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Consumers' preferences for biodiversity in vineyards: A choice experiment on wine

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Abstract

In recent years consumers' concerns regarding the environmental impact of food production has significantly increased, also due to food sustainability, food safety and food security issues. A number of certification systems for environmental-friendly products have been created e.g. water-saving labels and fishery sustainable labels. Among various environmental issues, the protection of biodiversity has recently gained popularity both in public opinion and in scientific debate. This paper describes the results of a Choice Experiment on wine consumers to estimate their willingness to pay for biodiversity conservation practices in vineyards. The survey was conducted by direct interviews at a wine tasting event in an Italian winery located at Montefano (Marche). The results show that consumers are willing to pay a premium price for wine certification that takes into account biodiversity not only for medium-high price wines, but also for low-price wines. Finally, quality of wine and organic certification remain important attributes in wine purchasing choices related to expensive wines.

1. Introduction

Over the last decades consumers' awareness of the environmental issues associated with conventional food production practices has increased (Ricci et al., 2018), leading an increasing number of consumers to shift towards consumption habits that are perceived as more sustainable (Plank and Teichmann, 2018). Several studies estimate consumers' Willingness to Pay (WTP) for environmental-friendly certified food products (Chen et al., 2018; Pomarici et al., 2018; Krystallis and Chryssohoidis, 2005), and how their purchasing behavior could substantially improve the sustainability of food systems (Lazzarini et al., 2018), encouraging firms to shift towards environmental-friendly processes (Nicolaou and Tsalis, 2018).

The most common environment-friendly practice in food market is probably the adoption of organic farming, which was introduced in the 20th century and has since increased its consumer base and advocates around the world. Some researchers have investigated the meanings that consumers associate to the concept of organic, as the term is interpreted by consumers with different meanings and connotations as healthy (Aschemann-Witzel et al., 2013) natural (Loebnitz and Aschemann-Witzel, 2016), and ethical (Zander and Hamm, 2010). The WTP for organic certified products is well documented, and the excellent sale performance of organic food on markets confirms this trend. Several authors have tried to assess the halo-effect of organic certification in relation to local products (Demartini et al., 2018) and to elicit the psychological attitudes in purchasing organic products (Bazzani et al., 2017).

In more recent times, several other environment-friendly certification systems have been created in the food industry, from water-saving and the reduction of emissions and waste (Pomarici et al., 2018) to those that foster sustainable fishery.

Although environmental sustainability of agricultural practices is now a widespread issue in the scientific, public and political debate, this is not always the case for the conservation

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of biodiversity. This is despite the facts that some ecosystem services that are fundamental for agricultural production, as pollination or natural pest control, depend on the number of species (Brugisser et al., 2010), and that intensification of agricultural practices is one of the major causes of the global loss of biodiversity (UNEP, 2016). Moreover, the food system globalization has led to strong homogeneity in the crop and livestock types employed in food production as well in the agricultural landscapes, with a genetic erosion of living species.

Biodiversity is defined by the Convention on Biological Diversity of United Nations as "*The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*".

Among the main crops in the Mediterranean area (Froidevaux et al., 2017), vineyards have some very specific characteristics that are suitable for interventions aimed at preserving biodiversity. Biodiversity in the vineyard has been seen as a limiting factor for a long time, but recent research has shown how it can positively affect the production process (Chou et al., 2018; Keegan, 2017) as confirmed by the inclusion of conserving biodiversity among the twelve fundamental environmental protection guidelines in production, processing and packaging practices for wine industry (Forbes et al., 2013). As vines are cultivated in monoculture, they are less affected by competition and covering from spontaneous weeds than the annual herbaceous crops, allowing opportunities for plant covers of the vineyard soil as well as actions to encourage the development of animal communities. Cover crops can help winegrowers to manage the vineyard in several ways: protect soil from erosion, regulate vine growth, improve soil fertility and structure, reduce heating, enhance biological diversity in the root zone, and provide a habitat for beneficial animals. More importantly, the adoption of agricultural practices aimed at preserving biodiversity has been associated with a greater number of species of insects and herbaceous plants in the vineyard, higher fertility and better maintenance of soil structure, reduced leakiness from irrigation and improved water quality, along with decreased run-off, erosion and salinity. Soil microbiota stimulation and fertility recovery in the vineyard through agricultural practices can protect biodiversity: the chemicals that characterize the profile of some soils could become markers for certain wines (Bokulich et al., 2013; Chou et al., 2018). Another important advantage of biodiversity in the vineyard is that the richer an agri-ecosystem is in biodiversity, the more resilient it is to changes (Retallack, 2012).

