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The willingness to pay of Sicilian consumers for a wine obtained with sustainable production method: An estimate through an ordered probit sample-selection model

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Abstract

The growing presence of Sicilian sustainable wine has pushed the research group to investigate and analyse the consumers' behaviour and their potential willingness to pay a *premium price* for the wine obtained through sustainable production processes. The analysis of the consumer's behaviour towards the wine made with sustainable production methods is carried out in order to provide potentially useful indications to Italian and in particular Sicilian wine enterprises regarding the production and marketing strategies to undertake in a future perspective. This study shows the result of an empirical investigation on the consumption of sustainable wine in Sicily. Through the Ordered (demographic profile, preference and attitudes), which influence the consumers' choices regarding sustainable wine. The assessment, based on the submission of a questionnaire, has highlighted the willingness to pay a *premium price* on the part of the 546 consumers interviewed. The study points out that the knowledge of sustainable production methods significantly influences the decision to support a premium price for wine consumption. This attests to the fact that a more attentive and informed consumer is ready to pay more for products obtained according to the principles of environmental sustainability.
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Keywords: Wine; Willingness to pay; Sustainability; Price

Contents

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1. Introduction

In the last years the wine sector in Italy has shown an interesting propensity to innovation both in production processes and in product differentiation. This trend, although to a much lesser extent, is also found in the production system of Sicilian wine enterprises.

This has favoured the progressive development of the viticulture obtained by implementing sustainable production methods (Cacchiarelli et al., 2014. Szolnoki, 2013). The concept of sustainable agriculture developed from the 1960s as a response to the irrational industrialization of the countryside and the irresponsible consumption of natural resources. Sustainability of wine means producing wine trying to preserve natural resources for future generations and researching the best methods to achieve the lowest possible impact on the environment. Through sustainable wine the best methods are assembled in different areas: biological, agronomic, ecological, etc. It is a constantly evolving system that is based on tradition but uses innumerable innovations. An example of a wine that respects the principle of sustainability is organic wine (Cantino at a., 2019. Moscovici and Gottlieb, 2017). This trend, along with the quality viticulture with protected designation of origin (PDO and PGI) has allowed a significant increase in the production of bottled wine, reducing that of marketed "bulk" wine (Ingrassia et al., 2018. Borsellino et al., 2012). This appreciation of sustainable wine can be found in both national and international markets (Stranieri et al., 2018. Di Vita et al., 2014). The preference towards high quality products has caused a reduction of the total consumption, with a change from a daily consumption of wine to an occasional one (Marone et al., 2017. Pomarici, 2016. Begalli et al., 2014). In the last years, indeed, the consumers' growing interest towards sustainable wine has been observed by several authors among whom *Casini* et al. *(2009); Schimmenti* et al. *(2016); Vecchio (2013)*. In recent years indeed, numerous studies have shown that consumers show a growing interest in products considered "sustainable". Sustainability is now a topic of primary importance even within the global wine sector. Consumers would be willing to pay a premium price, especially in countries with more recent winemaking traditions. In this context, there are many studies about the consumption of the Sicilian wine obtained with conventional methods, while there are quite few aiming at determining the WTP for the purchase of sustainable wine. In order to obtain detailed information on the consumer's potential interest in sustainable wine, this paper, by using the Ordered probit model with sample selection and by interpreting the consumer's willingness to pay a surplus price for a wine produced with sustainable methods, presents the results of a recent investigation carried out in Sicily. The aim of the present study is therefore to investigate the consumers' preference on the possibility of paying a premium price for sustainable wine (Galati et al., 2015. Bernetti et al., 2006). This approach is fundamentally important as it represents an extremely valuable source of knowledge for companies on which to base strategies of future market (Pomarici et al., 2017. Ferrarini et al., 2010). Indeed, determining the WTP is one of the most sensitive issues for an entrepreneur since it outlines how the consumer perceives the product quality (Boncinelli et al., 2019. Dal Bianco et al., 2018. Grebitus et al., 2013. Lusk and Hudson, 2004).

2. Willingness to pay a *premium price* for the wine obtained with sustainable production methods: a brief review of the literature

The wine sector is highly dependent on the environment in all phases of production and has a multimodal relationship with it: it uses environmental resources as the object of the economic activity and, at the same time, it releases wastes into the environment (Pappalardo et al., 2013. Hirschauer et al., 2012). The raising of awareness among consumers of the link existing between nutrition and environment evokes, in Italy, a positive effect on sustainable wine production methods (UrsoTimpanaro et al., 2018. Schimmenti et al., 2016). The consumer increasingly tends to associate sustainable production methods with positive externalities and a greater assurance in terms of health (Menghini, 2018. Marinelli et al., 2014). These factors push the consumer to change his consumption behaviour by attributing a greater value to the product for which he is favourable to a higher *trade-off* corresponding to the *premium price* that he attributes to sustainable production (Wongprawmas et al., 2016. Vecchio, 2013). This consumption behaviour also applies to the purchase of sustainable wine (Galati et al., 2017. Sillani et al., 2017. Balogh et al., 2016). The literature used in our study analyses sustainable wine consumption and the demand trend that has been developing in the last years (Fabbrizzi et al., 2017. Skreli et al., 2017. Capitello et al., 2015). Instead, in order to understand the trend of wine consumption and the factors which influence the demand, we take into consideration several academic studies. According to *Chládková* et al. *(2009),* the main factor which influences the demand for wine is the quality mainly linked to packages and production methods. According to *Corduas* et al. (2013), purchase decisions are highly influenced by the wine's intrinsic and extrinsic attributes. In fact, in the last decades, there has been a motivational change: a minor importance has been given to nutritional factors in favour of motivations linked to wellbeing and to the pleasure of consumption. However, the author demonstrates that this has entailed an increasing number of varieties of products, brands of national and imported wines, as well as an increase of the difference in wine styles and prices. According to Mann et al. (2012), the consumption of sustainable practices has increased the international demand for biological wine. According to Hertzberg and Malorgio (2008), wine consumption is linked to various factors connected to the territory. The authors examine the consumer's preferences for the wine's attributes. The research has been carried out on a sample of 444 wine purchasers in North-East Italy. The results show that the purchasing choice is strongly linked to the presence of DOC or IGT designation of origin. It can be noted that price has a minor influence compared to the other attributes. This shows that several empirical studies carried out by agricultural

