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Young consumers' preferences for water-saving wines: An experimental study

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Abstract

Freshwater scarcity is becoming one of the most pressing issues of the global environmental sustainability, and agriculture is the main responsible of that scarcity. During the last decade, there has been an increasing consumers' environmental concern about the impact of food production on water usage. This paper investigates young consumers' preferences towards water saving wines and the determinants of willingness to pay (WTP) for these products. Data were collected through an experimental auction mechanism in Italy by assessing young consumers' willingness to pay for three different wines (i.e. conventional-no water saving label, water saving front-of-pack labelled and water saving back-of-pack labelled). Young consumers' ($N = 200$) characteristics related to their personal values, pro-environmental attitudes, wine habits, labeling attitudes and socio-demographics were also collected. Results reveal that on average young consumers are willing to pay higher prices for water saving labeled wines. Additionally, wine consumption frequency, label trust and use as well as consumers' environmental-friendly attitude have a positive effect on willingness to pay for these wines. The current study offers valuable insights to policy makers and wine producers for product differentiation and for more efficiently targeting campaigns towards young consumers, in order to increase sustainability-labeled wine consumption.

Keywords: Wine; Water saving label; Young consumers; Italy; Experimental auctions; Willingness to pay; Environmental attitude

1. Introduction

1.1. General background – freshwater scarcity

The majority of the world surface (70%) is covered with water, but only 2.5% of it is in form of freshwater (Shiklomanov, 1993). Of this 2.5%, only a small part of the total freshwater could be used by humans because its availability is negatively affected by several factors such as quality, accessibility, distribution as well as the availability of infrastructures to draw water from rivers and aquifers (Rosegrant et al., 2009). Moreover, during the last decades, population growth, climate and diet changes as well as economic development have strongly reduced the freshwater resources (Hoekstra and Chapagain, 2006; Rosegrant et al., 2009). Thus, freshwater scarcity is currently one of the most pressing issues because it creates large economic, social and environmental concerns which heavily affect humankind and the life of future generations, with special emphasis to food security (Bartram, 2008; Hoekstra, 2014; Odegard and van der Voet, 2014; Strzepek and Boehlert, 2010).

Among the different drivers of water scarcity, agriculture is the main responsible because it consumes about 70% of the global freshwater (Hoekstra and Chapagain, 2006) which has significantly increased during the last 50 years (+12% land

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use, +100% irrigation, +250 – 300% more of agricultural yields) (FAO, 2011). Moreover, the consumptive water use for producing food and fodder crops is expected to increase at 0.7% per year in order to adequately feed the increasing global population of 9.2 billion by 2050 (Rosegrant et al., 2009). In terms of agricultural production, meat products have the highest levels of freshwater consumption compared to crops (Mekonnen and Hoekstra, 2010, 2011). More specifically, among the different crops there are large variations and nuts, followed by vegetable oils (e.g. soybean oil 4200 m^3/ton) and cereals (e.g. wheat 1827 m^3/ton) have the large consumption of freshwater (Mekonnen and Hoekstra, 2011).

1.2. The role of the wine industry

The wine industry is considered a global sector, in terms of end market, which is highly demanding in terms of world resources (Cichelli et al., 2010). Indeed, according to recent data almost 7.5 million hectares are used for viticulture and the estimated annual world production of wine is about 290 million hectoliters (OIV, 2016) which highly impact on natural resources that are needed for producing wine (i.e. vineyard irrigation, winemaking, etc.). Even if the water consumption for producing wine is not among the highest (i.e. 870 m^3/ton) compared to other food products (Mekonnen and Hoekstra, 2011) it is still important. Indeed, the water footprint network reported that to produce a glass of wine (0,125 l) 109 l of freshwater (Mekonnen and Hoekstra, 2011) are needed. Thus, the wine industry is far from being environmentally-friendly (Cichelli et al., 2010; Gabzdylova et al., 2009; Szolnoki, 2013) which indicates the need for the wine industry to evolve towards a more "sustainable" solution. Indeed, recently there has been a growing interest in wineries and for policy makers to engage in sustainable production practices that also take into account the amount of freshwater used (Schäufele and Hamm, 2017). A strong incentive for wine producers towards the adoption of environmentally friendly practices associated with the water footprinting labels could be the possibility to sell these wines at higher prices compared to the wines without this attribute. This is particularly important since environmentally friendly practices may increase the costs for producers. If the retail price premium for sustainable wine is small or absent, producers may have to rethink whether the costs associated with higher sustainability performances are justifiable (Pomarici et al., 2015).[1]

1.3. Public awareness of freshwater scarcity – water footprint labeling

The public awareness of the freshwater scarcity issue remains low (Grebitus et al., 2016; Segal and MacMillan, 2009). This is also due to the lack of familiarity towards water-savings labeling (Grebitus et al., 2016). Thus, in order to encourage firms to take into account the use of water in all processes a new concept called water footprint has been developed (Manson and Epps, 2014). Water footprint of a food product is the sum of all water consumed through all the stages of the supply chain (Rees, 1992) which makes the link between water use and the consumption of a product more explicit (Segal and MacMillan, 2009), in the same way as for carbon footprint label (Paxton, 1994). Indeed, using a water footprint label increases the transparency so that consumers can better understand how much they contribute to the water consumption, pollution and scarcity, and thus gives them a better tool for making informed decisions (Chapagain et al., 2006; Smith, 2008). Table 1 presents some water footprint statistics for several food products. In 2009, the Finnish food company "Raisio", was the first company to adopt a water footprint label on a package of oat flakes by showing that 101 l of total water were necessary to produce 100 g of oat flakes (Manson and Epps, 2014) while for producing 1 almond 5 l of freshwater are needed (Mekonnen and Hoekstra, 2011).