All these evidences highlight the need to overcome the vine-centric vision of the vineyard in order to be able to protect and enhance the biodiversity of the whole viticulture ecosystem.

At the same time the adoption of agricultural practices that preserve the biodiversity in the vineyard also represents a strategic marketing opportunity for wine producers by differentiating the product by means of environmental sustainability qualities. Specific agricultural practices in the vineyard are usually conveyed to consumers through the presence of labels on the bottles that certify that they respect certain production standards (Crespi and Marette, 2005). This represents an opportunity for the wine market, as wine consumers' choices are often based on any available information found on the bottle (Boncinelli et al., 2019).

Although several studies have focused on environmentally-friendly food certifications, very few have dealt with biodiversity. To our knowledge, published research has not yet addressed the elicitation of consumers' WTP for a bottle of wine with a label that certifies the use of agricultural practices that protect and promote biodiversity in the vineyard. Focusing on wine, we used a choice experiment (CE) to address this new topic, namely consumers' interest in buying biodiversity-friendly wines. We provide a monetary estimation of consumers' WTP for a hypothetical label that certifies the use of agricultural practices that protect biodiversity in the vineyard and investigate the key socio-demographic and attitudinal variables driving this interest.

This paper is organized as follows. Section 1.2 details the issues of biodiversity in vineyards, Section 2 presents the data and methods. Sections 3 and 4 present and discuss the results. Section 5 draws conclusions.

2. Methodology

2.1. Attributes selection and design of CE

Discrete choice experiments are survey-based methods and commonly used to estimate consumers' WTP for a given product and to test which characteristics of the good under estimation have the most influence on consumer's choices. A broad review of the CEs theory and case studies application can be found in the literature (Menghini, 2018; Bateman et al., 2002; Bennett, 2011; Rogers et al., 2015; Hensher et al., 2015). In brief, in CEs the good that is of interest is described by a number of attributes which are further classified into several levels, and respondents have to choose between alternative products that differ by levels of selected attributes (Menghini, 2018). The survey is composed of sets of alternative options, the "choice sets", consisting of at least two products and a no-buy option, among which the respondents must choose the alternative they would buy. Choices are repeated to obtain a more consistent estimation of respondents' preferences. So, a respondent is assumed to estimate the utility he obtains from the good, by evaluating the levels of the attributes. Utility is derived from the properties that goods possess, not from the good per se (Demartini et al., 2018).

Discrete CEs working in a hypothetical market suffer from different limitations (Lusk and Schroeder, 2004), being the main one the hypothetical nature of the purchase choices, but the major advantage is that they enable the study of products or attributes that are not currently available on the market. Since our main interest is to estimate the WTP for a label on wine bottles that certifies the adoption of biodiversity friendly agricultural practices in the vineyard, a conceptual framework

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Table 1
Description of attributes and levels of CE.

Attribute		Level 0	Level 1	Level 2	Level 3
Biodiversity label		no	yes	–	–
Organic label		no	yes	–	–
Quality level in tasting		1 glass (acceptable)	2 glasses (good)	3 glasses (excellent)	–
Price (€)	Base wine	FP[a] = 5.30	FP + 1.50 = 6.80	FP + 3.20 = 8.50	FP + 5.20 = 10.50
	Premium wine	FP = 10.10	FP + 2.00 = 12.10	FP + 6.00 = 16.10	FP + 10.50 = 20.60

[a] FP=Floor Price.

including attributes related both to the wine products and to the environmental-friendly products was developed. The wine attributes are described in Table 1.

The following attributes were included in the design of the CE: quality (three levels), biodiversity label (binary), organic (binary), and price (four levels).

To test for any differences in consumers' attitudes and preferences towards a biodiversity protection certification in the vineyard, we made the choice experiment using two different products with different average prices on the market: a base product (Rosso Piceno PDO, average price €5.30) and a premium product (Rosso Piceno Superiore PDO, average price €10.10). Price levels were indicated based on realistic average prices.