economists in Italy and abroad have been focused on the consumers' wine consumption habits and on the preferences which determine the choice at the time of purchase. The studies have concerned different determinants, from price to geographical provenance (*terrorir*), from the sensory analysis of labelling to the designations of origin and reputation (Golia et al., 2017. Rungsaran et al., 2015).

The studies seem to outline that among the various determinants price is the main driver in the consumer's process of choice. (Lanfranchi et al., 2015; Lanfranchi et al., 2014; Giannetto et al., 2016). However, other authors in other studies have also noted the importance that the consumer attributes to labelling, and therefore it represents for the business a valid means of communication of product quality (Zhllima et al., 2012).

According to Tait et al. (2019) and Mauracher et al. (2019), the consumers have a positive attitude towards organic products (wine in particular) and are more willing to pay. In particular, in their research the interviewees answered that they were willing to pay a price premium for organic wine. According to Sellers-Rubio and Nicolau-Gonzalbez (2016), the consumers that are more concerned about the environment are willing to pay a higher premium.

According to Schäufele and Hamm (2017), a considerable number of consumers across different countries had positive perceptions regarding these different production methods and reported a willingness to pay a premium for wine with characteristics of sustainable production except in some European countries and North America. According to Lusk et al. (2003), cheap talk can affect valuations even when an experimental monitor is not present to encourage subjects to put cognitive effort into their responses. Results indicate that cheap talk was effective at reducing willingness-to-pay for most survey participants.

According to Yoo et al. (2013), the consumers' preferences towards wine consumption are essentially linked to the benefits the product gives to health. The authors have carried out a research considering two groups of simultaneously and culturally different consumers, in particular Korean and Australian. The results have shown that the Australian consumers had a wine knowledge more linked to health compared to the Korean ones. The results also show that health-oriented wine is more attractive for the Korean consumers compared to the Australian ones. These results make the producers and operators in the wine sector more aware of the opportunity to aim mainly at two factors: the product sustainability and healthiness. According to Flint and Golicic (2009), wine purchase is mainly determined by the factor linked to sustainability. Sustainability is becoming increasingly important in supply chains, in particular in those which operate in highly competitive sectors. According to Schmit et al. (2013), the promoting environmentally friendly winegrape production practices would increase demand and lead to higher premiums for the products, but are only sustainable if consumers' sensory expectations are met on quality. Finally regarding there are some recent references about how consumers perceive "sustainable" attributes of wine. For example According to Capitello et al. (2019), the consumers perceive "sustainable" of wine through the following attributes: health benefits, taste, and ethics emerge as the most relevant discriminant dimensions. According to Maesano et al. (2019) the consumers perceive "sustainable" of wine through the attribute sustainable-labelled wines.

From an academic point of view, wine consumption in Sicily is determined by several factors. According to Di Vita et al. *(2015)*, in the last decades, Sicilian wine industry has experienced a strong expansion especially thanks to the Italian consumers' growing preferences towards Sicilian wines. The results of the study carried out by the authors show that quality certifications are the main determinant for wine purchase (Yoo et al., 2013).

From another academic point of view, in advanced societies the consumers' behaviour becomes varied and produces continuous changes. The reasons for that can be ascribed both to social and economic changes and to changes in modern lifestyles. Evolutionary processes have determined a different "approach" to the consumption of alcoholic drinks, in particular of wine. On one hand we can note a reduction in the consumption of table wine, on the other there has been a higher demand of quality wines. Wine, therefore, becomes a source of pleasure with a high hedonistic content that is increasingly focused on producing "emotions". In the context of the new trends in food consumption, the educated, aware, informed, attentive and selective consumer looks for quality, intended as an instrument of differentiation and for traditions, that only a "quality" product coming from areas limited in size is able to produce. In Sicily, in the last decade, there has been a growing interest in the quality wine industry.

3. Consumption of sustainable wine in Italy

According to the data provided by Sinab, biological products are increasingly consumed (SINAB, 2018). As in the other sectors, the wine business is also influenced by this change. Indeed, the biological vineyard surface in Italy has exceeded 83 thousand hectares of soil, of which around two thousand hectares are table grapes. Italy holds the world record in incidence of biological vineyard surface, followed by Austria with 7% and Spain with 10.2%. The three Italian regions with a larger biological surface are Sicily, Puglia and Tuscany (Di Vita et al., 2015). In Northern Italy the vineyards converted into biological are around 10%, except for Lombardia, which states 15%. Instead, great growths were recorded in Campania and Basilicata: indeed, biological vineyards amount to around 58%. Sicily is the region with more hectares of biological vineyard, more than 39 thousand hectares. The choice of biological wine consumption is often linked to an occasion, like a dinner with friends or an anniversary. Biological wine has a strong symbolic value: indeed, it creates a correlation between emotions, culture and the environment. With the globalization process, wine consumption models in Italy have been modified by external elements and, consequently, the consumer's preferences towards wine have been less influenced by regional traditions and more by the mixture