1.4. State of the art on water footprint labelling

While a growing literature can be found on carbon labeling of food products (Gadema and Oglethorpe, 2011; Grebitus et al., 2013; Pattara et al., 2012; Van Loo et al., 2015; Vlaeminck et al., 2014) to the best knowledge of the authors much less attention has been dedicated to consumers' preference towards food products with water footprint labels (Banterle et al., 2013; Grebitus et al., 2016; Leach et al., 2016) and there is only one study that has specifically investigated consumers' preferences for wines labeled with a water saving claim (Pomarici et al., 2016). Authors pointed out that consumers assign higher importance to the general issue of natural resources rather than specifically focus on water footprint in wine production. However, they found that a small segment of consumers is highly interested in wines with a water footprinting label. Grebitus et al. (2016) investigated the role of water usage and carbon emissions labels for consumers' preferences for potatoes, ground beef and yogurt using a hypothetical choice experiment in Canada and Germany. The outcomes indicate that the higher water usage and carbon emissions, the larger is the discount required by consumers to accept the products. Krovetz (2016) investigated consumers' willingness to pay (WTP) for vegetables with a water footprint label using a hypothetical choice experiment, finding that consumers are willing to pay higher price for water-saving vegetables. More research which investigates consumers' preferences towards water saving food products are needed to provide information to wine producers and policy makers. Most studies applied to sustainable food products adopt hypothetical value elicitation approaches (Echeverria et al., 2014; Grebitus et al., 2016; Krovetz, 2016) although these studies carry various types of biases in the WTP estimates (Lusk and Shogren, 2007).

[1] Several studies have dealt with the connection of sustainable wine and consumer preferences (Ginon et al., 2014; Sogari et al., 2015) and some have applied experimental auctions (Ay et al., 2014; Bazoche et al., 2008; Grebitus et al., 2013).

Table 1
The water footprint of some selected vegetable and animal products.Source: Mekonnen and Hoekstra (2010).

Food item	Water footprint per ton (m^3/ton)				Nutritional content			Water footprint per unit of nutritional value		
	Green	Blue	Grey	Total	Calorie (kcal/kg)	Protein (g/kg)	Fat (g/kg)	Calorie (litre/kcal)	Protein (litre/g protein)	Fat (litre/g fat)
Sugar crops	130	52	15	197	285	0.0	0.0	0.69	0.0	0.0
Vegetables	194	43	85	322	240	12	2.1	1.34	26	154
Starchy roots	327	16	43	387	827	13	1.7	0.47	31	226
Fruits	726	147	89	962	460	5.3	2.8	2.09	180	348
Cereals	1232	228	184	1644	3208	80	15	0.51	21	112
Oil crops	2023	220	121	2364	2908	146	209	0.81	16	11
Pulses	3180	141	734	4055	3412	215	23	1.19	19	180
Nuts	7016	1367	680	9063	2500	65	193	3.63	139	47
Milk	863	86	72	1020	560	33	31	1.82	31	33
Eggs	2592	244	429	3265	1425	111	100	2.29	29	33
Chicken meat	3545	313	467	4325	1440	127	100	3.00	34	43
Butter	4695	465	393	5553	7692	0.0	872	0.72	0.0	6.4
Pig meat	4907	459	622	5988	2786	105	259	2.15	57	23
Sheep/goat meat	8253	457	53	8763	2059	139	163	4.25	63	54
Bovine meat	14,414	550	451	15,415	1513	138	101	10.19	112	153

1.5. The aim of the study

The main aim of this paper is to investigate young consumers' preferences for wine carrying a water saving label (WSL). The empirical analysis focuses on the following research questions: (1) Are consumers willing to pay a premium price for wine with a WSL? (2) Is there any difference in consumers' WTP for wine with WSL on the front-of-pack and on the back-of-pack? (3) Which are the determinants that affect consumers' WTP for food products with a WSL?

To achieve the objective of the study, an experimental auction investigating young consumers' preferences for wines in Italy was applied. This target population was selected as young consumers for three main reasons. First, young consumers are interested in sustainability issues of the wine sector (Pomarici and Vecchio, 2014). Second, they represent one of the most relevant market segments for the wine world in the immediate future (Atkin and Thach, 2012) and finally, they are extremely proficient with computer-based surveys (Szolnoki and Hoffmann, 2013).