The biodiversity protection logo is shown in Fig. 1. The biodiversity logo we used for our CE is a real registered trademark of a private company[1] used for company certification concerning the application of biodiversity practices in vineyard. Nevertheless, this is the first time that this logo has been used on a bottle of wine as a label. This label certifies that specific agronomical practices have been followed to ensure the protection of biodiversity in vineyards during the production of the wine. The preliminary condition for effective sustainable management practices, as biodiversity protection practices are, is that consumers are willing to pay a premium price to cover the potentially higher costs, particularly those focused on the environment (Sellers, 2016).

The "organic label" represents compliance with organic certification standards of practices and products according to European law 203/2012. In particular, in the last twenty years the market of organic wine has grown steadily, gaining visibility even in large-scale retaling (Menghini, 2018). "Organic label" attribute was chosen because it represents one of the best-known food labels in the wine market, and it is widely used in wine CEs application (Boncinelli et al., 2019; Delmas and Lessem, 2015). In fact, a number of studies revealed that consumers elicited a higher willingness to pay for organic wine (among others: Brugarolas et al., 2010; Pagliarini et al., 2013, Wiedmann et al., 2014), and more in general for sustainable wine (Sellers, 2016; Vecchio, 2013). Our aim was to test the trade-off between a new wine logo as "biodiversity label" is, and the existing well-known organic logo.

The quality level in tasting simulates quality at taste judged by expert sommeliers according to the Gambero Rosso wine guide scale,[2] ranging from 1 to 3 "glasses" (1-lower quality, 3-higher quality; see Fig. 2). As reported in the literature (Costanigro et al., 2014) the level of "quality" is specifically important in wine consumers' perception, so we included it in the CE design. In fact, wine reputation resulted to be highly correlated with wine prices in hedonic studies (Costanigro et al., 2010).

Fig. 1. Biodiversity logo used in the CE.

The price is the consumers' WTP for a specific combinations of wine attributes levels presented in each choice and it is an essential attribute when consumers select wine (Contini et al., 2015). Since the evaluation of some wine attributes may change across price ranges, we decided to vary wine prices in three increments resulting in four price levels (Table 1), based on realistic average prices of these two products in the Italian market (Costanigro et al., 2010, 2014).

Before the CE task, the attributes used in the CE were shown with a brief description of the logo (es. Fig. 1), and a cheap talk script. According to De Marchi et al. (2016) the method consists of a script explaining the potential issue of hypothetical bias to the respondents before the start of the experiment (Cummings and Taylor, 1999) to lead them to reveal their real preferences.

To reduce the size of the design, random blocking was used to design the CEs for the two wines. We proposed two different questionnaires (Base and Premium products), each one divided in four blocks (A, B, C and D) (Table 2). Each questionnaire was composed by 10 choice sets, for a total of 30 alternatives. We randomly assigned respondents to one of the two products, and, successively, to one of the four blocks. In each block, respondents were asked to make 10 choices,

[1] Sata group.

[2] Gambero Rosso guide is the most famous wine guide in Italy, adopting a point-scale from 1 to 3 "glasses", corresponding to the taste score obtained by the wine; "3 glasses" is the highest achievable score.

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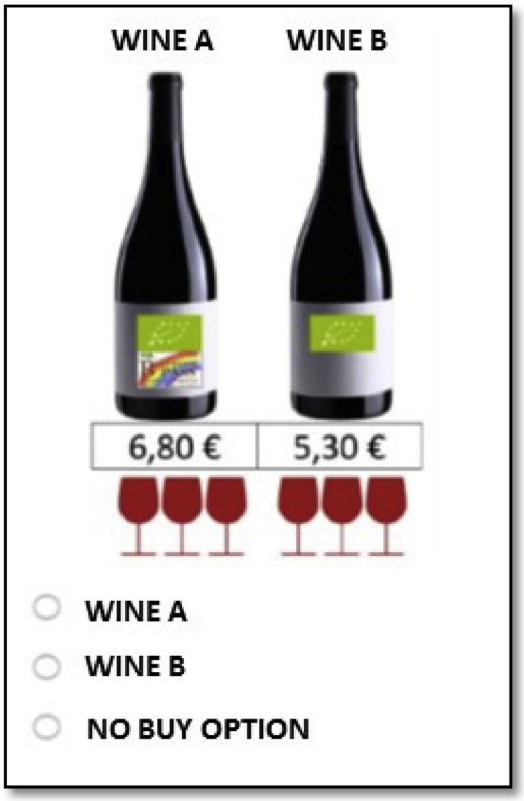

Fig. 2. Screenshot of a choice set.

each time from three alternatives, one of which was always the no-buy option. By using Qualtrics software randomization process path dependency or excess of survey fatigue were been avoided and the order of the questions in each block was randomly determined for each participant.