of cultures and by the opening to foreign markets. Globalizations has established a new competitive environment in the wine industry: wine producers have implemented strong marketing strategies with the aim of attracting the highest number of consumers. Therefore, in order to be competitive, the wine industry needs new strategies to ensure a wine production pleasing to consumers. Today the consumer is above all looking for a healthy and sustainable product. In Italy in 2018 the sales of bio wine reached 21,6 million euros only in the GDO, with an increase of 88% compared to the same period in 2017, in respect of an increase of 3% in the sales of wine in general. Nielsen's data show an increase also in the market share of bio wine that today is equal to 1.2% (in 2017 it was 0.7%). Abruzzo is the first region of Italy for sales of bio wine in the GDO (4 million euros, +38% compared to the previous year), followed by Veneto, Tuscany and Sicily with sales superior to 3 million euros. In Italy the most consumed biological wines are red wine (49% of the sales of bio wine in the GDO), even if the purchases of white wines are growing in a more significant way (+151%). The favourite channels for the purchase of bio wine are the GDO (33%) and the direct purchases from the producer or at the cellar (23%), followed by wine bars (19%) and food shops specialized in biological products (18%). The share of consumers who purchase bio wine online is 6%. The ordinary consumers of biological wine are willing to spend 20% more to purchase a bottle of bio wine compared to a bottle of conventional wine. This price differential is justified by the fact that the ordinary consumers of biological wine acknowledge its superior values and quality compared to non biological wine, notably with regard to the respect of the environment, healthiness, simplicity and authenticity.

4. Research design

4.1. Sample and variables

In general, methods to estimate willingness to pay can be distinguished whether they utilize surveying techniques or whether they are based on actual or simulated price response data. These methods can be classified into four groups: Analysis of market data, experiments, direct surveys, and indirect surveys (for a detailed discussion see, e.g. Breidert et al., 2006 for). But, each methods have specific theoretical and practical advantages and drawbacks. For example, using market data that represent the real behaviour, the willingness-to-pay is very reliable and has a high external validity, but by the other hand, these methods cannot be used, for example, to investigate about a new product for which there isn't exists market data and the demand at different price levels cannot be estimated. These problems could be solved, using experiments: laboratory experiments, field experiment, auctions. In particular, the experimental auctions are a special application of experiments, which can be carried out as laboratory or field experiments, and they are useful to gain knowledge of consumers' evaluations of a product or brand and can therefore be used to reveal consumers' valuations to facilitate future pricing

decisions. For these reasons, they have advantages over revealed preference methods because valuations for a good are directly obtained (Lusk and Shogren, 2007; Vecchio, 2013). Using these approaches, the products and prices can easily be adapted such that the participants are presented the necessary variations. Although, experiments are limited by small sample sizes and carry the potential for sample selection bias (Lusk, 2003). Moreover, another problem is due to higher time-consuming and costly. For this reason, often they are not suitable in many management situations. The problem can be solved applying another kind of methods, direct and indirect methods, that are less time-consuming and costly. In the case of direct method, the respondent is directly asked to state how much he or she is willing to pay for a certain good or service. Also if this approach has a number of possible biases, for example, when the product is unfamiliar, it is a method that allow to estimate the willingness to pay at individual level. Finally, with indirect surveys it's possible to estimate preference structure from which willingness to pay can be derived.

Many authors have compared the different approaches to willingness to pay measurement (Kalish and Nelson. 1991). But the conclusion, often, are inconsistent. Shogren et al. (2002) find that changes in experimental procedures impact significantly the results. For Nagle and Müller (2018), direct methods give results that could be potentially highly misleading, while a recent meta-analysis study (Schmidt and Bijmolt. 2019), contradicting the major results in academic field, it shows that, compared with direct measurement methods, the hypothetical bias is considerably higher in indirect measures. In conclusion, taking account that each method has its specific merits and limitations, the choose of a suitable method depends on the managerial task underlying the estimation of willingness to pay and is influenced by both conceptual considerations and pratical restriction. Despite the problems presented above, direct survey methods continue to be widely used (Anderson et al., 1992; Hofstetter et al., 2013). In fact, this technique will be the preferred methodological approach when the manager is facing monetary and/or time constraints.

Moreover the estimation of the willingness to pay at the individual level is particularly important if the price-sensitivity (Breidert et al., 2006).

In our study, focusing our attention on individual estimation, to estimate the willingness to pay a surplus for a wine produced with sustainable methods by the consumer, and the possible level of price premium, we use a direct method in which two questions become relevant: if the subjects are willing or unwilling to pay a surplus for a sustainable wine and the level of premium price.

A questionnaire was administered to individuals residing in Sicily. The data were collected between September 15th, 2018 and November 12th, 2018. The Internet based questionnaire was designed to include information on socio-demographic characteristics of the consumer, his/her attitudes and lifestyle, wine consumption habits, his/her knowledge regarding specific wine labels, and the sustainability practices. Following other studies, (e.g. Sellers-Rubio

Table 1
Summary of demographic characteristics, wine consumption and preferences by willingness to pay for a sustainable wine.

