable (because of data limitations). Using ordinal dependent variables provides information on the probability or likelihood of occurring an event.

Originality/value – The study results provide the first price premium indications that Australian consumers are willing to pay for eco-certified wines (other than organic).

Keywords Australia, Environment, Consumer behaviour, Regression, Logit/ Probit/ Tobit, Wine, Willingness to pay, Price premium, Eco-certification

Paper type Research paper

1. Introduction

Australia, in line with other developed nations, has seen an increasing trend towards greater health consciousness and both mental and physical health and wellness by citizens. This trend has manifested in part by increased consumer purchases of food and drinks with ecologically/environmentally friendly characteristics over the past few decades. This change in consumer preferences and attitudes has resulted in the development of a wide range of environmentally friendly consumer goods and an increase in the certification of these goods. There are a wide range of eco-certifications covering the production of goods more generally. Furthermore, there are specific certifications of individual goods, like wine; however, consumer awareness of them is low (Schäufele and Hamm, 2017; Mastroberardino *et al.*, 2020). We will examine five identifiable eco-certifications in wine: biodynamic, fairtrade, organic, natural and sustainable in this study (Moscovici and Reed, 2018).

Biodynamic wine is made with a holistic, ecological and ethical approach to farming arising from the Demeter method of agriculture (Delmas, 2010). These principles arose from the insights of Rudolf Steiner and the scientific experimentation of Ehrenfried Pfeiffer. It includes preparations made from fermented manure, minerals and herbs to help restore and harmonise the vital life forces of the farm and to enhance the nutrition, quality and flavour of the food being raised.

Fairtrade is a model of sustainable, ethical trade that puts people and the planet first (Niklas *et al.*, 2017). The fairtrade movement supports responsible companies, empowers farmers, workers and fishermen and aims to protect the environment.

Organic wine is produced without chemical substances and genetic engineering material (Gil *et al.*, 2000). Grapes are grown without synthetic fertilisers and in a manner that protects the environment and preserves the soil. Yeast going into making the wine must be certified organic.

Natural wine has no additives or processes such as yeasts, sulphites, vitamins, enzymes, chemicals, reverse osmosis, cryoextraction or powdered tannins (Moscovici and Reed, 2018). The wine that is produced that year is a representation of a piece of land in a particular year, as nothing else is added.

Sustainable wine is made with three main goals: environmental stewardship, economic profitability and social and economic equity (Moscovici and Reed, 2018). Wine-makers do this by pursuing healthy and productive vines for current and future generations, taking

care of those that work the land and giving back to the community – all while furthering business goals.

The eco-certification landscape can be confusing and individual methods of production differ across countries, and additionally, there is no accepted ranking of which certification is better. Consumers can be non-plussed by the wide variety of types of wine as well as other factors which go into their purchase decision. There are thousands of different types of traditionally produced wines in the marketplace and the addition of eco-certified wines only adds to the difficulty for consumers in their wine-purchasing decisions.

The aim of this study was to elicit from consumers their willingness to pay (WTP) a premium for wines with eco-certification. Approximately 500 Australian wine drinkers were surveyed about their knowledge and attitudes towards wine and eco-certification and their socio-demographic characteristics and aimed to discover if they had a WTP a premium for wine with any of the five different environmental wine certifications. This has previously been done for organic wine (Remaud *et al.*, 2008) but not for the other four wine types.

2. Literature review

There is a relatively small but rapidly growing market for eco-certified wines compared to traditionally produced wines. Multiple studies have found that consumers are willing to pay price premiums for wines with ecological/environmental characteristics.

The literature on consumer preferences for eco-certified wine is rapidly expanding and has some methodological limitations. The main foci of discussions in the literature are on consumer attitudes and knowledge, certification and reputation issues and the effects of socio-demographic factors on consumer choice as significant influences on WTP for environmental characteristics of wine. A brief introduction to the literature on Australian consumer attitudes towards eco-certified wines is also undertaken.

In summary, the literature indicates that a wide variety of wine knowledge and attitudes, label information (certification) and socio-demographic factors all affect the consumers' decision to pay a premium for an eco-certified wine compared to a conventional one.

2.1 Australian consumer attitudes

Saltman *et al.* (2015) investigated Australian wine consumers' acceptance of and attitudes toward the use of additives in wine production. Just over 1,000 consumers were classified based on their self-reported wine knowledge. Consumers considered winemaking additives, like tartaric acid, preservatives and tannins to be unacceptable, particularly those less knowledgeable consumers. Natural flavourings were considered more acceptable than currently used wine-making additives.

Remaud *et al.* (2008), in their study of 750 regular wine drinkers, showed that organic wine was valued very little by the average consumer. A small minority of consumers (14%) were willing to pay a price premium of up to $5 when buying organic wines above $12 in price.

There can be significant differences between wine consumers in different countries, with wine naturalness being significantly more important to Swiss consumers than Australian consumers and those consumers with a high level of self-reported knowledge of wine compared to respondents with low levels (Staub and Siegrist, 2019).

2.2 Wine knowledge and attitudes

The effect of high levels of wine knowledge and willingness to buy conventional wines is well documented. However, there has been limited analysis of the effect of wine knowledge on the potential price premium generated by eco-certification. Some literature indicates that

wine knowledge is related to a higher preference for organic-certified wines (Schäufele and Hamm, 2017) and that higher knowledge of wine increases the probability of paying for an organic wine with no added sulphites (D'Amico *et al.*, 2016; Gassler *et al.*, 2019). In contrast to this notion, Sellers-Rubio and Nicolau-Gonzalbez (2016) find that higher levels of wine knowledge decrease the likelihood a wine consumer will pay a premium for a sustainable wine, and similarly, if they decided to pay a premium, then it would be lower relative to those with less wine knowledge. The direction of this influence is, therefore, contested.

Knowledge and motivation are two factors that influence the decision to pay a premium for an eco-certified wine (Schäufele and Hamm, 2017). Two studies concluded that knowledge of sustainable practices results in a higher premium for wine with environmental characteristics (Schäufele and Hamm, 2017; Mann *et al.*, 2012). However, Mazzocchi *et al.* (2019) demonstrated that consumers' knowledge of biodiversity practices did not appear to affect their stated WTP premium for a biodiversity-labelled wine. Italian consumers' knowledge of sustainability is comparatively low, with variety and terroir more influential on purchasing decisions of wine (Mastroberardino *et al.*, 2020).

2.3 Certification and reputation issues

Label information, such as region and membership of premium wine groups, directly affects the price paid for the wine. Stated preference approaches find that consumers are willing to pay a higher premium for conventional wine based on the region of origin listed on the bottle (Gustafson *et al.*, 2016; Tait *et al.*, 2019). Similarly, a hedonic analysis of the German wine market has revealed that membership of the *Verband Deutscher Prädikatsweingüter* – a premium wine club – has a large positive effect on the price that consumers will pay (Fanasch and Frick, 2019). Although interestingly, when membership was coupled with eco-certification, the effect of membership changed slightly. In the case of organic certification, a lower premium was asked by wineries, and in the case of biodynamic certification, a higher price was elicited.

