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Assessing consumer preferences for organic vs eco-labelled olive oils

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Abstract In this study, a choice experiment was performed to investigate consumer preferences and willingness to pay for a set of eco-labels on extra-virgin olive oil. Specifically, we tested three types of eco-labels indicating that the olive oil was (i) obtained from ancient trees, (ii) produced in mountainous areas, and (iii) obtained with sustainable water use. These three different eco-labels were analyzed in combination with the well-known organic label and other relevant attributes of extra-virgin olive oil. The choice experiment was based on a consumer survey carried out in Italy, the largest olive oil consuming country in the world, in January–February 2017. A market research agency recruited a nationally-representative total sample of 1061 participants who were involved in a web-based interview. Consumer choices were analyzed using a Random Parameter Logit model. The main result of the study is that, on average, Italian consumers are willing to pay a significant premium price for all the tested eco-labels on extra-virgin olive oil with the organic label being the most preferred eco-label. However, high heterogeneity in consumer preferences was also detected.

Keywords Eco-labels · Sustainability · Olive oil · Choice experiment · Italy

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Introduction

The global food system is one of the main responsible for several environmental impacts such as greenhouse gas emissions, water pollution and consumption, soil erosion and degradation as well as biodiversity losses (Tilman et al. 2002). On the other hand, the global food system has undergone growing pressure due to the dramatic increase in the world's population and changes in food consumption patterns (Godfray et al. 2010). To satisfy the rising food demand, supply chains need to improve their productivity, which is often associated with an intensification of farming methods resulting in a significant increase in environmental impacts (Garnett et al. 2013).

Today, environmental sustainability is of interest not only for scholars and policy makers but also for consumers (Codron et al. 2006; Nash 2009; Rover et al. 2017). Increasing numbers of consumers are concerned about the environmental impacts of the products they purchase, and are also aware that their own consumption choices can contribute positively or negatively to the global environmental impact (Verain et al. 2012; Vermeir and Verbeke 2006).

Eco-labels have thus emerged as an important means to support consumer food choices by providing information on the environmental sustainability of a particular food product (Grunert et al. 2014; Thøgersen et al. 2010). This also enables producers to differentiate food products on the basis of a further quality dimension which depends on specific eco-friendly attributes (Prieto-Sandoval et al. 2016). Therefore, eco-labelling both generates added value for consumers and provides a competitive advantage for producers. At the same time, eco-labelling helps reduce the environmental impacts of food production through market self-regulation (Prieto-Sandoval et al. 2016).

In the food domain, in addition to the well-known organic label, other eco-labels with different standards have been introduced into the marketplace (e.g., carbon footprint, water footprint, rainforest alliance) (Grunert 2011). However, the level of sales of eco-labelled food products remains low (Grunert et al. 2014). In fact, being able to recognize more sustainable alternatives does not necessarily imply that consumers will actually buy them. In the context of food choice, eco-labels compete with other issues such as sensory and nutritional properties, healthiness, and convenience (Grunert et al. 2014). In addition, consumers need to understand the meaning of different eco-labels and what they really signify for themselves (Grunert 2011). In particular, given that organic and other eco-labelled products can all be perceived by consumers as eco-friendly products, it is possible that consumers interested in environmental protection may consider organic and other eco-labelled products as being interchangeable. However, while organic foods are obtained according to a production method that minimizes environmental impacts as well as the risks for health of humans, plants, and animals, other eco-labels usually cover limited aspects of the broader concept of environmental sustainability. Therefore, the success or failure of an eco-labelling scheme on the food market may be attributed to the scheme itself, to the general context in which it is implemented, and/or to the characteristics of the consumers who refer to the eco-label in their decision-making. In addition, there may be product-specific relationships between the environmental attributes and the other features of the food.

Consumer preferences for organic food products have been widely analyzed (Aertsens et al. 2009; Aschemann-Witzel and Zielke 2017; Janssen and Hamm 2012; Yiridoe et al. 2005; Krystallis and Chryssohoidis 2005; Schleenbecker and Hamm 2013; Zander et al. 2015; Zanoli et al. 2013), while only a few studies have focused on the trade-off between organic labelling and other eco-labels in some food markets such as meat (Risius and Hamm 2017; Van Loo et al. 2014), aquaculture products (Risius et al. 2017; Zander et al. 2018), and eggs (Andersen 2011).