	Willingness to pay for a sustainable wine								
	No			Yes			Total		
	mean or %	sd	N	mean or %	sd	N	mean or %	sd	N
Woman	44%		45	57%		254	55%		299
Man	59%		57	43%		190	45%		247
Age	30.42	7.521	102	32.13	6.837	444	31.81	6.994	546
Education level (low − medium)	56.86%		58	40.09%		178	43.22%		236
Education level (high)	43.14%		44	59.91%		266	56.78%		310
Income family <30000	64.71%		66	63.51%		282	63.74%		348
Income family ≥ 30000	35.29%		36	36.49%		162	36.26%		198
Price traditional wine (≤10 Euros)	70.59%		72	61.94%		275	63.55%		347
Price traditional wine (>10 Euros)	29.41%		30	38.06%		169	36.45%		199
Non-occasional consumer	41%		42	49%		216	47%		258
Occasional consumer	59%		60	51%		228	53%		288
Knowledge of sustainable methods	43%		44	43%		192	43%		236
Non-knowledge of sustainable methods	57%		58	57%		252	57%		310
Attributs: Certification (DOCG, DOC, IGT)									
Not at all important	14.71%		15	4.73%		21	6.59%		36
Slightly important	14.71%		15	15.32%		68	15.2%		83
Enough important	28.43%		29	31.98%		142	31.32%		171
Much important	30.39%		31	29.05%		129	29.3%		160
Very much important	11.76%		12	18.92%		84	17.58%		96

Note: we report standard Deviations only for continuous values.

and Nicolau-Gonzalbez, 2016), we consider for our analysis only wine consumers, even if occasional. Instead, the subjects who have declared that they never drink wine are excluded by the analysis. After eliminating the missing data or cases that cannot be used for the estimates, the sample is formed by 546 subjects. Approximately, 55% of our sample are women, and the average age is equal to 32 (St. Dev. 6.99). Moreover, for the 36% of the individuals, the annual family income is over 30,000 €. Further socio-demographic characteristics of our sample are shown in the following table, considering not only the full sample, but also considering consumers according to their willingness to pay or not to pay a price premium for the purchase of sustainable wine (Table

1). The table shows that the average price for the purchase of a bottle of conventional wine changes from one sub-sample to another. In particular, considering the full sample, about 64% of consumers spend less than 10.00 € per bottle. This percentage increases if we consider the subjects who would not pay a price premium for a sustainable wine (71%). 47% of respondents consume wine more than once a week, at weekends or daily, while 53% consume wine rarely, or at special events, or at most once a week. Regarding the importance that the consumer attributes to the certification (DOCG, DOC or IGT), the percentage relative to this second group is higher (76%) than that of the subjects that would not pay a price premium (67%).

Table 2
Premium Price - descriptive analysis.

			Premium Price					Total
			0.10−1.49	1.50−2.49	2.50−3.49	3.50−4.49	>=4.50	
Sex	Man	n	61	47	20	19	43	190
		%	32.11	24.74	10.53	10	22.63	100
	Woman	n	74	57	46	19	58	254
		%	29.13	22.44	18.11	7.48	22.83	100
	Total	n	135	104	66	38	101	444
		%	30.41	23.42	14.86	8.56	22.75	100
Non-occasional consumer	No	n	62	50	37	17	62	228
		%	27.19	21.93	16.23	7.46	27.19	100
	Yes	n	73	54	29	21	39	216
		%	33.8	25	13.43	9.72	18.06	100
	Total	n	135	104	66	38	101	444
		%	30.41	23.42	14.86	8.56	22.75	100
Knowledge of sustainable methods	No	n	96	63	30	15	48	252
		%	38.1	25	11.9	5.95	19.05	100
	Yes	n	39	41	36	23	53	192
		%	20.31	21.35	18.75	11.98	27.6	100
	Total	n	135	104	66	38	101	444
		%	30.41	23.42	14.86	8.56	22.75	100

From the preliminary analysis of our sample, just over 80% of the consumers would pay a price premium for a sustainable wine (444 subjects). In particular, women seem more inclined not only to buy a sustainable wine (57% versus 43% of men) but also to pay a medium or high premium price respect to men (Table 2). Occasional consumers would spend more on buying a sustainable wine as well as those who generally know the methods of sustainable production.

5. Methods

Several methodological problems occur in the estimation of willingness to pay. If we consider two separate decision process about the decision to pay a surplus and the subjective level of the premium price, the interpretation of the results could be misleading. In fact, considering only the premium price, when the level is equal to zero, discarding these observations from the analysis and running a regression on the censored variable of willingness to pay on the explanatory variables with, for example, an Ordinary Least Square (OLS) estimator, this will generate inconsistent estimates of the average willingness to pay amount. This derived from the fact that one would be implicitly assuming that the underlying decision model is the same for all subjects. If we drop the censored observation from our sample, in fact, we will reduce the efficiency of the estimates in both cases as full use cannot be made of the information contained in the sample. This is particularly true to the other observed characteristics of the non-respondent which may affect the willingness to pay. Moreover, when the sample size is not really large, discarding observations may not even be a feasible option. A solution could be to apply a Tobit model for censored data (Sigelman and Zeng, 1999), but, in this manner we risk to loos information about the full decision making process. Another solution could be to use a two stage methodology. Vecchio (2013) studying the willingness to pay for young sustainable wine drinkers, he analyse the factors that influence the willingness to pay applying a Tobit model and an OLS. Sellers-Rubio and Nicolau-Gonzalbex (2016) taking into account that both decision are nested and non-independent, they estimate simultaneously the decision process, applying a Heckit model.