These issues with the lack of unanimity in the definitions of certification also appear where Fanasch and Frick (2019) found that official organic certification has less of an impact on wine prices than self-declared organic practices, indicating that German consumers are willing to pay a premium for the environmental characteristics of wine without requiring certification.

Biodynamic certification can elicit a higher WTP as Fanasch and Frick (2019) found for German consumers. The few available studies that have investigated biodynamic certification often consider organic and biodynamic production jointly (Delmas and Gergaud, 2021). It is contended that many consumers consider biodynamic production "bizarre" (Delmas, 2010).

Fairtrade-certified wine serves a purpose beyond the consumption of the wine itself (Niklas *et al.*, 2017). The additional purpose of fairtrade goods, including wine, is to promote social, economic and environmental standards. There is little literature on the WTP for fairtrade wines. One study was Niklas *et al.* (2017), who undertook a comparative analysis of South African fairtrade and non-fairtrade wines in the UK market and found that fairtrade wines were priced at a significant discount to traditionally produced wines.

Perceived healthiness has been labelled as an important motivator for organic wine purchases (Schäufele and Hamm, 2017). Higher levels of environmental consciousness resulted in an increased likelihood to pay a higher premium for an organic-certified wine (D'Amico *et al.*, 2016; Di Vita *et al.*, 2019; Gassler *et al.*, 2019; Remaud *et al.*, 2008). In two studies on consumer preferences, the effect of naturalness – a proxy for health consciousness – is found to increase the likelihood of paying a premium for organic wine

(D'Amico *et al.*, 2016; Migliore *et al.*, 2020). However, interestingly, a more significant motivation for organic wine consumption was curiosity (D'Amico *et al.*, 2016; Amato *et al.*, 2017; Costanigro *et al.*, 2014).

The most important factors motivating consumers to buy natural wine tend to be associated with consumers perceptions of sulphites in wines as headache inducing (Amato *et al.*, 2017; Costanigro *et al.*, 2014). Two studies have concluded that natural wines elicit a price premium (Migliore *et al.*, 2020; Galati *et al.*, 2019), but a recent critique of the former paper has highlighted some methodological issues along with observing the lack of a widespread and clearly defined certification of natural wine (Alonso González and Parga-Dans, 2020).

Natural certification has a positive impact on the price premium consumers state they would pay. However, there is a disparity between the relative effect of natural certification and organic certification in WTP, with consumers valuing the latter much more (Di Vita *et al.*, 2019). This may indicate that organic wine consumers valuing environmental impact over health benefits or it may be simply because of a lack of evidence about the benefits of natural wine. This latter issue is discussed more fully by Migliore *et al.* (2020) when examining Italian wine consumer attitudes towards natural wine.

In studies focusing on wine produced with sustainable practices, environmental consciousness was an important influence in the decision to pay a premium or not (Pomarici *et al.*, 2018; Sellers-Rubio and Nicolau-Gonzalbez, 2016). Spanish consumers showed a WTP a premium for sustainable wines and that characteristics such as income, age and gender affect this willingness (Sellers-Rubio and Nicolau-Gonzalbez, 2016). Further, as consumers' wine knowledge increases, their WTP a premium for sustainable wine decreases, and the consumers more concerned about the environment have a higher WTP a premium. Young Italian wine consumers have a WTP a premium for sustainable wine (Pomarici *et al.*, 2018). Sustainable attributes in wine production were valued positively by Californian wine consumers (Tait *et al.*, 2019).

The existence of wine consumer preferences for other environmental attributes such as biodiversity conservation is less clear. A study involving Italian consumers indicated that, on average, they would pay a small premium for a biodiversity-labelled wine (Mazzocchi *et al.*, 2019). Conversely, Tait *et al.* (2019) found that winery biodiversity practices had a relatively insignificant effect on consumer preferences for wine. Barber *et al.* (2016) found that consumers who had pro-environment attitudes also had a WTP a premium for environmentally produced wines. Alonso Ugaglia *et al.* (2021) show that for French consumers, the WTP a premium for any eco-certified wine is influenced by the importance each consumer gives to the individual certification.

It is also important to note that other important factors influencing wine purchase decisions are sensory info (e.g. taste and aromatics) and collective reputation. Unless the consumer's environmental consciousness is very high, eco-certification is unlikely to outperform such variables (Schäufele and Hamm, 2017).

2.4 Socio-demographic factors

The influence of socio-demographic factors, such as income, age, education and gender, are often included in analyses of consumer preferences, because through attitudes, they can have an indirect effect on behaviour (Schäufele and Hamm, 2017; Sellers-Rubio and Nicolau-Gonzalbez, 2016). These characteristics can, in turn, influence consumer purchasing patterns.

2.4.1 Income. The income effect on consumer purchases is rarely debated, with the vast majority of the literature indicating that income is positively correlated with a positive WTP

for sustainably produced wine (Di Vita *et al.*, 2019; Migliore *et al.*, 2020; Sellers-Rubio and Nicolau-Gonzalbez, 2016).

2.4.2 Age. Young wine consumers have been the focus of many studies on consumer preferences for wine, particularly over the past decade (Pomarici *et al.*, 2018; Atkin and Thach, 2012; Castellini and Samoggia, 2018; Pomarici and Vecchio, 2014). The general consensus is that the younger demographic is more environmentally conscious than older generations, and as a result, more of them are willing to pay a premium for sustainable characteristics in wine and that their premium is larger than for older people (Pomarici *et al.*, 2018; Galati *et al.*, 2019; Atkin and Thach, 2012). However, Lanfranchi *et al.* (2019) found that those elders who were willing to pay, although lower in number, would pay a higher premium than millennials for eco-certified wine.

2.4.3 Education. Education is hypothesised as a significant factor influencing consumer attitudes. Loureiro (2003) used an interval probit model to examine Colorado consumer WTP for environmentally friendly wines and found it not to be statistically significant. Mann *et al.* (2012) interviewed 404 Swiss wine drinkers and education was also hypothesised as being a significant influence on WTP for organic wine. The regression analyses did not find any statistically significant relationship between WTP and education.

2.4.4 Gender. The effect of gender on WTP for eco-certification is less obvious, with the direction of influence varying among reviewed studies. Two experiments looking at the effect of different labels found that WTP for eco-certified wine is higher for females (Pomarici *et al.*, 2018; Pomarici and Vecchio, 2014). Similarly, Lanfranchi *et al.* (2019) and Vecchio (2013) found that women are more likely to pay a premium for a sustainable wine. Conversely, Di Vita *et al.* (2019) found that the WTP for organic wines is significantly higher for males.

3. Methods and data

3.1 Survey instrument

An online survey was developed to capture socio-demographic, attitudinal and price payment data from 500 wine consumers in Australia. The survey took between 5 and 10 minutes to complete and was open from November 2018 to April 2019.