2. Experimental auctions in consumer studies

The use of experimental economics methods has an increasing relevant role in estimating price and WTP for food products with added values (i.e. organic labeling, different taste, etc.) (Lusk et al., 2004; Lusk and Shogren, 2007). During the last two decades, non-hypothetical methods have gained increasing popularity as a tool for the evaluation of public and private goods since real products and real money are exchanged in an experimental market setting (Lusk and Shogren, 2007). In non-hypothetical experimental auctions a set of rules are used to determine, based on consumers' bids, who is the winner of the auctioned good and what the price she/he is willing to pay (Lusk and Shogren, 2007). There are different auction mechanisms that can be used such as the well-known English auction (were bidders are disclosed and prices ascending) or sealed-bid auctions (e.g. Vickrey auction) (see for a complete overview Lusk and Shogren, 2007). Experimental auctions have been applied to estimate the consumers' demand for a large variety of food products (Costanigro et al., 2015; Elbakidze et al., 2013; Froehlich et al., 2009; Lusk et al., 2004; Soler et al., 2002) also including wine (Barber et al., 2016; Gustafson et al., 2016; Sáenz-Navajas et al., 2013; Schmit et al., 2013; Vecchio, 2013). Non-hypothetical experimental auctions mechanisms have been also used by several authors to investigate sustainability labels (Vecchio and Annunziata, 2015; Yue et al., 2016).

3. Materials and methods

3.1. Experimental procedure

Due to the aforementioned reasons, to elicit consumers' WTP for wines reporting water saving labels, we adopted the non-hypothetical experimental auction mechanism (Lusk and Shogren, 2007). We applied a non-hypothetical Vickrey 5^{th} price auction (Vickrey, 1961) since this method has been previously demonstrated to be particularly useful in effectively engage all consumers (Lusk and Shogren, 2007) combining the advantages of second-price and random n^{th}-price auctions (Lusk et al., 2004). In the Vickrey 5^{th} price auction mechanism, all consumers simultaneously submit a sealed bid to purchase a good. The four highest bids win the auction and pay an amount equal to the fifth highest bid among the other

bidders of one session. The other bidders do not receive any goods and pay zero. To accommodate a non-hypothetical laboratory experiment avoiding deception, three wineries provided three wines with different water saving labels. Since previous scholars (Corrigan and Rousu, 2006; Drichoutis et al., 2008) have demonstrated that the provision of reference or field price information influences bid values in experimental auctions, we did not provide any reference price to the consumers. The full bidding approach was used, which means asking consumers to bid on all the three wines. Ordering effect was avoided through randomization of the three wines. To avoid welfare effect (which refers to the law of diminishing marginal utility by which each additional unit of a good that is consumed lowers the extra utility) only one round and one product were binding (Shogren et al., 1994). To recruit consumers, 500 emails were sent out from the experimental Lab database to possible consumers. Over 250 (more than 50% of the consumers involved) individuals answered declaring their initial availability to participate.

Consumers were initially asked whether they would participate in a survey in which they could buy food products and that they would receive a compensation for taking part in the study. The experiment was performed in February 2015 at the computer Lab of the University, in Naples (Italy). A total of 20 sessions were organized in eight consecutive weekdays, with 10 consumers each. Nobody could take part in more than one session. The total number of consumers was 200, composed by University students and staff, the only mandatory requirement needed to participate in the experiment was to consume wine at least once a month. The complete experimental procedure comprised seven phases (see Fig. 1), hereafter described in detail.

On arrival, each participant signs an individual consent form, which was mandatory for participation in the experiment. It indicates that she/he will receive 15 Euros at the end of the experiment for the time spent in the lab, and that she/he will be randomly assigned an ID and a monitor. Communication between consumers was strictly prohibited to avoid possible interactions altering individual decisions. The experiment instructions were distributed and read aloud by the researchers at the beginning of the experiment. Consumers were also encouraged to ask questions for clarification, if needed.

The experiment started by asking the consumers to fill in a computerized questionnaire about consumers' socio-demographics characteristics, together with lifestyle and wine habits. Then, the Vickrey 5th price auction mechanism was fully explained with a practical example shown on the dashboard. In addition, two training auctions with chocolate snacks were performed to better understand and familiarize with the auction mechanism. The results of the training auctions, namely the bids of all consumers, as well as the ID number of the four winners and the price to be paid, were written on a blackboard. Immediately after completing the training auction, the consumers were informed of the results and additional clarifications were offered on the mechanism. Then, via monitor, we

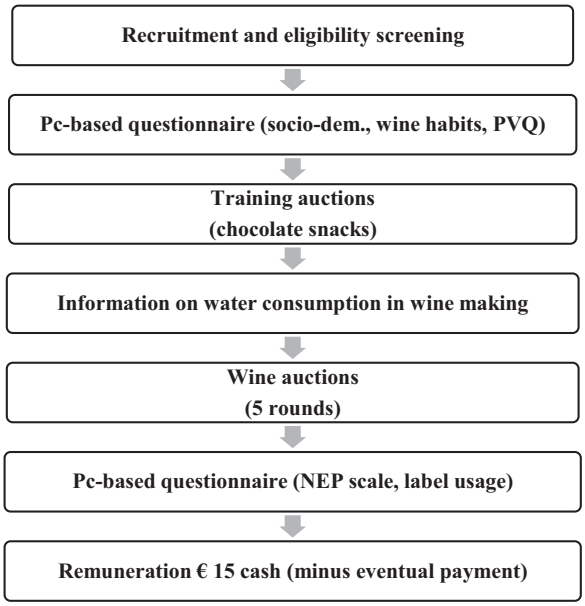


Fig. 1. Overview of experiment stages.

showed basic information[2] (identical wording) on water consumption in the wine-making process conveyed through a web wine-blog (about half sample) and a technical-viticultural journal.