In general, Heckman's two stage model is more flexible and allow to investigate the factors that influence the willingness to pay along with payment level in a single model. In this manner, we are able to avoid, not only the problem due to the bias derived from the sample selection when we drop observations, but we are able to understand and explain why some respondents are willing to pay and others not. The model consists of two steps: In the first stage, the decision of the respondent to pay or not to pay for a surplus is modeled. In the second stage, how much the respondents are willing to pay is modeled for all observations with a positive willingness to pay. In summary, according to Huang et al. (1999), Cummings et al. (1986); Nicolau and Más (2005) and Sellers-Rubio and Nicolau-Gonzalbex (2016), when we study the decision processes used by consumers, the subjects must jointly take two decisions, that are whether or not to pay a surplus and how much more to pay. Considering the different level of premium

price, the variable results censored for consumers that will not pay a surplus. Following other studies (i.e., Nicolau and Más, 2005; Sellers-Rubio and Nicolau-Gonzalbex, 2016), also in our analysis, we use a two stage estimation procedure in order to correct the potential bias due to the sample selection (Gronau, 1974; Lewis, 1974; Heckman, 1976) using the Heckman's sample selection models, that have become the most popular estimation methods (Cragg, 1971; Heckman, 1979). In this way it is possible to evaluate not only the consumer's willingness to pay by consumers for sustainable wine (WTP) but also how much they would be willing to pay for the product itself. While Sellers-Rubio and Nicolau-Gonzalbex (2016), consider the percentage of Premium Price that the consumer would be willing to pay as a quantitative variable and estimate the two-stage model using a Heckit Model, other studies consider the categorical and ordinal nature of the same variable that presupposes the use of a multiordered response model (Huang et al., 1999; Moon et al., 2002; Cranfield and Magnusson, 2003). In our study, the methodology proposed to estimate the surplus that the consumer would pay for the purchase of a wine produced with sustainable methods is based on the estimation of an Ordered probit model with sample selection, that allows us to decompose the choice process into two steps. Subjects have two decisions to make jointly. Also the proposed model, jointly estimating the willingness to pay and the level of premium price, allows to estimate, moreover, the outcome in an unbiased manner avoiding methodological problems due to the possible sample selection. In fact, if we consider in the analysis of Premium Price only the subjects that would be willing to pay a surplus for a wine produced with sustainable methods compared to a traditional wine, this would exclude from the analysis the subjects for whom this premium price is equal to zero and this could lead to a distortive effect due to sample selection (Heckman, 1979).

In fact, even if we are interested in modelling the outcome, there are two dependent variables in the ordered probit sample-selection model because we must also model the sample selection process.

We consider, therefore, two categorical variables: the ordinal outcome relative to the outcome or regression equation, and a binary variable that indicates whether each case in the sample is observed or unobserved (equation selection). The error terms used in the determination of the selection and the ordinal outcome value may be correlated.

We define therefore the two following dependent variable, one relative to the selection equation (WTP) and the other relative to the outcome equation (PP).

In particular, the variable relative to the Outcome equation (Eq. (1)), the premium price that the consumer would pay (PP), identifies an ordered response that indicates the different level of premium price expressed by the consumer (μ_j: 1 = 0.10–1.49; 2 = 1.50–2.49; 3 = 2.50–3.49; 4 = 3.50–4.49; 5 = greater than or equal to 4.50). While, the discrete nature of the decision "willing to pay a premium price" leads us to use a dichotomous variable (WTP), that assumes a value equal to 1 if the consumer would pay

a premium price and 0 otherwise (Selection equation, Eq. (2)).

It is important to note that, while the selection equation is estimated over the whole sample, the outcome (PP) is only observed for the subjects who have declared a value of Premium Price for the purchase of sustainable wine greater than zero. The observations then used to estimate the regression or outcome equation represent a censored sample that could lead to biased estimates due to the sample selection, if evaluated separately. From a methodological point of view, it is important to emphasise that, even though the two separate equations can be estimated, this would involve a loss of efficiency of the estimated parameters (Meng and Schmidt, 1985).

Ordered Probit Outcome :

$$PP_i^* = x_i\beta + \varepsilon_i \tag{2}$$

$$PP_i = j \; if \; \mu_{j-1} < PP_i^* \leq \mu_j$$

(PP_i, x_i) *observed when* $WTP_i = 1$

Selection equation :

$$WTP_i^* = z_i\,\gamma + u_i \tag{1}$$

$$WTP_i = 1 \; if \; WTP_i^* > 0, \quad PP_i = \mu_{j-1} < PP_i^* \leq \mu_j$$
$$WTP_i = 0 \; if \; W_i^* \leq 0, \qquad PP_i \; unobserved$$

Where WTP^* is a latent variable that indicates the willingness or unwillingness to pay a premium price; Z_i is a vector of variables determining the selection process; γ the parameters to estimate; PP is the level of premium price that the subject should pay for the purchase of sustainable wine; x_i is a vector of variables that determines the outcome PP; β the parameters to estimate; u_i *and* ε_i are the errors terms of the two equations: $u_i \backsim N(0, 1)$; $\varepsilon_i \backsim N(0, \sigma)$; $corr(u_i, \varepsilon_i) = \rho$.

ρ is the correlation between the two errors terms. When $\rho \neq 0$ the standard estimate technique applied to the regression equation (eq. (2)) gives us unbiased estimates.

The independent variables used in our two-stage model refer to consumer socio-demographic characteristics (e.g. age, sex, education, income), consumer preferences and life style, knowledge of production techniques with sustainable methods.