The survey had four sections. First, consumers were asked about their wine-purchasing behaviours. This included questions about purchasing behaviour: number of bottles purchased per month, the average spent on a bottle, number of times in the year they visit a winery, primary and secondary reasons they drink wine, favourite varietal, where they buy wine and important considerations when buying wine. Second, respondents' opinions and views on eco-certified food and wines and their attitudes towards purchasing these types of goods. In the third section, consumers were asked about their willingness to purchase eco-certified wine and how much they were willing to pay. Respondents could choose zero or non-zero answers, and for the latter, they were presented with choices from a range of price brackets which were ($0; $1–$5; $6–$10; and greater than $10). Their responses indicate their WTP a price premium for any of the five wine certifications outlined. Fourth, the socio-demographic characteristics of respondents: income, age, education and gender were requested.

3.2 Study population

The study population was accessed using convenience sampling. There were three cohorts sampled. The first cohort was contacted using LinkedIn and personal emails to the first author's professional network. This comprised 72 respondents. The second cohort included canvassing members of a wine buying club where the first author is a member, and eight

respondents were included. Third, widespread advertising on the social media platform Facebook was geo-cached to Australia and resulted in 415 respondents attempting the survey. The aim was to achieve the goal of 500 wine drinking respondents. The provided information to all cohorts was identical and respondents could click on an embedded link to access the survey, which was hosted on the Qualtrics survey platform. The survey was completely anonymous, and only those who volunteered participated. Responses were counted only if a survey was fully completed. A total of 454 complete and useable responses of 495 surveys submitted were able to be used for the analysis.

3.3 Statistical analysis

Survey data were analysed using regular statistical tests. Descriptive analysis was performed to identify the socio-demographic details of participants. Pearson's chi-squared test and ordinal logistic regression with marginal effects were used to examine whether the WTP a premium for different types of certified wines differ significantly based on past environmental-related purchasing behaviour and socio-demographic characteristics. The survey data were analysed using STATA (Version 18).

The dependent variable WTP a premium was an ordinal variable in the survey. Respondents were asked, "How much more, in addition to the current price, would you be willing to pay for a bottle if it was certified as? ...." Then biodynamic, fairtrade, organic, natural and sustainable were listed and respondents could choose whether they want to pay \$0, \$1–5, \$6–10 or greater than \$10 for a wine that is eco-certified. Responses of WTP = \$0 were the most pre-dominant response. For example, WTP = \$0 for biodynamic wine $n = 196$ (43%), for fairtrade wine 146 (32%), for organic wine 136 (30%), for natural wine 190 (42%) and for sustainable wine 134 (29%). In addition, WTP = \$1 to \$5 was 71 (15%), 74 (16%), 69 (15%), 57 (12%) and 72 (15%) for biodynamic, fairtrade, organic, natural and sustainable wines, respectively. Therefore, the combined responses to higher WTP (\$6–10 and greater than \$10) for all five eco-certified wines were half of the responses or less.

Only for the chi-squared test did this study use the dichotomised response variable (WTP). To this end, the WTP for five types of eco-certified wines were converted into a binary variable. If the participants had a WTP of \$1 or more (for eco-certified wine), then WTP was denoted as 1 and 0 (WTP = \$0) otherwise. The authors acknowledge that some information was lost but the process assisted in estimating the probability of positive WTP for eco-certified wines. Previously, several studies have constructed WTP as a binomial variable (Kostakis and Sardianou, 2012; Naanwaab *et al.*, 2014).

Several other categorical predictors were used as explanatory variables. Age and education level were converted into seven categories. In contrast, wine knowledge and likely to buy eco-certified wine had six categories each. The primary aim of Pearson's chi-squared test is to compute variations among the pattern of observed frequencies from the pattern of expected frequencies of certain categories (Field, 2018). The model makes an assumption about the independence of the residual and it cannot be used on a repeated-measure design. For further details of the chi-squared test and its properties, see Gujarati (2009) and Wooldridge (2015).

3.4 Ordinal logistic regression model

After identifying potential factors through the chi-squared test, the variables identified were used in the ordinal logistic regression analysis. In the model, the dependent variable was the WTP a premium (i.e. non-zero value) for various types of eco-certified wines. The variable has four ordered categories and, thus, has a categorical and ordered characteristic. The converted dependent variable (four categories) was "willing to pay a premium":

- none or no additional value = 1;
- $1–$5 = 2;
- $6–$10 = 3; and
- more than $10 = 4.

As the values in each of the categories in the dependent variable have a sequential order, this study used the ordinal logistic regression model to estimate the key factors that influence the WTP a premium for eco-certified wines (Long and Freese, 2006). If the dependent variable is ordinal, then many essential assumptions of the ordinary least square model (e.g. best linear unbiased estimating method) are violated (Hamilton, 1995). Therefore, ordered and logistic models have been widely used as a framework for analysing such responses (McKelvey and Zavoina, 1975).

The model is constructed around a latent regression method which is:

$$y^{*} = x^{*}\ \beta + \quad \varepsilon \tag{1}$$

Where y (ordered dependent variable) has four possible answers and respondents choose the option that most closely represents their opinion, x represents various measurable factors (Table 1) that determines the respondent's selection of an option and ε denotes the unobserved factors. The explanatory factors were: previously bought eco-certified goods, likely to buy wine with certification, previously bought wine with eco-certification, income, age and gender. Here, the following is observed (McKelvey and Zavoina, 1975):

$$\gamma = 0 \quad if \quad \gamma^{*} \leq 0$$

$$\gamma = 1 \quad if \quad 0 < \gamma^{*} \leq \varphi_1$$

$$\gamma = 2 \quad if \quad \varphi_1 < \gamma^{*} \leq \varphi_2$$

$$\gamma = j \quad if \quad \varphi_{j-1} \leq \gamma^{*}$$

where φ is the vector of unknown parameters and β is used to estimate the unknown parameters. Therefore, the equation is:

$$P_r \ \ [y_i \leq j] = \quad \left[P_r\left(+\left(P_r(y=2) + \quad \ldots + P_r \quad (y=j)\right)\right]\right. \tag{2}$$

Hence, the estimated cumulative probability of observing an outcome can be written as (Greene, 2002):

$$Prob \quad (y = 0 \ |x) = \varnothing \quad \left(-x^{*}\beta\right) \tag{3}$$

$$Prob \quad (y = 1 \ |x) = \varnothing \quad \left(\varphi - x^{*}\beta\right) - \quad \varnothing \quad \left(-x^{*}\beta\right)$$

Table 1.
Descriptive analysis (n = 454 respondents)