In this study, consumer preferences and willingness to pay for a set of eco-labels, including the organic label, were jointly analyzed using extra-virgin olive oil as the case study. Although a number of consumer studies have already focused on this food product (Aprile et al. 2012; Boncinelli et al. 2017; Carlucci et al. 2014; Casini et al. 2014; Chan-Halbrendt et al. 2010; Del Giudice et al. 2015; Di Vita et al. 2013; Kalogeras et al. 2009; Krystallis and Ness 2005; Menapace et al. 2011; Panico et al. 2014; Roselli et al. 2016; Roselli et al. 2018a; Roselli et al. 2018b; Roselli et al. 2018c; Salazar-Ordóñez et al. 2018; Tsakiridou et al. 2006), to the best of our knowledge, no empirical studies have investigated consumer preferences and their willingness to pay for new eco-labels on olive oil. We also focused on olive oil because this product has great economic importance, particularly in Mediterranean countries such as Spain, Italy, Greece, and Portugal. In these countries, olive farming covers a large proportion of agricultural land and, depending on the level of production intensity, provides important positive and negative environmental externalities (Gómez-Limón et al. 2012; Pienkowski and Beaufoy 2000; Weissteiner et al. 2011). Despite the increasing spread of "intensive modern plantations", most European olive farming is still represented by "low-input traditional plantations" with the following characteristics: (i) low-density plantations with large and very old trees; (ii) location in hilly or mountainous areas, frequently on terraces; (iii) not irrigated; (iv) minimal use of agro-chemicals; (v) soil management with minimal tillage and/or grazing. As a result of their particular physical features and farming practices, low-input traditional olive plantations are characterized by a high natural value (i.e., biodiversity preservation and landscape protection), high positive environmental impacts (i.e., prevention of soil erosion on sloping lands), and low negative environmental impacts (i.e., low exploitation of water resources and low use of agro-chemicals) (Pienkowski and Beaufoy 2000). However, traditional olive plantations are also the least viable in economic terms and hence the most vulnerable to abandonment (Roselli et al. 2009).

Therefore, taking into account the growing consumer interest in environmental sustainability, using an eco-label could help to differentiate the olive oil obtained from low-input traditional plantations in order to preserve their important environmental benefits. However, this raises at least three main questions. First, how should a specific eco-label be designed in order for it to be easily understandable and appealing for consumers? Second, are consumers really willing to pay a premium for this eco-label? Third, could there be a possible competition between the organic label and another eco-label on the olive oil market? A preliminary investigation of the potential that new eco-labels on olive oil may have before their introduction into the marketplace could be extremely useful in order to prevent failures and subsequent waste of resources.

The remainder of the article is organized as follows. The next section presents the methodological approach, the experimental design, and the method for the statistical analysis. In the subsequent section, the results of the statistical analysis are described and discussed. The last section presents the conclusions together with practical recommendations for olive oil producers with respect to the use of the organic label and the other eco-labels tested in order to better differentiate the olive oil obtained from low-input traditional plantations.

Data and methods

Methodology

To investigate consumer preferences and willingness to pay for different eco-labels on extra-virgin olive oil, we carried out a choice experiment which entailed creating a hypothetical market situation where real consumers are asked to choose between different product alternatives.

The origins of choice experiments can be traced back to the theoretical framework proposed by Lancaster (1966), where consumers are assumed to derive utility directly from the characteristics or quality attributes embedded in a product, rather than from the product itself. In other words, differentiated products are considered as a bundle of different quality attributes which are independently valued by consumers at the time of purchase. We thus assumed that consumers choose olive oil after considering different quality attributes, including possible environment-related ones (i.e., eco-labels). In addition, according to the Random Utility Theory (Thurstone 1927), consumers express individual preferences for product characteristics and maximize their utility under budget constraints. Therefore, consumers' purchasing choices can be assimilated to the solution of maximization problems for the utility that can be obtained from a set of available alternatives.