A Bayesian approach has been used to generate the design. Thus, a prior distribution of likely parameter values has been assumed, optimizing the design over that distribution rather than assuming a single fixed prior for each attribute (Sándor and Wedel, 2001). The design of the CEs followed a three-step process (Scarpa et al., 2007). A pilot survey on 40 respondents was conducted, by using a D-Optimal design generated without any specification of the priors. Then, the data obtain from this survey were analysed through a Multinomial Logit Model (MLM). At least, coefficients estimates and variances for the different attributes obtained from MLM were employed as priors to generate the final D-optimal design (Bliemer and Rose, 2010).

Table 2
Questionnaires divided per block.

Block	Typology	Questionnaires (n°)	Total
1	base	27	102
2	base	26	
3	base	25	
4	base	24	
1	premium	27	105
2	premium	26	
3	premium	25	
4	premium	27	
			207

The prior for the biodiversity logo was set to zero as the estimation of consumers' WTP for this attribute is the main objective of the research.

The questionnaire included three parts. The first part covered personal data. The second part proposed a series of questions related to respondents' attitudes towards wine consumption, and in the third the choice experiment was presented.

2.2. Case study and data

The survey was conducted by direct interviews at a wine tasting event called "*Cantine Aperte*",[3] at a winery located in Montefano (Macerata, Marche). The winery is called "Conti Degli Azzoni" and produces about 60,000 bottles per year.

Marche is one of the main agricultural regions in Italy and boasts more than twenty Protected Designation of Origin (PDO) wines and a total of 17,563 ha of vineyards. About 85% of the vineyards are located in the hills, and the other are on the plains (10%) and in the mountains (5%). The total wine production is 1,039,000 hL, of which 39% are PDO and the 24% are Protected Geographical Indication (PGI) wines (UIV, 2013). The wine typology included in the CE questionnaire is Rosso Piceno PDO, a typical Marche red wine obtained mainly from Montepulciano and Sangiovese grapes. This PDO wine is produced in two types: base, the Rosso Piceno PDO, and premium, the Rosso Piceno Superiore PDO. Both were included in the survey.

Surveys took place on the 26th and 27th of May 2018, and 102 questionnaires for "base" and 105 for "premium" typology were collected, for a total of 207 respondents. The answers are balanced per type of questionnaire.

2.3. Econometric model

In CE, the utility obtained for discrete choice models is measured on ordinal scale (ordinal utility theory), thus only differences in utility matter.

The utility function is described as:

$$U_{njt} = \beta_n^{'} X_{njt} + \varepsilon_{njt} \quad (1)$$

where:

n is the individual, j is the alternative, t is the choice occasion. βn is a vector of individual-specific parameters accounting for preference heterogeneity and is assumed to be random.

A mixed logit model (MXL) was used. The MXL model is flexible and allowed us to control for random taste variation, correlations in unobserved factors over time, and unrestricted substitution patterns. Moreover, this model makes it possible to account for heterogeneity in preferences (Hole and

[3] "Cantine Aperte" is a wine tasting event promoted every year by the "City of wine association" in italian wineries.

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Table 3
Socio-demographic and knowledge-related characteristics per wine typology.

		Base		Premium	
Variables	Range	Frequency	Percentage	Frequency	Percentage
Gender	Female	40	39.22	45	42.86
	Male	62	60.78	60	57.14
Age	18−24	25	24.51	19	18
	25−34	25	24.51	42	40
	35−49	28	27.45	27	26
	50−64	24	23.53	17	16
Education	primary school	1	0.98	1	0.95
	middle school	14	13.73	9	8.57
	high school	53	51.96	27	25.71
	degree	28	27.45	63	60
	PhD and post-graduate courses	6	5.88	5	4.76
Income	0 to 15.000 €	48	47.06	50	47.62
	15.000 to 25.000 €	34	33.33	37	35.24
	25.000 to 50.000 €	12	11.76	13	12.38
	more than 50.000 €	5	4.90	3	2.80
	not declared	3	2.94	2	1.90
Frequency of wine consumption	1-2 times a week	35	34.31	39	37.14
	3-5 times a week	27	26.47	28	26.67
	less than once a week	16	15.69	15	14.29
	everyday	24	23.53	23	21.90
Favorite wine typology	white	40	39.22	46	43.81
	dessert	1	0.98	4	3.81
	rosé	5	4.90	3	2.86
	red	55	53.92	44	41.9
	sparkling	1	0.98	8	7.62
Participation in wine tasting courses	no	61	59.8	74	70.48
	yes	41	40.2	31	29.52
Knowledge of biodiversity concept	no	83	81.37	24	22.86
	yes	19	18.63	81	77.14
Average price spent for a bottle of wine	less than 3 €	7	6.86	6	5.71
	3 to 5 €	31	30.39	30	28.57
	5 to 7,5 €	29	28.43	36	34.29
	7,5 to 10 €	19	18.63	22	20.95
	10 to 15 €	12	11.76	9	8.57
	more than 15 €	4	3.92	2	1.90