Variables	Mean (Median)	SD	Minimum	Maximum	Categories (% of survey population)
Income level – 11 categories	6.655 (7)	3.014	1.00	11.00	Less than $20,000 (3%), $20,000–$34,999 (9%), $35,000–$49,999 (9.3%), $50,000–$64,999 (9.1%), $65,000–$79,999 (13.2%), $80,000–$94,999 (8.8%), $95,000–$109,999 (10.2%), $110,000–$124,999 (7.5%), $125,000–$139,999 (8.2%), $140,000–$164,999 (9.5%) and $165,000 or more (15.2%)
Age – 7 categories	4.808 (5)	1.332	2.00	8.00	18–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years and 75 years or older
Education level – 7 categories	4.183 (4)	1.789	1.00	7.00	High school/GED (8.6%), Some college, no degree (13%), Associate degree (6.4%), Bachelor's degree (32.7%), Master's degree (19.9%), Professional degree (1.5%), Doctorate (17.9%)
Gender – 2 categories	0.449 (0)	0.497	0.00	1.00	Male = 1 (45%) and Female = 0 (55%)
Wine knowledge – 6 categories	0.390 (0)	0.608	0.00	2.00	Very little (4.2%), Know basic types (18%), Navigate wine list (25.2%), Culture and history (20.2%), Recommend and choose (25.9%) and Expert (6.6%)
Previously bought eco-certified goods	0.839 (0)	0.367	0.00	1.00	No = 0 (16.01.1%) and Yes = 1 (83.99%)
Likely to buy wine with eco-certification – 6 categories	3.27 (3)	1.238	0.00	5.00	Not sure = 0 (8.5%), Much less likely to buy = 1 (1.5%), Less likely to buy = 2 (1.7%), No change = 3, (39.7%), More likely to buy = 4 (38.8%) and Much more likely to buy = 5 (9.5%)
Buy biodynamic – 6 categories	4.055 (4)	1.224	1.00	6.00	Never (3.3%), Rarely (2.9%), Sometimes (28.2%), Often (31.9%), Very Often (18.1%) and Always (15.6%)
Buy fair trade – 6 categories	4.127 (4)	0.992	1.00	6.00	Never (1.3%), Rarely (1.8%), Sometimes (21.4%), Often (43%), Very Often (23.6%) and Always (9%)
Buy organic – 6 categories	3.978 (4)	0.998	1.00	6.00	Never (2.6%), Rarely (3.3%), Sometimes (20.5%), Often (45.4%), Very Often (23.6) and Always (4.6%)
Buy natural – 6 categories	3.929 (4)	1.142	1.00	6.00	Never (3.5%), Rarely (3.7%), Sometimes (26.4%), Often (39%), Very Often (17.2%) and Always (10.1%)
Buy sustainable – 6 categories	4.182 (4)	0.969	1.00	6.00	Never (2.2%), Rarely (1.1%), Sometimes (16.5%), Often (43%), Very Often (30.8%) and Always (6.4%)
Buy product that has eco-certification*	0.843 (1)	0.363	0.00	1.00	No = 0 (15.6%) and Yes = 1 (84.4%)
Willingness to pay a premium for biodynamic*	0.566 (1)	0.496	0.00	1.00	No = 0 (43.4%) and Yes = 1 (56.6%)
Willingness to pay a premium for fair trade *	0.676 (1)	0.468	0.00	1.00	No = 0 (32.4%) and Yes = 1 (67.6%)
Willingness to pay a premium for organic *	0.700 (1)	0.458	0.00	1.00	No = 0 (30%) and Yes = 1 (70%)
Willingness to pay a premium for natural *	0.579 (1)	0.494	0.00	1.00	No = 0 (42.1%) and Yes = 1 (57.9%)
Willingness to pay a premium for sustainable *	0.704 (1)	0.456	0.00	1.00	No = 0 (29.5%) and Yes = 1 (70.5%)

Note: *Means this variable was only used for chi-squared test

$$Prob \quad (y = j \mid x) = 1 - \varnothing \quad \left(\varphi_{j-1} - x^{*}\beta\right)$$

[For all $0 < \varphi_1 < \varphi_{2\ldots} < \varphi_{j-1}$]

Furthermore, for all the estimated probabilities, the marginal effects (the change in the probability that the outcome occurs as the measurable factor changes by one unit while holding all the other explanatory variables constant) of changes in the regression are (Greene, 2002):

$$\frac{\Delta \quad P_r \quad (y = 0 \mid x)}{[\text{jmath}]x} = \quad = \varnothing \quad (-x^{*}\beta)\beta \tag{4}$$

$$\frac{\Delta \quad P_r \quad (y = 1 \mid x)}{\Delta x} = \quad = [\varnothing \quad (-x^{*}\beta) - \varnothing \quad (\varphi - x^{*}\beta)] \quad \beta$$

$$\frac{\Delta \quad P_r \quad (y = 2 \mid x)}{\Delta x} = \quad = \varnothing \quad (\varphi - x^{*}\beta)\beta$$

Importantly, the sum of the marginal effects will be equal to 0, following the requirement if the total probabilities are equal to 1. According to Greene (2008), the marginal effects from ordered logistic regression (from STATA's margin command) may generate reverse signs than its coefficient sign, as increasing a measurable factor (independent variable) actually shifts the distribution to the right (holding the coefficient and threshold estimates fixed). For further explanation of ordinal logistic regression model, please see Greene (2008) and Greene (2009).

4. Results

4.1 Descriptive results

Table 1 presents the descriptive characteristics of the respondents who successfully completed all components of the questionnaire. The survey respondents were 55% women and 45% men with a median income level of $95,000–$109,000. In addition, the median age was 45–54 years, and the median education attainment was the completion of a bachelor's degree. Respondents often buy biodynamic, fairtrade, organic, natural and sustainable goods. The majority of respondents have shown a positive (greater than zero) WTP a premium for biodynamic (56%), fairtrade (67%), organic (70%), natural (58%) and sustainable (70%) wines.

4.2 Chi-squared results

Table 2 outlines the Pearson's chi-squared test results which estimated whether the WTP a premium for different types of wines varied based on our selected variables. The table also shows percentage values within the specific categories of the WTP a premium for the different types of certifications. According to the estimated results, no significant variations were observed for WTP a premium based on knowledge of wine (except for fairtrade). However, those who are much more likely to buy wine if it is labelled with a certification have significantly higher WTP a premium for all types of certified wine. More than 80% of the respondents who are much more likely to buy have reported a positive WTP a premium. As expected, the respondents who buy eco-certified goods are more likely to have a positive

Table 2. Pearson's chi-squared test (percentage of respondents prepared to pay a premium for eco-certified wines)