Specifically, in a given situation t, each individual n obtains utility $[U_{nit}]$ from a product alternative i, and this utility is separable in a deterministic component $[V_{nit}]$, depending on the specific mixture of product attributes and individual characteristics, and a stochastic component $[\varepsilon_{nit}]$:

$$U_{nit} = V_{nit} + \varepsilon_{nit} \tag{1}$$

Considering a finite set of J alternatives, an individual n maximizes their utility by selecting the alternative that provides the highest utility. Specifically, the individual n chooses the preferred alternative by operating a pairwise comparison over the full set of alternatives: the alternative i is preferred to alternative j if alternative i provides higher utility than alternative j ($U_{nit} > U_{njt}$; $\forall j \neq i$). Given the stochastic nature of the hypothesized utility function, the maximization problem can be solved probabilistically. Therefore, considering a set of alternatives J, the probability that the individual n chooses alternative i (P_{nit}) is equal to the probability that alternative i provides the highest utility:

$$P_{nit} = \text{Prob}\left[(V_{nit} + \varepsilon_{nit}) > \left(V_{njt} + \varepsilon_{njt}\right)\right] > 0; \forall j \neq i, \forall J \tag{2}$$

The empirical counterpart of this theoretical problem is the estimation of a discrete choice model using data collected through a choice experiment (McFadden 1986).

The choice experiment

The choice experiment was performed through a consumer survey in Italy, the largest olive oil consuming country in the world, with about 20% of global consumption (IOC 2016). In January–February 2017, a market research agency administered the choice experiment and a questionnaire through a web-based survey. The inclusion criteria for the target population were as follows: (i) being a household responsible for food purchasing, and (ii) having bought olive oil at least once in the last year. Participants were recruited with a stratified quota sampling based on the geographical area, municipal size, age, gender, and education, in order to ensure the representativeness of the sample at the national level. Each interview was checked and validated for data completeness and procedure correctness before being included in the final sample, which overall consisted of 1061 individual observations. The composition of the final sample based on the participants' socio-demographics is summarized in Table 1.

The choice experiment was primarily designed to compare the organic label, which already exists on the olive oil market, with three hypothetical eco-labels specifically formulated to take into account the main eco-friendly characteristics of low-input olive plantations, namely that the olive oil was: (i) obtained from ancient trees, (ii) produced in mountainous areas, and (iii) obtained with sustainable water use. In addition, as the country-of-origin indication plays a key role in consumer choices for extra-virgin olive oil (Del Giudice et al. 2015), two different country-of-origin indications, namely "Italy" and "EU countries," were also included in the choice experiment. Finally, we considered the price with six levels representing the range of market prices directly detected on supermarket shelves at the time of the study.

It should be noted that consumers' purchasing behavior can result in a very complex pattern, which is typical of the extra-virgin olive oil market (Del Giudice et al. 2015). However, the explorative aim of this study led the choice experiment to be as simple as possible. In fact, each eco-friendly attribute was assumed to be mutually exclusive, while other relevant attributes such as geographical indications were excluded.

The selected attributes with related levels are reported in Table 2.

Attributes and their levels were combined to create hypothetical product alternatives to be presented to participants as "choice sets." In order to facilitate respondents and optimize the research work, a D-optimal design was performed to select the best subset of all possible combinations of product alternatives (Kanninen 2002). This allowed to generate only six choice sets, each including four product alternatives, to be presented to all participants.

Each choice set was presented in the form of a choice card with photo-realistic images showing four hypothetical olive oils (options A, B, C, D), as well as the "no-choice" option. This latter option was used to help prevent any constrained choices when none of the proposed alternatives were considered sufficiently attractive to be purchased. An example of a choice card is shown in Fig. 1.

Prior to making their choices, participants were invited to consider themselves in a real purchase situation and to have to choose between different products, all represented by extra-virgin olive oils with their own preferred brand and packaged in a 1 litre glass bottle. A clear and concise explanation of the meaning of all the considered attributes, in particular the meaning of each

Table 1 Socio-demographic characteristics of the sample

	Sample		Italian population*
	N	%	%
Total	1061	100	100
Geographical area			
North-West	279	26	27
North-East	202	19	19
Centre	238	23	23
South	342	32	31
Municipal size (inhabitant)			
≤ 5000	170	16	17
5001–20,000	313	29	30
20,001–100,000	315	30	30
≥ 100,000	263	25	24
Age			
Mean (std dev)	44 (14)	–	51
Gender (female)			
Mean (std dev)	0.50 (0.50)	–	0.52
Education			
Primary	120	11	41
Secondary	538	51	42
Tertiary	403	38	17

*Source: Italian Institute of Statistics – ISTAT (2014)

Table 2 Attributes and levels of the choice experiment

Attributes	Levels
Eco-labelling	organic; from ancient trees; mountain product; sustainable water use; no eco-label
Country of origin	Italy; EU countries
Price (per liter)	€3.90; €5.90; €7.90; €9.90; €11.90; €13.90

eco-label, was also presented to participants immediately before the cards were shown. Participants were thus asked to choose the preferred alternative from within each choice set.