Kolstadt, 2012). More in detail two MXL models were specified. Model 1 is the basic specification, taking into account only for the main effects.

The utility can be modeled as follows:

$$U_{nj} = \beta_0 * NoBuy_{nj} + \beta_1 * Price_{nj} + \beta_2 * Biod_{nj} + \beta_3 * Org_{nj} + \beta_4 * Q_{nj} + \varepsilon_{nj} \quad (2)$$

where n = 1,. . .,n is the number of respondents, t is the number of choice occasions, j is the alternative option (option 1, option 2, no-buy option); NoBuy is an alternative-specific dummy variable (=1 for the no-buy alternative, = 0 for all other alternatives in the choice set). $Price_{nj}$ is a continuous variable referred to the price of a bottle of wine. $Biod_{nj}$ and Org_{nj} are dummy variables (=1 for the presence of the logo, = 0 for the absence of the logo). Q_{nj} represents the quality discrete variable. ε_{nj} is the unobserved random error term.

Model 2 is the specification including the interaction terms between each non-monetary attribute and characteristics collected in the first and second part of the questionnaire for each respondent, that is personal features as age, gender, etc … and respondents' attitudes towards wine consumption. To identify the best fitting model and to decide the best interactions to be included in the Model 2, a stepwise approach was used, adding one variable in each step and checking for any increase or decrease in the goodness of fit indicator, the Log-Likelihood value. In Model 2 the utility function can be expressed as follows:

$$Unj = \beta_0 * NoBuy_{nj} + \beta_1 * Price_{nj} + \beta_2 * Biod_{nj} + \beta_3 * Org_{nj} + \beta_4 * Q_{nj} + \beta_5 * Q1Age1_{nj} + \beta_6 * Q3Age4_{nj} + \beta_7 * Q1Male_{nj} + \beta_8 * OrgAge3_{nj} + \varepsilon_{nj} \quad (3)$$

where Q1Age1 is the term related to the interaction between level 1 of "Quality level in tasting" variable (the lowest quality) and respondents comprised in the age range of 18−24 years; Q3Age4 is the term related to the interaction between level 3 of "Quality level in tasting" variable (the highest

Table 4
Main effects estimates using mixed logit model.

		Model 1 (main effects)		Model 2 (with interactions)	
Wine typology	Variables	Coefficients	Log-likelihood	Coefficients	Log-likelihood
Base(obs n = 3,060)	Biodiversity label	0.39**(0.17)	−838.836	0.40*(0.17)	−833.481
	Organic label	0.03 (0.18)		−0.05 (0.20)	
	Quality level in tasting Q1	−0.27 (0.18)		−0.65**(0.23)	
	Quality level in tasting Q3	0.22 (0.18)		0.25 (0.19)	
	Price	−0.10*(0.06)		−0.11*(0.5)	
	No-buy	−1.81***(0.39)		−1.75***(0.39)	
	*Male*Quality 1*			0.77**(0.30)	
	*18-24age*Quality 1*			0.41 (0.35)	
	*50-64 age*Quality 3*			0.314 (0.31)	
	*35-49 age*Organic*			0.36 (0.28)	
Premium(obs n = 3150)	Biodiversity label	0.66**(0.20)	−804.434	0.64**(0.19)	−793.083
	Organic label	0.81***(0.21)		0.69**(0.22)	
	Quality level in tasting Q1	−0.91***(0.20)		−1.49***(0.25)	
	Quality level in tasting Q3	−0.514**(0.17)		0.65***(0.18)	
	Price	−0.17***(0.030)		−0.19***(0.03)	
	No-buy	−5.49***(0.47)		−5.58***(0.49)	
	*Male*Quality 1*			0.98**(0.33)	
	*18-24 age*Quality 1*			0.78*(0.45)	
	*50-64 age*Quality 3*			−0.96**(0.43)	
	*35-49 age*Organic*			0.72*(0.40)	