	Biodynamic	Fairtrade	Organic	Natural	Sustainable
Wine knowledge	$\chi^2 = 5.31$ (0.37)	$\chi^2 = 12.31$ (0.03)	$\chi^2 = 3.41$ (0.64)	$\chi^2 = 5.34$ (0.37)	$\chi^2 = 6.39$ (0.27)
Very little	68.4%	84.2%	84.2%	73.7%	84.2%
Know Basic types	53.7%	74.4%	70.7%	62.2%	76.8%
Navigate wine list	55.8%	70.8%	69.0%	60.2%	72.6%
Culture and history	56.5%	70.7%	70.7%	57.6%	68.5%
Recommend and choose	53.4%	58.5%	66.1%	53.4%	66.1%
Expert	73.3%	53.3%	76.7%	46.7%	60.0%
Previously bought eco-certified goods	$\chi^2 = 20.08$ (0.00)	$\chi^2 = 17.18$ (0.00)	$\chi^2 = 44.81$ (0.00)	$\chi^2 = 17.82$ (0.00)	$\chi^2 = 29.11$ (0.00)
No	32.4%	46.5%	36.6%	35.2%	43.7%
Yes	61.1%	71.5%	76.2%	62.1%	75.5%
Likely to buy wine with eco-certification	$\chi^2 = 74.66$ (0.00)	$\chi^2 = 64.28$ (0.00)	$\chi^2 = 74.15$ (0.00)	$\chi^2 = 64.15$ (0.00)	$\chi^2 = 66.74$ (0.00)
Much less likely to buy	28.6%	42.9%	42.9%	42.9%	57.1%
Less likely to buy	30.0%	60.0%	30.0%	30.0%	60.0%
No change	37.4%	48.0%	52.0%	41.9%	51.4%
More likely to buy	74.0%	85.9%	86.4%	75.7%	87.6%
Much more likely to buy	88.4%	81.4%	95.3%	81.4%	90.7%
Not sure	42.1%	65.8%	65.8%	34.2%	63.2%
Previously bought wines with eco-certification	$\chi^2 = 27.5$ (0.00)	$\chi^2 = 6.88$ (0.09)	$\chi^2 = 16.5$ (0.00)	$\chi^2 = 4.81$ (0.02)	$\chi^2 = 4.81$ (0.03)
No	48.0%	65.7%	63.3%	55.5%	68.7%
Yes	74.0%	84.8%	81.3%	68.7%	82.8%
Income level	$\chi^2 = 24.49$ (0.00)	$\chi^2 = 11.32$ (0.33)	$\chi^2 = 14.06$ (0.17)	$\chi^2 = 14.03$ (0.17)	$\chi^2 = 11.99$ (0.28)
Less than $20,000	69.2%	61.5%	69.2%	61.5%	69.2%
$20,000–$34,999	53.6%	67.9%	67.9%	57.1%	75.0%
$35,000–$49,999	76.2%	73.8%	83.3%	73.8%	85.7%
$50,000–$64,999	61.0%	68.3%	73.2%	63.4%	63.4%
$65,000–$79,999	66.7%	73.3%	80.0%	61.7%	71.7%
$80,000–$94,999	45.0%	52.5%	57.5%	45.0%	57.5%
$95,000–$109,999	58.7%	78.3%	73.9%	60.9%	78.3%
$110,000–$124,999	50.0%	58.8%	55.9%	50.0%	67.6%
$125,000–$139,999	67.6%	75.7%	70.3%	67.6%	75.7%
$140,000–$164,999	37.2%	65.1%	65.1%	44.2%	65.1%
$165,000 or more	46.4%	63.8%	66.7%	55.1%	68.1%

(*continued*)

Table 2.

	Biodynamic	Fairtrade	Organic	Natural	Sustainable
Age	$\chi^2 = 22.18$ (0.00)	$\chi^2 = 19.09$ (0.00)	$\chi^2 = 15.16$ (0.02)	$\chi^2 = 11.39$ (0.08)	$\chi^2 = 16.85$ (0.01)
18–24 years old	66.7%	88.9%	77.8%	77.8%	88.9%
25–34 years old	64.0%	75.3%	75.3%	65.2%	79.8%
35–44 years old	70.4%	77.8%	81.5%	65.4%	77.8%
45–54 years old	59.2%	68.8%	71.2%	57.6%	70.4%
55–64 years old	41.3%	56.7%	60.6%	51.0%	62.5%
65–74 years old	44.2%	51.2%	55.8%	44.2%	55.8%
75 years or older	33.3%	66.7%	66.7%	33.3%	33.3%
Education level	$\chi^2 = 9.18$ (0.00)	$\chi^2 = 6.41$ (0.37)	$\chi^2 = 1.31$ (0.97)	$\chi^2 = 4.40$ (0.61)	$\chi^2 = 5.43$ (0.49)
High school/GED	56.4%	53.8%	69.2%	61.5%	64.1%
Some college, no degree	61.0%	64.4%	71.2%	61.0%	74.6%
Associate degree	72.4%	75.9%	75.9%	62.1%	79.3%
Bachelor's degree	56.1%	71.6%	69.6%	56.1%	68.9%
Master's degree	60.0%	70.0%	71.1%	62.2%	73.3%
Professional degree	28.6%	57.1%	57.1%	28.6%	42.9%
Doctorate	46.9%	65.4%	67.9%	54.3%	70.4%
Gender	$\chi^2 = 9.84$ (0.00)	$\chi^2 = 7.91$ (0.00)	$\chi^2 = 12.10$ (0.00)	$\chi^2 = 9.55$ (0.00)	$\chi^2 = 6.99$ (0.01)
Female	63.2%	73.2%	76.8%	64.4%	75.6%
Male	48.5%	60.8%	61.8%	50.0%	64.2%

Notes: Values in percentage (within that category) represent the positive willingness to pay ($1 or more), *p*-value in the parenthesis. N = 454. Premium = additional value (>0) for eco-certified wines

WTP a premium for all types of certified wines, and the results are significant at 95% confidence interval.

The results also indicate that demographic characteristics have a substantial impact on WTP a premium. Surprisingly, income level is only a significant factor for the biodynamic type of wine. Interestingly, those who are in a relatively higher income group ($80,000 or more) were less likely to have a positive WTP a premium for wines with biodynamic characteristics. Age is a significant factor except for natural wine. Young respondents (age 18–54 years) are significantly more likely to have a positive WTP a premium compared to older respondents (aged 55 years or more). Female respondents reported a higher WTP for all categories of certified wines compared to males. No significant differences were observed in WTP a premium and education level except for a single category of wine (biodynamic). Respondents with professional and doctorate degrees are significantly less likely to have a positive WTP a premium in comparison to respondents from other categories. Education was highly correlated with age and income in the data. It was not used in the logistic regression to avoid multicollinearity issues.

Only those variables that were significant in the chi-squared test were used in the logistic regression. Education (except for biodynamic) and wine knowledge (except for fairtrade) were not statistically significant and were not included.

4.3 Logistic regression results

Tables 3 to 7 demonstrate the key factors that determine respondents' WTP a premium for various eco-certified wines.

According to the estimated results, respondents who had previously bought goods with eco-certification have 1.42, 1.54, 2.91, 1.80 and 2.15 times higher likelihood of paying more for biodynamic, fairtrade, organic, natural and sustainable-certified wines, respectively, than those who do not.

Consumers who are likely to buy wines with eco-certification have 1.54 (biodynamic), 1.51 (fairtrade), 1.67 (organic), 1.30 (Natural) and 1.49 (sustainable) times higher odds of paying an additional price for eco-certified wines than those not likely to buy wines with certification.

Respondents who previously bought biodynamic wines showed 2.49 times higher odds of WTP a premium for biodynamic wines than those who did not buy. Similar findings are available for fairtrade (2.12), organic (1.89), natural (1.92) and sustainable (2.79).

Conversely, the likelihood of being at or below a particular willing to pay a premium for biodynamic wine reduced by a factor of 0.92 with one unit increase in income. This value was below 1 for all categories of income except for fairtrade (1.01).