Next consumers closely examined the three bottles of wines and posted five bids for each wine, using the z-Tree software (Fischbacher, 2007). We used five bidding rounds as literature has demonstrated that this is the ideal number of rounds to efficiently elicit consumers' true WTP (see, among others, Lusk and Shogren, 2007). In addition, consumers were asked to reply to a series of questions related their pro-environmental attitude, personal values and labeling attitudes. Finally, consumers received 15 Euros in cash for cost/opportunity compensation minus the price paid if winner.[3] Each session lasted approximately fifty minutes.

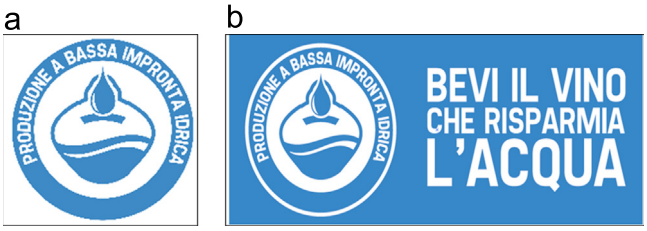
3.1.1. *Wines auctioned*

The products auctioned were three wines[4] which differed only for the WSL since all the other products attributes were kept constant (i.e. origin, denomination, grape variety, vintage, alcoholic content, cork type, etc.). The three wines were with

[2]Information on the average amount of water used by Italian wineries to produce a single bottle of wine were briefly presented, without stressing positive or negative issues.

[3]All procedures in the experimental design have followed previous scholars' suggestions on the optimal experimental auction design (Lusk and Shogren, 2007). In addition, the overall methodological approach has been previously, effectively, utilised in similar research. Nevertheless, overall robustness of our results could also be tested using different levels of cash endowments and different types of auction mechanisms (Lusk et al., 2004).

[4]The choice of auctioning only three products was motivated by the desire to keep the experiment simple for respondents, avoiding excessive cognitive efforts. Nevertheless, the bulk of research using experimental auctions to investigate consumer valuations for food products offers a number of goods between 2 and 5 (Lusk and Shogren, 2007).



Front label[10] Back label[11]

Fig. 2. Front (a) and back (b) WSL used in the experiment. a) Front label (Translation:"Environmentally friendly production" and "Drink wine which save water'). b) Back label. (Translation: "Environmentally friendly production).

the same Protected Designation of Origin Ischia Bianco[5] (white), same vintage (2013), same alcohol volume (12.5%), same traditional cork and the three bottles were all Bordeaux-style with simple labels' aesthetics.

The information carried out on the labels of the wine bottles were different (Fig. 2):

1. one wine had a regular label with no additional information related to water saving,
2. one wine carried out the WSL on the front of the bottle and,
3. one wine carried out the WSL on the back of the bottle.

Consumers were handed-out the three bottles (standard 0.75 l) and were asked to look carefully at both the front and the back of the bottles. The experiment did not include any tasting, or sensory/hedonic valuation of the auctioned products.

3.1.2. Consumers' characteristics

Beyond the experimental auction, we also collected a number of consumers' characteristics. These information were selected based on previous literature on wine consumer behavior (see, among others, Lockshin and Corsi, 2012) and environmental attitudes (e.g. Steg and Vlek, 2009). The consumers' characteristics investigated are *i*) socio-demographics, *ii*) personal values measured through Schwartz Portrait Value Questionnaire – PVQ (Shalom et al., 2001), *iii*) wine consumption and purchasing habits, *iv*) attitudes towards environment and nature using the New Environmental Paradigm (NEP) scale by Dunlap et al. (2000), and *v*) food labeling use and trust by applying the constructs[6] developed by Krystallis et al. (2012).

Consumers' characteristics are measured using nominal, ordinal and continuous variables (see Table 2). For the importance of the 15 items that compose the NEP, the scale is anchored from 1 (Not important at all) to 5 (Very important). The personal values were measured by using the Portrait Values Questionnaire (PVQ) that is composed by 21 questions (differentiated by gender) presented as a description of an individual. We used the PVQ values because several scholars have stated that sustainable consumption intention depends strongly on personal values (Caracciolo et al., 2016; Thøgersen and Ölander, 2002; Vermeir and Verbeke, 2008).

3.2. Data analysis

3.2.1. Consumers' characteristics

Consumers' characteristics were analyzed using univariate descriptive statistics for socio-demographics, wine habits and attitudes towards environment. In particular, the attitudes towards the environment were measured adopting the NEP scale that is composed by 15 items (Dunlap et al., 2000, p.438) by using an index which is the sum of all the scores given by consumers ranging from 15 to 75 (i.e. 15 items with agreement scale from 1 to 5). The greater the index the stronger the pro-ecological worldview of the respondent. The personal values were measured by using the 21-items that compose the Portrait Values Questionnaire (PVQ). Principal Component Analysis (PCA) was performed on the 21-items to obtain the meta-values.

3.2.2. Auction data

Auction data can be analyzed using different econometric models (Lusk and Shogren, 2007). Among the different models, we used the random-effects Tobit regression models with left-censoring,[7] due to the panel structure of our data (i.e. consumers could bid zero and each participant submitted five bids for each wine type for a total of fifteen bids). The random-effects Tobit regression model allows to investigate which independent variables have an impact on the dependent variables (i.e. final bids in Euro for the three wines) (Greene, 2003). In our main specification model (Eq. (1)), we investigated the main effects of socio-demographics, wine consumption habits and environmental attitudes.