*p < 0.1; **p < 0.05; ***p < 0.001.

quality) and respondents comprised in the age range of 50−64 years. Q1Male referred to the interaction between level 1 of "Quality level in tasting" variable (the lowest quality) and the males quota in the sample; OrgAge3 is the "Organic label" variable interacted with respondents comprised in the age range of 35−49 years.

The introduction of these covariates has led to an improvement of the basic model without covariates, tested through the Log-Likelihood value, leading to the best fitting model (Model 2) shown in Table 4.

The average willingness to pay (WTP) for each attribute can be calculated as a function of the parameters of the model:

$$WTP = -(\beta a/\beta 3) \quad (4)$$

where a = 1, 2, 3 depending on the attribute of interest, and β3 is the estimated price coefficient, or the marginal disutility depending on an increase in the price of product.

Since the WTP for an attribute is given by the ratio of the attribute coefficient to the price coefficient, the WTP from a mixed logit model is given by the ratio of two randomly distributed terms. We use Stata 14 for implementing this model, using the command *mixlogit*.

3. Results

Summary statistics are in Table 3

As shown in Table 3, the sample is well balanced in terms of gender and age for both in the Base and Premium samples. Respondents generally have a high educational level, most of them have a degree or a high school diploma, with a higher number of graduates in the Premium sample (60%) and fewer in the Base one (27%). More than 60% of the total sample stated that they drink wine at least once a week up to four times a week, while only 15% drink wine less than once a week, so the majority of respondents can be considered to be regular wine consumers.

Knowledge of biodiversity was different between the Base and Premium samples: 77% of the premium sample were familiar with the concept of biodiversity but only 19% of the base sample. More than half of the sample buy bottles for a price lower than €7 on average, while only 2% of Premium respondents and 4% of the Base ones buy bottles for more than €15on average.

The estimated parameters for the mixed logit model in Eq. (3) are shown in Table 4. The best fitting models are those with interactions, according to the Log-Likelihood value. Estimated standard errors are quite low and the coefficients are significant at least at a 90% level, except for "Organic label" and "Quality" in the Base sample, thus validating the choice of attributes and experimental design.

All the coefficients signs confirm our a priori expectations, as the two environmental labels and the highest level of quality have positive coefficients, meaning that an increase in utility is associated with the presence of these attributes. On the contrary, the lowest level of quality is perceived as a negative characteristic, which is not surprising since quality is notoriously one of the elements that mostly guide consumer in the choice of purchase, given external constraints.

Respondents show a positive significant WTP for a wine that is produced respecting biodiversity practices in the vineyard, revealing that consumers are sensitive towards this issue. Indeed, both in the Premium and in Base samples, "Biodiversity label" variable is associated with a positive WTP of €3.62 for the Base Rosso Piceno and €3.80 for the Premium

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wine. In both cases respondents are willing to pay a percentage premium on the top of reference price equal to 68% for the base product and 38% for the premium product. That is, consumer's interest and WTP for this attribute exists, but there is a difference in the amount of the premium consumers would be willing to pay for it in relation to the two types of wine.

Our results confirm that "Quality levels in tasting" attribute is one of the main drivers of consumers' choices for wine, as the coefficient is statistically significant and highly positive in the Premium sample for the highest level of quality and negative for the lowest one. The declared WTP for an increase in the quality is €2.95 for level 3 and -5.21 for level 1.

The presence of the organic certification on the bottles adversely affected consumers' WTP for the two products: for Rosso Piceno PDO organic certification does not seem to be one of the drivers in the choice of the product, as the organic label coefficient was not statistically significant. As for the Rosso Piceno Superiore PDO the organic certification plays a decisive role in the choice of the product and consumers had a WTP of €4.63.

The interactions in the Base sample show positive relationships only between "Males" and level 1 of the "Quality levels in tasting" attribute.