Independent variables:

a) Woman: dichotomous variable that assumes value 1 if the consumer is a woman, 0 otherwise;
b) Age: Age of the consumer expressed in years;
c) Dummy Education: dichotomous variable takes a value of 1 if the level of education is high (degree or post-graduate), 0 otherwise;
d) Income family: dichotomous variable that assumes value 1 if the value of the income family is high (≥ 30000), 0 otherwise;

e) Non-occasional consumer: dichotomous variable that assumes value 1 if the subject consumes wine more than once a week, at weekends or daily, 0 otherwise;
f) Knowledge of sustainable methods: dichotomous variable that assumes value 1 if the subject knows sustainable production techniques, 0 otherwise;
g) Price for traditional wine: measured through 4 price categories relative to the purchase of traditional wine;
h) Attributes − Certification DOCG, DOC, IGT: level of importance attributed to the "certification" characteristic (1 = Not important at all −5 = Very much important).

6. Results

The estimated parameters and the statistics related to our estimated Ordered probit model with sample selection are shown in the following table (Table 3). Regarding the regression diagnostics, the Wald test is highly significant, indicating a good model fit ($\chi^2 = 26.35$; p value = 0.0000), while the likelihood-ratio test indicates that we can reject the null hypothesis that the errors for outcome and selection are uncorrelated ($\chi^2 = 6.49$; p value = 0.0109). These results confirm that the choice to use the Ordered Probit Sample-Selection model instead of the simple Ordered Probit model is correct.

In general, the estimation results show that women are more likely to pay a surplus for the purchase of a sustainable wine. Moreover, the decision to pay a premium price is positively influenced by age, and by how much the consumer normally spends buying a bottle of traditional wine. Finally, also the importance of certifications play an important role in the decision process, at least in the first stage. Household income did not have statistically significant effects on the willingness to pay. If being a non-occasional wine consumer is not significant in determining the propensity to purchase sustainable wine, the same variable becomes negative and significant in determining the level of the premium price that the consumer would be willing to pay. This means that the occasional consumer, who drinks only wine at the restaurant or during an occasional event, would be willing to pay a higher price than the usual consumer of traditional wine.

The knowledge of sustainable production methods is positive and significant, but only in the outcome equation. If the consumer knows sustainable methods of production, the price premium he/she will be willing to pay for the purchase of a sustainable wine will be higher.

Finally, the decision to pay a premium price is positively influenced by age, but we can note also in this case a reversal of the sign with respect to the results of the estimate of equation relative to the willingness to pay. In particular, the probability of buying a sustainable wine paying a surplus increases with age, but the premium price level increases as the consumer age decreases.

Table 3

Estimation results of the Ordered probit model with sample selection. Equation (1): Premium Price; Equation (2): Willingness to pay.

	Eq.1 PP			Eq.2 WTP		
	Coef.	Std. Err	p value	Coef.	Std. Err	p value
Woman (1 = yes)	−0.039	0.103		0.296	0.128	*
Age	−0.014	0.006	*	0.023	0.010	*
Knowledge sustainable methods (1 = yes)	0.329	0.113	**	0.088	0.138	
Non-occasional consumer (1 = yes)	−0.230	0.102	*	0.110	0.130	
Dummy Education (1 = degree or post graduate)				0.090	0.130	
Dummy Income family (1 = high)				−0.084	0.122	
Certification DOCG, DOC, IGT				0.110	0.053	*
Dummy Price for traditional wine (1 = high)				0.398	0.124	**
Constant				−0.595	0.358	
/cut1	−1.139	0.237	***			
/cut2	−0.573	0.242	*			
/cut3	−0.227	0.250				
/cut4	−0.006	0.258				
/athrho	−1.108	0.375	**			
Number of observations	444			546		

Note: Number of observations = 546; Censored observations = 102; Uncensored observations = 444; p-value: *p < 0.05; **p < 0.01; ***p < 0.001. LR test of indep. eqns. ($\rho = 0$): $\chi^2(1) = 6.49$, Prob > chi2 = 0.0109.
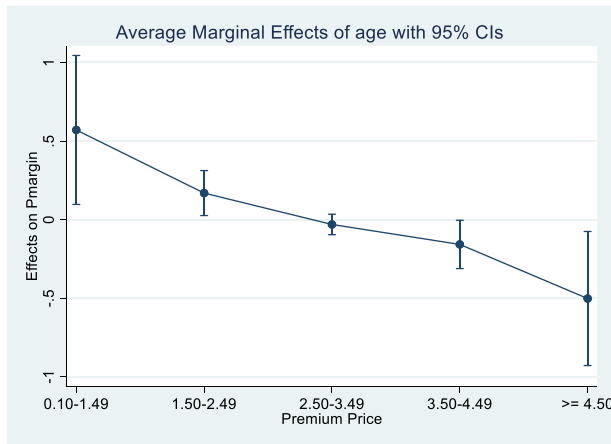

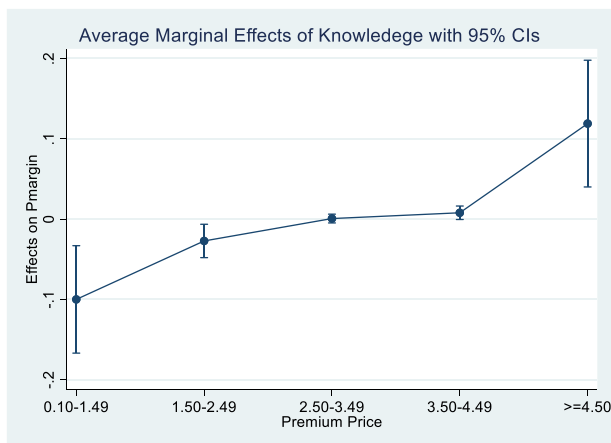Fig. 1. Average marginal effects of age.