The odds of being at or below a particular willing to pay a premium for eco-certified wines decreased by a factor of 0.78 (biodynamic), 0.75 (fairtrade), 0.78 (organic), 0.92 (natural) and 0.73 (sustainable) with one unit increase in age.

Males have a lower probability of paying additional for eco-certified wine compared to women. For example, in biodynamic, it is 20% less (0.80) but the gender variable was not significant. The odds of being at or below a particular willing to pay a premium for eco-certified wines decreased by a factor of 0.73 (fairtrade), 0.88 (organic), 0.69 (natural) and 0.79 (sustainable) with a one unit increase in age. These patterns were the same across all eco-certifications: women were willing to pay more than men, but the relationship was not statistically significant.

The marginal effect denotes the changes in the dependent variable (WTP a premium) as a function of the adjustments in the variable of interest holding all other variables in the ordinal logistic model constant.

Table 3. Factors affecting willingness to pay a premium for biodynamic wines

	Ordinal logit model coefficients	Estimated marginal effect of variables on probability of willingness to pay a premium for four price ranges			
Variable	Odds ratio (robust SE)	Outcome 1 P = 0 dy/dx	Outcome 2 P = $1–$5 dy/dx	Outcome 3 P = $6–$10 dy/dx	Outcome 4 P = > $10 dy/dx
Previously bought eco-certified goods	1.42 (0.45)	−0.09 (0.08)	0.06 (0.06)	0.02 (0.01)	0.01 (0.00)
Likely to buy wine with eco-certification	1.54 (0.17)*	−0.11 (0.02)*	0.07 (0.01)*	0.02 (0.00)*	0.01 (0.00)*
Previously bought wine with biodynamic certification	2.49 (0.52)*	−0.21 (0.04)*	0.13 (0.02)*	0.04 (0.01)*	0.03 (0.01)
Income	0.92 (0.02)*	0.02 (0.01)*	−0.02 (0.01)*	−0.004 (0.00)*	0.003 (0.00)*
Age	0.78 (0.06)*	0.06 (0.02)*	−0.04 (0.01)*	−0.01 (0.00)*	−0.01 (0.00)*
Gender	0.80 (0.16)	0.05 (0.04)	−0.04 (0.28)	−0.01 (0.00)	−0.01 (0.00)
Probability of each outcome occurring		0.42	0.50	0.05	0.03
Observations	454				
Wald χ^2	73.95*				
Log pseudo likelihood	−431.68				
Pseudo R^2	0.09				
Multicollinearity test (VIF)	1.10				
Multicollinearity test (Condition number)	10.08				
Ramsey RESET test (omitted variables)	1.99				

Notes: dy/dx is the discrete change of dummy variable from 0 to 1. Cut 1 = 0.05, Cut 2 = 2.72 and Cut 3 = 3.73. Dependent variable = willingness to pay a premium. Outcome 1: None, Outcome 2: $1–$5, Outcome 3: $6–$10 and Outcome 4: $10+. * – statistically significant at the 5% level

Table 4.
Factors affecting willingness to pay a premium for fair trade wines

Variable	Ordinal logit model coefficients	Estimated marginal effect of variables on probability of willingness to pay a premium for four price ranges			
	Odds ratio (robust SE)	Outcome 1 P = 0 dy/dx	Outcome 2 P = $1–$5 dy/dx	Outcome 3 P = $6–$10 dy/dx	Outcome 4 P = > $10 dy/dx
Previously bought eco-certified goods	1.54 (0.48)	−0.09 (0.07)	0.06 (0.05)	0.02 (0.01)	0.01 (0.00)
Likely to buy wine with eco-certification	1.51 (0.18)*	−0.08 (0.02)*	0.05 (0.01)*	0.02 (0.00)*	0.01 (0.00)*
Previously bought wine with fair trade certification	2.12 (0.67)*	−0.14 (0.04)*	0.05 (0.01)*	0.05 (0.02)	0.04 (0.01)
Income	1.01 (0.03)	−0.003 (0.01)	0.002 (0.003)	0.001 (0.00)	0.00 (0.00)
Age	0.75 (0.05)*	0.06 (0.02)*	−0.03 (0.01)*	−0.01 (0.00)*	−0.01 (0.00)*
Gender	0.73 (0.14)	0.07 (0.04)	−0.04 (0.02)	−0.02 (0.01)	−0.01 (0.00)
Probability of each outcome occurring		0.30	0.60	0.06	0.04
Observations	454				
Wald χ^2	53.98*				
Log pseudo likelihood	−433.76				
Pseudo R^2	0.07				
Multicollinearity test (VIF)	1.09				
Multicollinearity test (Condition number)	9.90				
Ramsey RESET test (omitted variables, F-stat)	0.52				

Notes: dy/dx is the discrete change of dummy variable from 0 to 1. Cut 1 = −0.25, Cut 2 = 2.80; Cut 3 = 3.83; *statistically significant at the 5% level

Table 5.
Factors affecting willingness to pay a premium for organic wines

Variable	Ordinal logit model coefficients	Estimated marginal effect of variables on probability of willingness to pay a premium for four price ranges			
		Outcome 1 P = 0	Outcome 2 P = $1–$5	Outcome 3 P = $6–$10	Outcome 4 P = > $10
	Odds ratio (robust SE)	dy/dx	dy/dx	dy/dx	dy/dx
Previously bought eco-certified goods	2.91 (0.97)*	−0.24 (0.07)*	0.16 (0.06)*	0.05 (0.01)*	0.03 (0.01)*
Likely to buy wine with eco-certification	1.67 (0.22)*	−0.10 (0.02)*	0.05 (0.01)*	0.03 (0.01)*	0.02 (0.01)*
Previously bought wine with organic certification	1.89 (0.38)*	−0.12 (0.04)*	0.05 (0.02)*	0.04 (0.01)*	0.03 (0.00)*
Income	0.96 (0.03)	0.01 (0.00)	−0.004 (0.00)	−0.002 (0.00)	−0.001 (0.001)
Age	0.78 (0.06)*	0.05 (0.01)*	−0.03 (0.00)*	−0.02 (0.00)*	−0.009 (0.003)*
Gender	0.88 (0.18)	0.02 (0.04)	−0.01 (0.02)	−0.01 (0.01)	−0.004 (0.007)
Probability of each outcome occurring		0.27	0.62	0.07	0.04
Observations	454				
Wald χ^2	70.75*				
Log pseudo likelihood	−438.10				
Pseudo R^2	0.09				
Multicollinearity test (VIF)	1.08				
Multicollinearity test (Condition number)	10.30				
Ramsey RESET test (omitted variables, F-stat)	0.97				

Notes: dy/dx is the discrete change of dummy variable from 0 to 1. Cut 1 = 0.61, Cut 2 = 3.65 and Cut 3 = 4.79 * – statistically significant at the 5% level