In the Premium sample positive interactions are between "Males" and level 1 of "Quality levels in tasting" attribute, people of "18−24 years" and level 1 of "Quality levels in tasting" attribute, people of "35−49 years" and "Organic label" attribute. As for negative interactions, there is a relationship between people of "50−65 years" and level 3 of "Quality levels in tasting" attribute.

4. Discussion

The results show that the "Biodiversity label" in both samples had a significant positive WTP. Respondents demonstrated an interest in conservation of biodiversity and a positive WTP for implementing sustainable practices in the vineyard. We now discuss the results in the two samples.

4.1. Base sample

Previous knowledge of the concept of biodiversity seems not to be a relevant factor in determining a WTP for a biodiversity protection label in the base sample; in fact, although the 83% of the respondents declared to be not familiar with it, the "Biodiversity label" variable shows a positive coefficient in Table 4, and a WTP of 3.62€ (Table 5).

Table 5
Willingness to Pay in relation to wine typology.

Wine typology	Variables	WTP (€)
Base	Biodiversity label	3.62
Premium	Biodiversity label	3.80
	Organic label	4.63
	Quality level in tasting Q1	−5.21
	Quality level in tasting Q3	2.95

The fact that individuals who had no knowledge of biodiversity are willing to pay for a "Biodiversity label" may be explained by a sort of empathy for the term biodiversity, that probably evokes a positive and environmental-friendly feeling as occurred for organic, for which a halo-effect exists and its confirmed in the literature (Demartini et al., 2018). For instance, organic labelling may imply irrational healthy perceptions related to food products (Lee et al., 2013). In the same way, the concept of biodiversity may move people towards a positive image of nature and wellbeing, leading to choose for the biodiversity label in the CE.

Moreover, the proposed biodiversity label shows a rainbow with a positive association of love and respect for nature, in line with research that demonstrates that the visual aspect of packaging affects how the corresponding brand and product are perceived by consumers (Celhay and Remaud, 2018). Thus, the respondents may have been attracted by the graphic design used in the biodiversity logo.

"Organic label" and "Quality levels in tasting" variables resulted to be not significant in the Base sample. The reason why these attributes were not significant, was probably due to the fact that interviewees consider Rosso Piceno PDO a *basic* wine, and high reputation in wine guides or organic label do not push them to spend more to purchase such a wine. This hypothesis is confirmed in literature by Di Vita et al. (2015a,b) according to which in the case of PDO and PGI wines, certified wines receive a premium price that is increasingly higher as the price level of the wine increases.

Regarding the interactions, a positive relationship is found between "Males" and level 1 of "Quality level in tasting" attribute. This could suggest that males are less interested in considering a high reputation of wine in the guides, compared to the other attributes presented in the CE; moreover, according to our results, in a study realized by Di Vita et al. (2015a) on a sample of 1,200 Italian wine consumers, the majority of males resulted to consume basic wines in comparison to the women, that are usually to purchase high-end quality wines. Furthermore, in the Base sample the predominance is male (62% of the total sample), so the result is also due to the larger male population.

4.2. Premium sample

The additional price that respondents have declared to be willing to pay for the biodiversity label on a bottle of Rosso Piceno Superiore PDO is the 38% of the average price of 10.10€, corresponding to 3.80€ in absolute value. This shows that consumers are sensitive to biodiversity protection also for expensive wines, revealing a widespread awareness of biodiversity issues and a good acceptance of this concept associated with wine. Moreover, the 81% of Premium sample stated that they are familiar with the term biodiversity, although the interactions between "knowledge of biodiversity" and the "Biodiversity label" resulted to be not significant both in the Base and in the Premium sample, and it was not included in the Model 2. Therefore, in this case, communicating the conservation practices of biodiversity applied in the vineyard

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on the wine bottle might be a way to increase profits for wineries while reducing the negative impacts on the environment. In fact, according to Sellers (2016), as consumers are not present during the production process of the wine they cannot assess the sustainable friendliness of production process, so, extrinsic cues as labeling might be used to reduce the gap between producer and consumer, in particular to correct the information asymmetry existing between them.