Specifically, the random effects regression models were estimated in the following way:

$$\mathrm{WTP}_{it} = \max(0, \alpha + \beta' \mathrm{X}_{it} + \gamma' C_{it} + \delta' L_{it} + \chi' H_{it+} u_i + \varepsilon_{jt}) \quad (1)$$

where WTP_{it} is the WTP for the ith consumer in the tth bidding round; X_{it} is a vector that represents the socio-demographic characteristics of participant i and β' is the associated coefficient vector; C_{it} is a vector that represents wine-related characteristics of participant i and γ is the associated coefficient vector; L_{it} is a vector that represents consumers' environmental attitudes and δ is the associated coefficient vector, H_{it} is a vector that represents consumers' personal values and χ is the associated coefficient vector, u_i is the individual random disturbance for the i^{th} consumer and ε_{njt} is the overall error term.

[5] This PDO is well suited for the aims of the current experiment, as it is very small in terms of production volumes and rather unpopular among final consumers. Avoiding strong reputation effects that could bias valuations.

[6] In particular, we measured respondent's use of label while wine shopping (frequency scale 1 to 5), respondent's agreement with the statement "I trust the information on wine label" (scale 1 to 5), and respondent's agreement with the statement "I always understand easily labels on wine" (scale 1 to 5).

[7] In order to determine which estimation method was most appropriate between Tobit and double hurdle, we followed Lusk and Shogren (2007) and calculated a likelihood ratio statistic.

Table 2
Selected variables description and scaling/coding.

Variable	Description	Scale
Age	Age	Continuous
Gender	Gender	Nominal: Female = 1, Male = 0
Father's education	Father school and university education in years	0 ≤ Continuous
Mother's education	Mother school and university education in years	0 ≤ Continuous
Household size	Number of people living in respondent's household	1 ≤ Continuous
Household annual net income	Yearly household net income in Euros	0 ≤ Continuous
Information	Information source before auction	Nominal: Technical journal = 1, Web blog = 0
Wine consumption frequency	Monthly wine consumption frequency	Ordinal: 1–5 (1 = once a month; 5 = daily)
Wine purchases frequency	Monthly wine purchasing frequency	Ordinal: 1 - 5 (1 = zero bottles; 5 = six or more)
Average price for wine purchase for home consumption (€)	Average price of purchased wine for in-home consumption (0.75 l bottle)	0 ≤ Continuous
Average price for wine purchase for out of home consumption (€)	Average price of purchased wine for out of home consumption (0.75 l bottle)	0 ≤ Continuous
Environmental care (NEP)	Score on the Ecological Paradigms scale	15 to 75
Label use	Use of label while wine shopping (frequency)	Ordinal: 1–5(1 = never, 5 = always)
Label reading	Agreement with the statement "I carefully read the information on wine labels"	Ordinal: 1–5(1 = never, 5 = always)
Label trust	Agreement with the statement "I trust the information on wine label"	Ordinal: 1–5 (1 = totally disagree, 5 = totally agree)
Label understanding	Agreement with the statement "I always understand easily labels on wine"	Ordinal: 1–5 (1 = totally disagree, 5 = totally agree)

Table 3
Sample description (N = 200).

Variable	Mean	S.D.
Socio-demographics		
Age	22.50	2.62
Father's education (in years)	11.2	4.31
Mother's education (in years)	9.4	3.73
Household size	4.4	0.96
Household annual income (€)	17.270	8.790
Wine habits		
Wine consumption frequency	2.48	1.05
Wine purchases frequency	2.39	1.05
Label use	3.93	0.95
Label trust	3.72	0.77
Label understanding	2.73	1.04
Average price for wine purchased for home consumption (€)	4.10	3.08
Average price for wine purchased for out of home consumption (€)	8.52	4.06
Schwartz values		
Benevolence	2.71	1.12
Universalism	2.57	0.76
Self-direction	2.61	1.14
Stimulation	3.02	1.29
Hedonism	2.83	1.18
Achievement	2.78	1.06
Power	3.40	1.74
Security	2.48	1.69
Conformity	3.07	1.23
Tradition	2.74	1.35
Attitudes towards environment		
NEP Index	36.95	4.32

Table 2 describes the variables and the scales as well as coding used in the data analysis. The analyses was performed using STATA 13.0 (Stata Corp, College Station, Texas).

4. Results

4.1. Sample description

Table 3 presents the consumers' characteristics of the participants, such as socio-demographics, wine habits, personal values and attitudes towards environment.

The sample includes 200 young wine consumers. 55% were males while in terms of age consumers were between 19 to 32 years with a mean of 22.5 years. The average household is composed of 3.3 members, while the average annual net income (household) is 17.270 Euros.

Beyond socio-demographic characteristics, consumers were asked to state their wine purchasing and consumption habits. Frequency scales range from 1 (low) to 5 (high), while agreement degree ranges from totally disagree (1) to totally agree (5). On average, consumers drink more than two and a half bottles of wine a month and buy two bottles in the same time span; the importance of label use during wine purchases is high (3.93). The average price paid for a bottle of wine consumed at home is approximately 4 Euros, less than half of to the price of wine consumed out of home (Euro 8.52). In addition, 58% of consumers declared to drink wine mostly out of home.