Fig. 2. Average Marginal Effects of Knowledge of sustainable production methods.
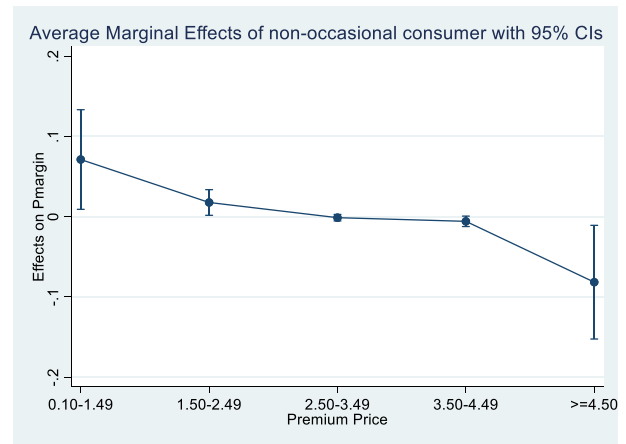
Fig. 3. Average Marginal Effects of non-occasional consumer of traditional wine.

To better understand the effects of some variables considered particularly relevant in determining the level of premium price that the consumer would be willing to pay, we also calculated the average marginal effects for the variables relating to the age of the consumer (Fig. 1), to the knowledge of sustainable methods production in general (Fig. 2), and finally to be a regular consumer of wine (Fig. 3).

Considering the importance of factors concerning the knowledge of production techniques with sustainable methods in general and the condition of being a non-occasional consumer of conventional wine, we have estimated a restricted model of our two-stage model focusing on these two variables and their effect of interaction. In the model we also considered some demographic variables such as sex, age and education level, as well as the price for the purchase of traditional wine. Considering that the selection equation must contain at least one variable that is not contained in the equation relating to the outcome, the latter variable and the education level appear only in the equation relative to the estimation of the willingness to pay. The estimation results are shown in the following table (Table 4). Also in this case the likelihood-ratio test

Table 4

Estimation results of the restricted Ordered probit model with sample selection with interaction effects. Equation (1): Premium Price; Equation (2): Willingness to pay.

	Eq.1 PP			Eq.2 WTP		
	Coef.	Std. Err	p value	Coef.	Std. Err	p value
Woman (1 = yes)	−0.052	0.102		0.295	0.127	*
Age	−0.013	0.006	*	0.021	0.010	*
Knowledge sustainable methods (1 = yes)	0.423	0.150	**	−0.147	0.181	
Non-occasional consumer (1 = yes)	−0.141	0.133		−0.082	0.165	
Knowledge*Non-occasional	−0.209	0.200		0.516	0.262	*
Dummy Education (1 = degree or post graduate)				0.084	0.128	
Dummy Price for traditional wine (1 = high)				0.416	0.117	***
Constant				−0.099	0.342	
/cut1	−1.076	0.229	***			
/cut2	−0.519	0.231	*			
/cut3	−0.183	0.238				
/cut4	0.029	0.246				
/athrho	−1.288	0.488	**			
Number of observations	444			546		

Number of observations = 546; Censored observations = 102; Uncensored observations = 444; p-value: #p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001; LR test of indep. eqns. ($\rho = 0$): $\chi^2(1) = 9.79$, Prob > chi2 = 0.0018.

indicates that the two-stage model is the most correct one ($\chi^2 = 9.79$; p value = 0.0018).

Regarding demographic variables and the price of traditional wine purchases, the estimated coefficients maintain the same signs and significance with respect to the previously estimated model (Table 3), further confirming the robustness of our analysis. As regards the two variables of interest, while knowledge affects in a positive and significant manner the premium price, being a non-occasional consumer is not a statistically significant coefficient. Also in this case, the negative sign, however, means that the probability of paying a premium price is greater for occasional consumers who would be willing to pay a very high premium price. Regarding to the coefficient relating to the interaction effect between the two variables of interest is positive and significant only in the selection equation. In the following tables (Table 5), first we show the average marginal effects, for each level of premium price, of all covariates used in our model (Outcome equation), and after, focusing on the two variables of interest, we present the predicted margins.

The knowledge of sustainable production methods and being a regular consumer of traditional wine seem to have completely opposite effects, especially among consumers who are willing to pay a premium price not higher than 1.50 euros or higher than 4.50 euros for the purchase of organic wine.

The difference between consumers who know sustainable production methods and those who don't know is positive with an average marginal effect equal to 0.12 (0.415-0.295, Table 6) only for the last categories of premium price. Otherwise this difference is negative and not always significant (Table 5). Regarding the second variable of interest, that is the frequency with which traditional wine is consumed, we observe, for consumers who occasionally drink wine or only during special occasion, the higher level of predicted margin in correspondence of the higher category of Premium Price (−0.086 = 0.302−0.388). Finally, to better understand the meaning of the interaction effects between the two variables, we have calculated the average marginal effects and the predicted margins considering the lowest and the highest level of premium price (Table 7).

Also considering the interaction effects, we can see that for the minimum level of Premium Price, both among the occasional and non-occasional consumers, the different level of knowledge of sustainable production methods generate negative differences but only in the first case, these differences are significant (−0.118 and −0.071, respectively). This means that when the sustainable production methods are unfamiliar, consumers tend to overestimate the level of premium price. If we consider the same level of knowledge for both type of consumers, the average marginal effects is positive and

Table 5

Average Marginal effects - outcome equation (Premium Price).