Table 6.
Factors affecting willingness to pay a premium for natural wines

Variable	Ordinal logit model coefficients Odds ratio (robust SE)	Estimated marginal effect of variables on probability of willingness to pay a premium for four price ranges Outcome 1 P = 0 dy/dx	Outcome 2 P = $1–$5 dy/dx	Outcome 3 P = $6–$10 dy/dx	Outcome 4 P = > $10 dy/dx
Previously bought eco-certified goods	1.80 (0.52)*	−0.15 (0.07)*	0.10 (0.05)*	0.03 (0.01)*	0.02 (0.01)*
Likely to buy wine with eco-certification	1.30 (0.15)*	−0.06 (0.02)*	0.04 (0.01)*	0.01 (0.00)*	0.01 (0.00)*
Previously bought wine with natural certification	1.92 (0.51)*	−0.15 (0.06)*	0.08 (0.02)*	0.04 (0.02)*	0.03 (0.01)
Income	0.98 (0.03)	0.005 (0.00)	−0.003 (0.00)	−0.001 (0.001)	−0.007 (0.00)
Age	0.92 (0.00)*	0.05 (0.01)*	−0.03 (0.01)*	−0.01 (0.00)*	−0.008 (0.00)*
Gender	0.69 (0.13)	0.09 (0.05)	−0.06 (0.03)	−0.02 (0.01)	−0.01 (0.00)
Probability of each outcome occurring		0.41	0.49	0.06	0.04
Observations	454				
Wald χ^2	37.00*				
Log pseudo likelihood	−450.13				
Pseudo R^2	0.05				
Multicollinearity test (VIF)	1.10				
Multicollinearity test (Condition number)	9.68				
Ramsey RESET test (omitted variables, F-stat)	0.67				

Note: dy/dx is the discrete change of dummy variable from 0 to 1. Cut 1 = −0.013, Cut 2 = 2.54 and Cut 3 = 3.53 * – statistically significant at the 5% level.

Table 7. Factors affecting willingness to pay a premium for sustainable wines

Variable	Ordinal logit model coefficients	Estimated marginal effect of variables on probability of willingness to pay a premium for four price ranges			
		Outcome 1 P = 0	Outcome 2 P = $1–$5	Outcome 3 P = $6–$10	Outcome 4 P = > $10
	Odds ratio (robust SE)	dy/dx	dy/dx	dy/dx	dy/dx
Previously bought eco-certified goods	2.15 (0.65)*	−0.17 (0.07)*	0.10 (0.05)	0.04 (0.01)*	0.02 (0.01)*
Likely to buy wine with eco-certification	1.49 (0.17)*	−0.08 (0.02)*	0.04 (0.01)*	0.02 (0.01)*	0.02 (0.01)*
Previously bought wine with sustainable certification	2.79 (0.91)*	−0.16 (0.04)*	0.03 (0.02)	0.08 (0.03)*	0.06 (0.03)*
Income	0.99 (0.03)	0.001 (0.006)	−0.001 (0.003)	−0.002 (0.002)	0.001 (0.001)
Age	0.73 (0.06)*	0.06 (0.01)*	−0.03 (0.01)*	−0.02 (0.01)*	−0.01 (0.00)*
Gender	0.79 (0.16)	0.05 (0.04)	−0.02 (0.02)	−0.01 (0.01)	−0.01 (0.01)
Probability of each outcome occurring		0.27	0.62	0.07	0.04
Observations	454				
Wald χ^2	61.19*				
Log pseudo likelihood	−436.62				
Pseudo R^2	0.08				
Multicollinearity test (VIF)	1.08				
Multicollinearity test (Condition number)	9.92				
Ramsey RESET test (omitted variables)	1.00				

Note: dy/dx is the discrete change of dummy variable from 0 to 1. Cut 1 = −0.34, Cut 2 = 2.73 and Cut 3 = 3.85. * – statistically significant at the 5% level.

Holding all other variables at their mean values constant, the probability of being in Outcome 1 for biodynamic (additional pay = 0) reduces by 11% and being in Outcome 2 (additional pay $1–$5 for biodynamic) increases by 7% for participants who are likely to buy wine with certification. For respondents who previously bought biodynamic wines, the probability of being in Outcome 1 lessens by 21% and being in Outcome 2 rises by 13%. However, for biodynamic wine, one unit increase in age reduces the probability of being in Outcome 2 (additional pay $1–$5) by 4%, and one unit increase in income reduces the probability of being in Outcome 2 by 2%.

For organic wine, past purchase of eco-certified wine, likely to purchase certified wine and past purchase of organic wine raises the probability of being in Outcome 2 by 16%, 5% and 5%, respectively. Nonetheless, one unit increase in age reduces the probability of being at Outcome 2 by 3% (additional pay $1–$5 for organic).

In terms of fairtrade wine, likely to buy wine with certification and previously bought fairtrade-certified wine curbed the possibility of being at Outcome 1 by 8% and 14%, respectively, and increased the probability of being at Outcome 2 by 5%. One unit increase in age had the opposite effect (6% increased probability for Outcome 1 and 3% reduction for Outcome 2).

For natural wine, past purchase of eco-certified wine, likely to buy certified wine and previous purchase of natural wine decreased the likelihood of being in outcome 1 by 15%, 6% and 15%, respectively. Though, one unit increase in age decreased the probability of being in Outcome 2 by 3% reduction.

Finally, the estimated results for sustainable wine are as shown. Previously bought eco-certified wine (17%), likely to buy certified wine (8%) and previously bought wine with sustainable certification (16%) decrease the probability of being in Outcome 1. Conversely, a one unit increase in age increases the probability of being at Outcome 1 (6%) and decreases the probability of being at Outcome 2.

Several diagnostic tests were performed. Higher Wald chi-squared values (>37) and associated small p-values (<0.01) indicate that for all the estimated models, at least one of the regression coefficients in the model is not equal to 0. The variance inflation factor (VIF) command was used to check for multicollinearity. Generally, a variable whose VIF values are greater than 10 may merit further investigation. None of the models and variables in this study showed such values. Additional regression collinearity diagnostic procedures were also performed in STATA using the Coldiag command (Belsley *et al.*, 2005). The test examines the "conditioning" of the matrix of independent variables. Coldiag computes the condition number of the matrix. Belsley *et al.* (2005) concluded that a condition number of 30 or higher indicates then there may be collinearity problems. The conditioner number estimated for each model generated very low values (<15). All condition numbers (singular values) are also smaller than 30 which indicates that collinearity problems are non-existent in this model. Hence, the conclusion is that there is no multicollinearity issue in the estimated models. Finally, the Ramsey RESET test was used to test the issue of omitted variables in the model. For all the models, the higher p-value (>0.05) means that the null hypothesis (no omitted variable in the model) is accepted.

5. Discussion

Consumers in Australia, in common with developments in other developed countries, are increasing their consumption of eco-certified goods. Production of eco-certified wine is increasing to meet increasing demand. Environmental considerations of what is produced and its impact upon the earth's ecosystem are at the forefront of consumers' minds when

they are making purchasing decisions. This paper has explored Australian consumers' interest in consuming eco-certified wines and their WTP a price premium for them.

The role of consumer motivation has some influence on the WTP a premium for eco-certified wine. Motivations for paying a premium for eco-certified wine is something that has been addressed in multiple studies. The explanatory factors used in the ordinal logistic regression analysis were: previously bought eco-certified goods, likely to buy wine with certification, previously bought wine with eco-certification, income, age and gender. Results proved that most Australian wine consumers has WTP a price premium for wines with eco-certification.