We identified five Principal Components (PCs) explaining over 72% of total variance. The five components were: *i*) the

Table 4
Mean WTP values for the three wines and significance of differences.

Type of label	Median	Mean	S.D.	Min	Max	Wilcoxon signed-rank test	*p*-value
A) Conventional	3.00	4.16	3.32	0	21.1	Δ *A-B*	0.000
B) Front WSL	3.47	4.51	3.31	1	18.3	Δ *B-C*	0.067
C) Back WSL	3.41	4.32	3.20	0	18.8	Δ *A-C*	0.003

dimension of self-transcendence, grouping the values of benevolence and universalism; *ii*) the dimension of openness to change, comprising self-direction and stimulation; *iii*) the dimension of conservation, including security, conformity and tradition values; *iv*) the domain of self-enhancement, embracing power and achievement; *v*) the dimension of hedonism. The scores of the five extracted components were subsequently included as regressors in the econometric model (see Section 3.2.2).

The New Ecological Paradigm (NEP) was applied to measure consumers' attitudes towards environment. The overall NEP index has a mean of 36.95 ($\pm$ 4.32) indicating that consumers have a relatively low pro-environmental worldview ($\alpha = 0.65$). Moreover, outcomes reveal a weak statistical relationship between individual's NEP score and both wine consumption and purchasing frequencies.

4.2. Consumers' preferences and willingness to pay (WTP)

4.2.1. Willingness-to-pay (WTP)

Table 4 shows the average WTP values (i.e. the bids given by the consumers) for the three wines, with means calculated considering all the five rounds. The mean bid for the conventional wine was Euro 4.16 (Euro 3.00 median) while the mean bid for the front WSL wine was Euro 4.51 (median 3.47) and the mean bid for the back WSL wine was Euro 4.32 (median 3.41). As we cannot assume that the bids for the three wines are normally distributed, Wilcoxon signed-rank test