Estimation and willingness-to-pay

Consumer choices were modelled using the Random Parameter Logit (RPL) model, which is highly flexible and can approximate any Random Utility Model (RUM) by relaxing the assumption of homogenous individual preferences (McFadden and Train 2000). In fact, as highlighted in Scarpa and Del Giudice's (2004) study, it is very likely that individual preferences for extra-virgin olive oil are heterogeneous. In the RPL model, taste variation among individuals is explicitly treated. The utility function of the individual n for the alternative i at a given situation t is specified as follows:

$$U_{nit} = \beta' X_{nit} + \varepsilon_{nit} \quad (3)$$

where β' is a vector of random parameters, with known mean and variance, which represents heterogeneity in individual preferences, X_{nit} is the full vector of explanatory variables, including product attributes embedded in the alternative i and characteristics of individual n, while ε_{nit} is the stochastic error.

Following Train (2009), the probability of the individual n choosing the alternative i at given situation t is computed as follows:

$$P_{nit} = \int \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} f(\beta) d\beta \quad (4)$$

where the distribution $f(.)$ of the random parameters β is specified by the analyst.

Specifically, for the model formulation, we assumed a normal distribution for the price variable (PRICE), treated as a continuous variable, and a triangular distribution for the remaining attributes, coded as dummy variables. For the eco-labelling attribute, five dummies were created (ORGANIC, WATER, MOUNTAIN, ANCIENT, NO_ECOLABEL); the option "NO_ECOLABEL" was used as the reference level. Likewise, for the country-of-origin attribute, two dummies were created (ITALY and EU), keeping EU origin as reference. Finally, an alternative specific constant (ASC) was also included in the model to capture the preferences for the "no-choice" option.

Two different RPL models were applied: in the first one (Model 1), only olive oil attributes were used as explanatory variables of consumer utility, while in the second one (Model 2), the respondents' socio-demographics were also included as covariates. However, as argued in previous studies (Aertsens et al. 2009; Aschemann-Witzel and Zielke 2017; Gracia and de Magistris 2008), pro-environmental behavior is only partially linked to, and poorly explained by socio-demographics such as gender, age, and education.

A summary of all the variables used in the analysis is presented in Table 3.

Model estimations were performed using NLOGIT 6 with a simulated maximum likelihood using Halton draws with 1000 replications. The parameter estimates are interpreted in relative terms and represent changes in utility (or in choice probability) due to the presence of a given attribute compared to the omitted alternative, all other characteristics being equal. The willingness-to-pay (WTP) is computed through the ratio of the estimate for each attribute and the estimate for the price:

$$WTP_k = -\frac{\beta_k}{\beta_p} \quad (5)$$

In the above expression, WTP_k is the willingness-to-pay for the kth attribute, β_k represents the estimated parameter of the kth attribute, and β_p is the estimated coefficient for price. Confidence intervals at 95% for the WTP estimates were calculated using the method proposed by Krinsky and Robb (1986).

Results and discussion

The results of the two RPL models (Model 1 and Model 2) are shown in Table 4.

Both models were statistically significant (chi-squared statistic equal to 6375.68 and 6366.84, respectively, with a *p-value* much lower than 0.01 in both cases) and showed a good ability to fit data (McFadden pseudo R-squared equal to 0.310 and 0.311, respectively).

The price coefficients were negative and statistically significant in each model. As expected, all other characteristics being equal, increasing price was associated with a lower utility, which implies a lower choice probability. Similarly, in both models, the ASC was negative and statistically significant, indicating a general acceptance of the products presented through the choice sets.