Consumers reveal a propensity to pay more for the "Organic label" in Rosso Piceno Superiore PDO, as literature suggests that organic label products can imply higher costs compared to non-organic wines (Ellison et al., 2015). Feelings about organic certification are shown to be positive and can regard issues as environmental sensitivity, taste, healthiness (Lee et al., 2013) and a number of researches confirmed the consumers' WTP for organic wines (Schäufele and Hamm, 2017). A positive WTP for organic wines is thus very credible as the organic wines market is in rapid expansion (UIV, 2013). Furthermore, as Rosso Piceno Superiore PDO can be considered a high quality product with a higher price than the Rosso Piceno PDO, other studies affirmed that for wine consumers higher prices indicate higher quality, and this fact is an important heuristic for wine purchase decisions (Palma et al., 2016).

The "Quality level in tasting" attribute plays a role in determining consumer preferences and WTP in the choice of wine, as the WTP in the case of Rosso Piceno Superiore PDO is equal to €2.95 and −5.21€ respectively for the highest and the lowest quality levels. According to Costanigro et al. (2014) the decision to purchase a wine is heavily influenced from quality indications and consumers often first establish desirable quality and price levels, and then consider tradeoffs between other attributes. Based on these findings, many respondents in our samples are also influenced by the famous 1−3 glass classification for quality in wine of the Gambero Rosso guide. In fact, a positive evaluation of a wine by this guide is an important determinant of the reputation of the wine itself and its sales in Italy. This result seems to confirm a trust in guides among consumers, especially for expensive wines.

As for Premium sample interactions, young people (18−25 years) are more prone to choose wines with the lowest level of quality. Recent studies on Millennials wine consumers (Castellini and Samoggia, 2018) revealed that they are favourably inclined towards new wines and require change and innovation from the wine industry. In this case, young consumers first establish the other attributes levels, and then consider tradeoffs between "Quality level in tasting" attribute levels.

Also, 50−64 years people prefer not to choose the highest level of quality. It can be hypothesized that, while for the total sample the level 3 of "Quality level in tasting" has a positive coefficient with a WTP of 2.95€, the oldest group of respondents consider the fact that Rosso Piceno Superiore PDO is a *non-basic* product, a guarantee of high quality per se, so they were not interested in choosing high levels of "Quality level in tasting" attributes.

The positive interaction between "Organic label" and people of 35−49 years might be due to the fact that people of this age are likely to be active workers and have a discrete availability of money, and compared to 50−65 years old people, they are reasonably more informed about organic certification. For these reasons, they include in the evaluation of a wine to purchase the presence of organic logo on wine bottle.

5. Conclusions

This paper aims to fill the gap in the literature about consumers' interests in buying biodiversity-friendly certified wines. Environmental concerns are spurring the demand for products that respect the environment and the agro-food system has recently become engaged in sustainable practices in relation to biodiversity. This topic is relatively new in the wine market, and only a few studies have addressed this issue (Pomarici et al., 2016, 2018).

Nevertheless, some limitations can be found in our research. The fact that the survey took place in a winery event with wine lovers participant, might be a limitation of the study and might have introduced some bias to the average estimates of the models in terms of comparisons with the all consumers' population (Bethlehem, 2010). But, the respondent sample refers to a specific market segment that differs from the regional population statistics, and properly refers to a defined group of consumers (Demartini et al., 2018). Thus, for the aim of this study, the possibility to have a sample of wine lovers and consumers can be more effective and realistic in terms of purchasing choices. Moreover, the "Cantine Aperte" is a wine tasting event promoted every year, that usually involves thousands of people, which are not only wine lovers as sommeliers, but also a number of tourists which appreciate Italian winery locations, especially in rural and hills areas, and that are interested in eno-gastronomic tours, and people living in areas close to the winery. So, the sample of population attending "Cantine Aperte" can be considered quite various and representative of wine lovers, wine tourists and consumers. Anyway, future steps of the research could contemplate to realize the same CE in other locations, as a possible treatment to use in the experiment.

Finally, we can draw some considerations. Firstly, our results show that the introduction of a biodiversity protection certification for wine would meet the consumers' interest and WTP both for a medium-high price product and a cheap wine. Future work should explore the halo-effect of biodiversity in relation to wine, an issue never investigated in literature, which could provide new suggestions about environment-friendly certifications for wineries. Then, wine companies can improve knowledge of biodiversity through projects and marketing tools in order to increase consumer awareness. In many cases scarce information on quality certifications and lack of knowledge about agricultural production practices can lead to information asymmetry. At least, quality of wine and organic certification remain important attributes in wine purchasing choices related to expensive wines.

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Conflict of interest

There is no conflict of interest.

Appendix A. Supplementary data

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