The study results showed that the presence of eco-certification on the label was associated with a positive influence on consumer WTP a premium. The findings indicated that the higher the wine consumers' knowledge of wine, the less likely were they to have a positive WTP for eco-certified wines. Our findings mirror the conclusions of Sellers (2016) and Sellers-Rubio and Nicolau-Gonzalbez (2016), who found that higher levels of wine knowledge negatively impact WTP for sustainable wines in the Spanish population. However, the authors also concluded that knowledge about wine culture had a negative relationship with WTP. This relationship was not statistically significant except for fairtrade wines. The critical reason behind such outcomes could be the knowledgeable consumer's scepticism about products (e.g. wines) with green claims and their suspicion that that eco-certification is a way of increasing price unjustifiably (Peattie, 1995; Forbes *et al.*, 2009). Others may believe that current wine-making process is already green or eco-friendly (Berghoef and Dodds, 2011). Consumers who had previously bought eco-certified goods were much more likely to buy organic, natural and sustainable wine. Those consumers who bought wine previously with eco-certification and had previously bought one of the eco-certified wine types were much more likely to do it again. These results are consistent with the existing literature which concluded that consumers who have positive attitudes towards environmental protection have higher WTP for eco-certified wines (Sogari *et al.*, 2015; Sogari *et al.*, 2016; Sellers-Rubio and Nicolau-Gonzalbez, 2016).

Income is positively correlated with a higher WTP for a wide range of goods and services, so it is with eco-certified sustainable wine (Di Vita *et al.*, 2019; Migliore *et al.*, 2020; Sellers-Rubio and Nicolau-Gonzalbez, 2016). Nevertheless, in this study, income is only a significant factor in having a higher WTP for biodynamic wine and has no influence on the other eco-categories of fairtrade, organic, natural or sustainable. Interestingly, those in relatively higher income groups were less likely to have a positive WTP for biodynamic wines than those from lower income groups. Previously, numerous studies have failed to establish a statistically significant relationship between participants income (D'Amico *et al.*, 2016; Grebitus *et al.*, 2013; Sellers, 2016) and education level with attitude towards eco-certified wines and higher WTP.

The discussion about the influence of age on consumer attitudes towards eco-certification, for the most part, indicate that younger wine consumers are more environmentally conscious than older generations and are willing to pay a premium for eco-certified wine compared to older consumers but that is not always the case. Lanfranchi *et al.* (2019) found that Sicilian consumers from older age groups had a higher WTP than younger consumers for eco-certified wine, albeit there were less older consumers willing to pay compared to their younger compatriots. On the contrary, Sogari *et al.* (2015) found that younger participants have a more positive attitude towards eco-certified wines. The results in our study indicate that age does play a role in WTP except for natural wine. Those aged 18–54 years have a much higher positive WTP for eco-certified wines compared to their older counterparts and this is WTP is higher the younger the consumer, with the 18–24 age

group exhibiting the highest WTP of any age group. Nonetheless, D'Amico *et al.* (2016), Sellers (2016) and Grebitus *et al.* (2013) found no significant association between age and behavioural attitude towards or higher WTP for eco-certified wines.

The influence of gender on WTP for eco-certification is more contested. Most studies indicate that females have a higher WTP than males (Pomarici *et al.*, 2018; Pomarici and Vecchio, 2014; Lanfranchi *et al.*, 2019; Sellers, 2016; Vecchio, 2013). Interestingly, Di Vita *et al.* (2019) showed that in a group of Sicilian consumers, men had a higher WTP for organic wines when compared to females. The results of the current study show that gender was not a statistically significant influencing factor on WTP a premium for eco-certified wines. However, women expressed a higher likelihood of having a positive WTP compared to males.

The chi-squared results indicate that education level did not positively influence consumer WTP for eco-certified wines except for biodynamic wine. Two previous studies (Loureiro, 2003; Mann *et al.*, 2012) have confirmed that education does not significantly influence WTP for eco-certified wines.

Findings of the current study should provide valuable information for marketers of wines in Australia, especially when developing marketing strategies for wines with eco-certification. If the production cost of eco-certified wines is higher than that of traditional wines, then marketers need to target consumers with specific characteristics and buying habits who have a higher WTP for such wines.

6. Conclusions

The findings indicate that Australian consumers often buy pro-environmental goods. The majority have a positive (greater than 0) WTP a premium for biodynamic, fairtrade, organic, natural and sustainable-labelled wines. Australian consumers' main factors influencing eco-certified wine purchase decisions are previously bought eco-certified goods, previously bought eco-certified wine and age. Income, education or previous wine knowledge did not positively influence WTP a price premium for eco-certified wines. Contrary to a priori expectations, previous wine knowledge, income and education did not positively influence WTP a premium for eco-certified wines. Unless the consumer's environmental consciousness is very high, eco-certification is unlikely to be more important than the listed variables in their decision-making process.

6.1 Study limitations

Most studies in the literature use stated preference experiments to elicit WTP, and these are valuable exercises, as they can provide an indication of consumer preferences for potential certifications, before they have been introduced to the market. Conversely, the hedonic price models used in Fanasch and Frick (2019) do not have this ability; instead, they provide information on the revealed preferences of consumers based on market data. In the case of organic certification, this provided an important comparison to the rest of the literature analysed, revealing that many of the stated preference experiments may overestimate WTP for eco-certification. A potential reason for this overestimation is because of the hypothetical nature of the experiments.

The recruitment methods and numbers should introduce a note of caution about the representative nature of the survey responses. The majority (83%) of respondents were recruited through social media. Future studies of Australian wine consumers should consider a representative recruitment strategy.

In this study, we used an ordinal dependent variable in the logistic regression instead of a continuous variable (because of data limitations). Using ordinal dependent variables

provides information on the probability or likelihood of occurring an event. For example, the estimated results indicated that men are more likely to buy eco-certified wines compared to women. But it is unknown how much additional value men are willing to pay for eco-certified wines. Hence, using an ordinal input variable means part of the information is lost.

6.2 Future research

The study results distinguished specific market segments or groups of consumers potentially interested in buying and paying a premium for wines labelled with eco-certification. The study results confirm some a priori expectations that are supported by the literature, while some other important factors in the purchasing decisions of consumers of eco-certified goods like wine were not borne out by the data and results.

Further investigation about consumer motivations to purchase eco-certified wine in Australia is required. This will enable a closer match between changing consumer preferences, especially those of younger wine drinkers who are seeking more environmentally produced goods, and existing wine producers who can increase revenues and profits by diversifying their production and sales to meet changing consumer demands. Further analysis is also required to determine the relationship between lack of information regarding eco-certification and if this affects WTP for those certifications. Additional research can also inform grape growers and wine-maker strategies. As consumers become more environmentally conscious, producers will need time to adjust wine-making methodologies and the additional data will allow them to target marketing to the consumers most interested and WTP for the eco-certifications.

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