	Premium Price														
	0.10−1.49			1.50−2.49			2.50−3.49			3.50−4.49			≥ 4.50		
	Margin	Std. Err.	p	Margin	Std. Err.	p	Margin	Std. Err.	p	Margin	Std. Err.	p	Margin	Std. Err.	p
Sex	0.016	0.031		0.004	0.008		0.000	0.000		−0.001	0.002		−0.019	0.037	
Age	0.004	0.002	*	0.001	0.000	*	0.000	0.000		0.000	0.000		−0.005	0.002	*
Knowledge	−0.096	0.034	**	−0.029	0.011	**	−0.002	0.003		0.006	0.004		0.120	0.040	**
Non-occasional	0.067	0.032	*	0.021	0.008	*	0.002	0.003		−0.004	0.003		−0.086	0.036	

Note: p-value: *p < 0.05; **p < 0.01; ***p < 0.001.

Table 6
Predicted margins (PM) - "Knowledge sustainable methods", "Non-occasional consumer of traditional wine".

Premium Price											
		0.10−1.49		1.50−2.49		2.50−3.49		3.50−4.49		≥ 4.50	
		PM	Std. Err.	PM	Std. Err.	PM	Std. Err.	PM	Std. Err.	PM	Std. Err.
Knowledge	no	0.288	0.025	0.209	0.020	0.131	0.017	0.076	0.013	0.295	0.039
	yes	0.193	0.024	0.181	0.018	0.129	0.018	0.082	0.015	0.415	0.036
Non-occasional	no	0.216	0.022	0.187	0.018	0.129	0.018	0.081	0.015	0.388	0.036
	yes	0.283	0.026	0.207	0.020	0.131	0.017	0.077	0.013	0.302	0.036

Note: all estimated predictive margins are statistical significant (p value < 0.001).

Table 7
Predicted margins and average marginal effects: Knowledge*Non-occasional consumer.

		Predicted margins	Std. Err.	p	Average marginal effects	Std. Err.	p
Premium Price 0.10−1.49	Knowledge: No; Occasional consumer	0.266	0.033	***	−0.118	0.041	**
	Knowledge: Yes; Occasional consumer	0.148	0.027	***			
	Knowledge: No; Non-occasional consumer	0.313	0.035	***	−0.071	0.050	
	Knowledge: Yes; Non-occasional consumer	0.242	0.037	***			
	Occasional consumer; Knowledge: No	0.266	0.033	***	0.048	0.045	
	Non-occasional consumer; Knowledge: No	0.313	0.035	***			
	Occasional consumer; Knowledge: Yes	0.148	0.027	***	0.095	0.042	*
	Non-occasional consumer; Knowledge: Yes	0.242	0.037	***			
Premium Price >= 4.50	Knowledge: No; Occasional consumer	0.318	0.045	***	0.161	0.056	**
	Knowledge: Yes; Occasional consumer	0.479	0.047	***			
	Knowledge: No; Non-occasional consumer	0.270	0.045	***	0.075	0.053	
	Knowledge: Yes; Non-occasional consumer	0.344	0.044	***			
	Occasional consumer; Knowledge: No	0.318	0.045	***	−0.048	0.045	
	Non-occasional consumer; Knowledge: No	0.270	0.045	***			
	Occasional consumer; Knowledge: Yes	0.479	0.047	***	−0.135	0.058	*
	Non-occasional consumer; Knowledge: Yes	0.344	0.044	***			

Note: p-value: *p < 0.05; **p < 0.01; ***p < 0.001.

significant (0.095), but only for the minimum level of premium price. The opposite situation occurs when we consider the maximum values of premium price (greater than or equal to 4.50 Euros). In fact, in this case the average marginal effect is equal to −0.048.

7. Conclusion

The aim of this paper was to analyse the consumer's willingness to pay a price surplus for a wine obtained with sustainable production methods and to estimate this price surplus compared to a conventional wine with similar organoleptic properties. This research has studied the WTP of a sample of heterogeneous consumers in the Sicilian wine market and the most significant correlations concerning the different characteristics of consumers with a high willingness to pay by using an Ordered probit model with sample selection. The results have shown that, considering a low level of Premium Price, occasional and non-occasional consumer with the same lack of knowledge about the sustainable production methods, are more propense to buy sustainable wine but only when the premium price is low. In fact, considering the maximum level of premium price (≥4.50 Euros), the situation appears reversed. In general, knowledge plays an important role in the decison-making process when the premium price increases. This is the case for both types of

consumers, although the probability increases more for occasional consumers.

This article aims at providing a contribution to the increasingly numerous studies which tend to identify the type of consumer who shows an actual willingness to pay more for a sustainable wine. Our results are in line with the previous studies which show the consumer's general interest towards environmentally friendly or socially responsible wines (Lanfranchi et al., 2016). Besides, the results obtained can have interesting implications by contributing to identify some features of consumers and this represents an important driver for wine companies when trying to predict their preferences towards sustainable wines. Indeed, the increasingly fierce competition in the world market pushes wine companies to differentiate production methods in an attempt to adjusting their offer to the consumers' demand. In this context, sustainable wines can represent an interesting market opportunity for wine enterprises. The relationship that is taking shape between quality viticulture and the socio-economic territorial system represents an opportunity to promote local development. In fact it is in quality viticulture that we can reconstruct one of the most important models of multi-functionality in agriculture. In this way it will be possible to realize an added value, which is that of the sustainable product, and it will be possible to improve the bargaining power, nowadays weak or almost null, between producers and large distributors.

Research offers some interesting insights into the future scientific debate, as it highlights the importance of consumer information. In fact, the more information asymmetry about production methods is removed the more the consumer is willing to recognise a higher price for a product obtained with sustainable methods.

The results of this study show how a better knowledge and information of biological methods can lead to positive externalities for society and the environment, and can guide wine-growing enterprises towards a sustainable production in accordance with the ecosystem.

Conflicts of interest

There is no conflicts of interest.

Acknowledgements

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