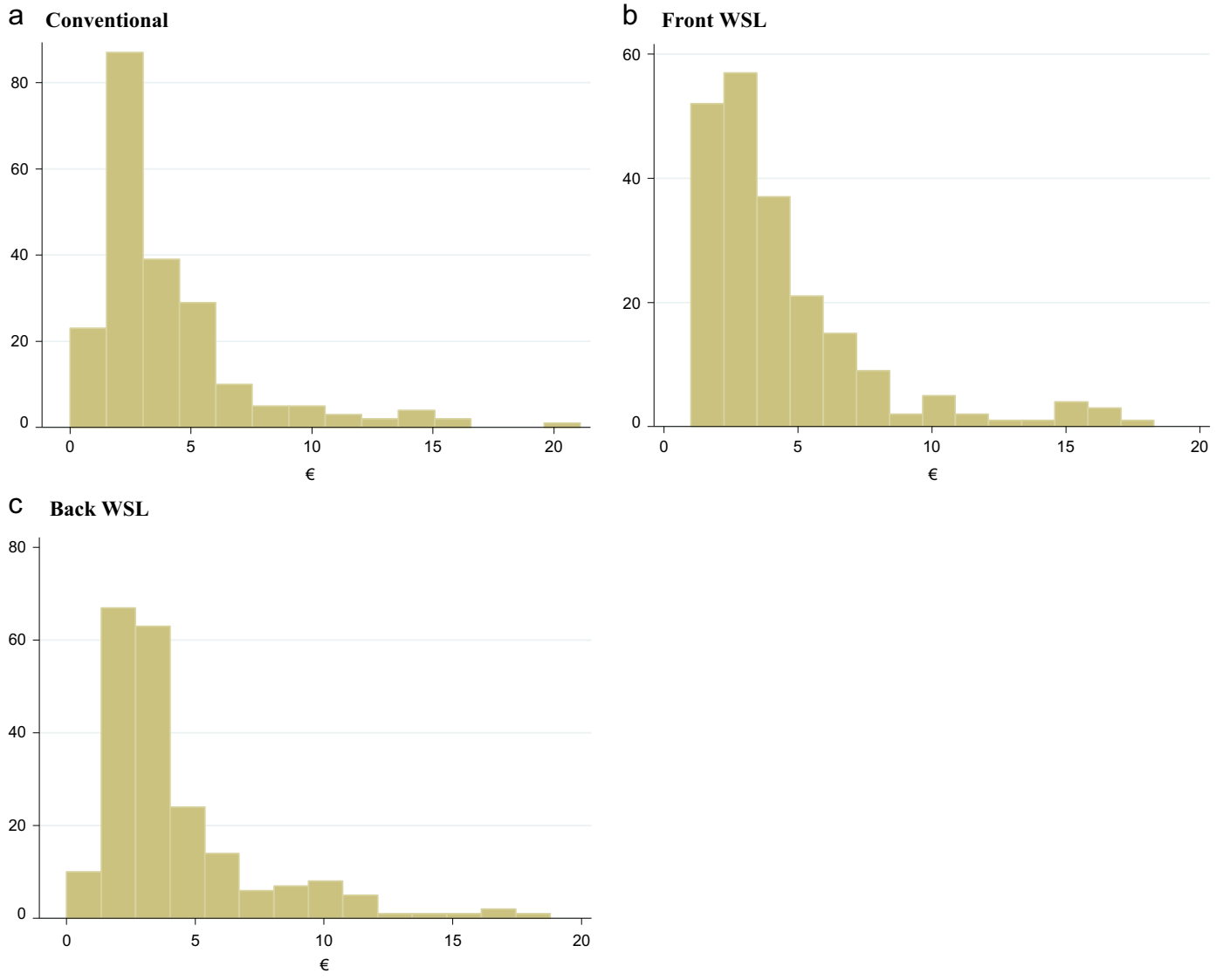


Fig. 3. WTP frequencies: Conventional (a), Front WSL (b), Back WSL (c).

Table 5
Selected parameters estimates of random effects Tobit models for the two wines carrying WSL (standard errors in parenthesis).

Parameter	Front WSL	Back WSL
Age	−0.148*	−0.109*
	(0.061)	(0.060)
Female	0.659**	0.442**
	(0.238)	(0.153)
Wine consumption frequency	0.376*	0.156*
	(0.191)	(0.081)
In-home consumption	−0.392*	−0.272
	(0.224)	(0.167)
Environmental care (NEP)	0.622**	0.531**
	(0.082)	(0.085)
Label use	0.659**	0.805**
	(0.238)	(0.236)
Label trust	0.276*	0.259*
	(0.155)	(0.115)
Self-enhancement	−0.185*	−0.393*
	(0.092)	(0.164)
Number of observations	*1000*	*1000*
Log likelihood	*−142.844*	*−147.105*
Prob > χ^2	*0.000*	*0.000*

(Wilcoxon, 1945) were performed for paired samples. According to the test both the WTP medians for front and back WSL are statistically different from wine with no label (1% level), while the WTP medians for front and back WSL are statistically different at 10% level.

Fig. 3 shows that consumers value both the WSL wines and then they are willing to pay a premium price for these products.

4.2.2. Drivers of willingness-to-pay

Table 4 presents the drivers of consumers' WTP for both WSL wines. Taking into consideration socio-demographics only age and gender have a statistically significant effect on WTP. Age has a negative sign for both WSL whereas gender (female) has a positive sign. In other words, younger consumers and females have higher reservation prices for both water saving wines. The type of information source provided to convey the issues related to water consumption of the products does not exert effect on consumers' WTP. Wine consumption frequency (higher) positively effects bids for both WSL wines, while consumers that mainly consume wine at home express lower WTP for the front WSL wine. Environmental care, measured through NEP index, has a significant positive effect on WTP for both WSL wines. Similarly, label use and trust (higher scores) increase consumers' bids for both water saving wines, while label understanding does not impact on consumers' WTP. As regards personal values, the only dimension that proved to exert a negative statistically significant effect on WTP (for both WSL wines) is self-enhancement of the econometric estimation models for the two WSL wines.[8]

5. Discussion

The main aim of this paper was to investigate young consumers' preferences and the determinants of WTP for wines labeled with WSL using auction data collected in Italy.

The first research question aimed to investigate if consumers are willing to pay higher prices for WSL wine. We found that on average young consumers are willing to pay premium prices for wines carrying WSL respectively +8.4% for front of bottle and +3.8% for back of bottle compared to conventional wine (i.e. wine without any WSL). These findings are consistent to Sellers-Rubio and Nicolau-Gonzalbez (2016) and Vecchio (2013), which found higher WTPs for wines with different sustainability labels compared to conventional counterparts. Results are also in line with findings of studies focusing on water footprints by Grebitus et al. (2016) for potatoes, ground beef and yogurt in Canada and Germany and also by Krovetz (2016) for vegetables in California. Table 5.

The second research question aimed to investigate if there are any differences in consumers' WTP for front and back WSL wines. We found that positioning the WSL in the front, consumers are willing to pay (WTP) 4.4% more compared to the wine carrying the WSL in the back of the bottle. This finding has an important implication for wine marketers, since it appears that conveying the WSL in the front might provide higher economic returns to wine producers.

The third research question aimed to investigate the drivers (consumers' characteristics) affecting consumers' willingness to pay (WTP) for WSL wines. A relevant driver is the wine consumption frequency, meaning that as consumers drink more frequently wine they are willing to pay higher prices for WSL wine. Another relevant driver is gender. Indeed, as we found that on average females are willing to pay higher prices for water saving labeled wines. The latter result is consistent with findings revealed by several other scholars (Vecchio and Annunziata, 2015; Barber et al., 2010; Pomarici and Vecchio, 2014; Sellers-Rubio and Nicolau-Gonzalbez, 2016). Furthermore, important drivers of WTP are label use and trust, i.e. consumers that use and trust labels are willing to pay higher prices for water savings wine.

Moreover, pro-environmental attitude also exerts positive effects on bids for the WSL wines, consistent with several authors (Barber et al., 2010; Grebitus et al., 2013; Sogari et al., 2015). Whereas, among the personal values only self-enhancement proved to be statistically significant with a negative sign (as shown also by Caracciolo et al., 2016). In contrast with several studies that have demonstrated that higher scores of self-transcendency and openness to change generally support pro-environmental behaviour (Dreezens et al., 2005; Krystallis et al., 2008).

[8] We present only the statistically significant results from the full models. The Tobit model for the conventional wine is not reported here due to space constraints. However, data are available upon request.

6. Conclusions

Recent research findings suggested that producing and marketing wine with sustainability characteristics is a promising strategy for quality differentiation (Schäufele and Hamm, 2017). This research aimed at exploring consumers' preferences for wines reporting WSL. We found that young consumers are willing to pay higher prices for water saving labeled wines and that the premium price is influenced by consumers' characteristics such as gender, wine consumption frequency, pro-environmental attitude, use and trust of labels. As effectively pointed out by Costanigro et al. (2015) when focusing on credence characteristics of products it can be expected that quality perception becomes more subjective and thus the role of beliefs should be even more central in determining consumer food purchases.

This study has several implications for both wine producers and policy makers. Wine producers can use this information by addressing the business and marketing strategies towards the use of environmental-friendly productions by including the information about water saving on wine labels for younger consumers. The differences in WTPs for wines without WSL could be compared with wine with WSL, and then compared with cost of production of environmental-friendly productions. In addition, the drivers of consumers' WTP could address the marketing strategies to specific consumers' segments which are more sensitive to the issue of freshwater scarcity, and also how to label and present food products (Lee and Hatcher, 2001). Policy makers should continue to support wine producers into adopt more environmental-friendly production methods, as done by the Common Agricultural Policy (CAP) rural development regulation of the European Union, which may contribute to improve the public awareness towards more environmental-friendly food choices.

Several limitations can be identified in this study. First, our estimates relate to a small, convenience sample of young consumers from which we cannot infer results to the general population. Thus, broadening the sample to other geographical areas, different age cohorts and diverse levels of involvement with the product should be done in order to provide deeper insights for marketers and policy makers. Second, WTP values should be cautiously considered as participantss might consider that their maximum prices in the experiment should include a discount compared to market prices - as they face a limited offer and may not have planned to buy wines at the time of the experiment (Combris et al., 2009; Vecchio, 2017). In addition, even if the wine selected for the study was very small in terms of production volumes and rather unpopular among final consumers, in general, we did not ask respondents their specific familiarity and knowledge of the PDO. Thus, we cannot exclude that some anchoring (among some respondents), due to reputation or previous experience, may have occurred.

Furthermore, the experiment protocol did not include any tasting and previous scholars have demonstrated that positive premiums for environmental attributes of wine are obtained only if consumers' sensory expectations are satisfied (Schmit et al., 2013). Finally, in the experimental design we may have inserted a potential bias, as Huffman et al. (2004) have pointed out that consumers are able to correctly read and trust labeling signals when the market contains only one labeled and one unlabeled product.

Further research should be conducted in several directions. First, further analysis of the present study could investigate individual differences to identify possible consumers' segments for better target marketing strategies (Asioli et al., 2016; Næs et al., 2010). Second, further research should explore together different sustainability labels, such as WSL, carbon footprint, fair trade and others, which could enrich the current debate around this topic (Pomarici and Vecchio, 2014). This is because most probably WTP estimates will be different when consumers are also asked to evaluate other environmental-related attributes. Third, the application of specific methods and treatments to reduce social desirability bias, inherent in these type of experiments, and windfall effect (Vecchio and Pomarici, 2013) could strengthen overall reliability of results. Fourth, the investigation of consumers' general use of sustainability labels (i.e. analyzing if these labels are used as simplifying "rules of thumb" to guide shopping choices among the myriad of market-based signals and alternatives) are encouraged (Costanigro et al., 2014; Fitzsimons et al., 2002; Heiman and Lowengart, 2011).

Finally, the results of this study indicate the need to adopt an integrated approach to reduce freshwater use which should involve all the stakeholders of the food chain such as food producers, retailers, consumers, policy makers and academia (Mancosu et al., 2015). This integrated approach will help and guide the food system to reduce the pollution and waste, also managing more effectively and becoming more efficient in all freshwater uses at individual, collective, and production levels. By doing so, we may achieve higher water productivity levels and in turn contribute to reduce freshwater scarcity. Thus, only if we are able to change the today's approach towards a more integrated strategy and also better inform consumers about the freshwater scarcity we will help ensure a better world for today's generation.

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Conflict of interest

None declared.

Appendix A. Principal component analysis (PCA) of Schwartz values

Value	Self-transcendence	Openness to change	Conservation	Self-enhancement	Hedonism
Power	−0.099	−0.073	0.087	**0.608**	0.201
Benevolence	**0.507**	0.241	0.143	−0.112	0.134
Universalism	**0.561**	0.305	0.089	−0.130	
Self-direction	0.383	**0.502**	−0.199	0.306	−0.152
Stimulation	0.359	**0.410**	−0.301	0.204	0.197
Hedonism	0.020	0.068	0.047	0.101	**0.890**
Achievement	0.033	0.054	0.030	**0.574**	−0.035
Security	0.109	0.088	**0.501**	0.306	−0.220
Conformity	−0.115	−0.042	**0.560**	0.109	0.061
Tradition	0.026	0.103	**0.582**	−0.205	0.073

The criterion followed for the extraction of the principal components was to have an eigenvalue higher than 1. In bold loadings greater than |0.4|.

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