Fig. 1 Example of choice card

Focusing on Model 1 (without socio-demographics), the country-of-origin indication shows a large influence on consumer choices. There was a home bias effect given that the indication of Italian (domestic) origin increases the probability of choosing an extra-virgin olive oil. This also means that consumers associate higher utility to extra-virgin olive oil with Italian origin rather than EU countries origin, in line with the findings of Del Giudice et al. (2015). Regarding the influence that our selected eco-labels have on consumer choices, estimates reveal that they all have a positive and statistically significant effect, although different in terms of magnitude. This means that, on average, the presence of an eco-label on extra-virgin olive oil is associated with higher utility compared to the alternative without any eco-label, which implies that when an olive oil is provided with eco-labels, its choice probability increases.

Model 1 estimates also provide insights into the heterogeneity of consumer preferences, and, in particular, for all parameters, the standard deviations were statistically significant. This proves that there is heterogeneity in individual preferences for all attributes, and the relatively high magnitude of the standard deviations for all parameters implies that, for each attribute, consumers may have reverse preferences. The country-of-origin indication reported the highest standard deviation of parameter distribution.

In Model 2, socio-demographics were added, which have an effect on both the values of taste parameters and relative standard deviations. In general, the taste parameters values for all the considered attributes decrease although they remain positive and statistically significant. Note that when socio-demographics are included, estimated parameters averages no longer relate to the entire sample, but only to the control group.

The effects of socio-demographics are reported in Table 5, which shows how consumer utility for the different attributes is significantly influenced by age,

Table 3 Summary of variables used in the analysis

Model 1	Model 2	Variable definition
Product attributes		
ORGANIC	ORGANIC	1 if labelled "organic", 0 otherwise
WATER	WATER	1 if labelled "sustainable water use", 0 otherwise
MOUNTAIN	MOUNTAIN	1 if labelled "mountain product", 0 otherwise
ANCIENT	ANCIENT	1 if labelled "from ancient trees", 0 otherwise
ITALY	ITALY	1 if labelled "100% Italian", 0 otherwise
PRICE	PRICE	Price of the product (€/L)
Socio-demographics		
GENDER		1 if female, 0 otherwise
AGE		respondents age (continuous variable)
LOW_EDUCATION		1 if respondent achieved primary education, 0 otherwise
NORTH_WEST		1 if respondent resides in North West of Italy, 0 otherwise
NORTH_EAST		1 if respondent resides in North East of Italy, 0 otherwise
SOUTH		1 if respondent resides in South of Italy, 0 otherwise
MUNICIPAL_SIZE		1 if respondent resides in Cities bigger than 100,000 inhab.

and to a lower extent by education and place of residence. In particular, eco-labels, including the organic label, are more appreciated by younger consumers, while domestic origin is more valued by older consumers. Moreover, less-educated consumers and consumers in southern Italy show less interest in the organic label and domestic origin of olive oil. On the other hand, less-educated consumers attach higher utility for the label "from ancient trees".

As a whole, when socio-demographics are used as covariates, standard deviations of taste parameters decrease. However, the effect is not dramatic considering that standard deviations remain statistically significant and large compared to the magnitude of taste

Table 4 Estimation results of RPL models

	Model 1 (without socio-demographics)		Model 2 (with socio-demographics)	
	Mean coefficient (S.E.)	Standard deviations (S.E.)	Mean coefficient (S.E.)	Standard deviations (S.E.)
Random parameters				
ORGANIC	2.68186*** (0.315)	2.86979*** (0.310)	1.38644*** (0.159)	1.56591*** (0.133)
WATER	1.56366*** (0.334)	2.54050*** (0.314)	0.72867*** (0.169)	1.38299*** (0.152)
MOUNTAIN	1.47375*** (0.386)	3.64484*** (0.310)	0.85202*** (0.190)	1.73947*** (0.178)
ANCIENT	2.17615*** (0.357)	3.23696*** (0.278)	1.27438*** (0.174)	1.53978*** (0.145)
ITALY	2.29820*** (0.381)	5.36211*** (0.242)	1.04917*** (0.190)	2.78454*** (0.129)
PRICE	− 0.37545*** (0.061)	0.94693*** (0.051)	− 0.24761*** (0.064)	0.87140*** (0.050)
Non-random parameters				
ASC	− 1.41942*** (0.098)	–	− 1.06500*** (0.092)	–
	No. of obs.: 6366 (1061 respondents)		No. of obs.: 6366 (1061 respondents)	
	Log likelihood function: − 7056.230		Log likelihood function: − 7060.650	
	Chi-squared: 6375.68		Chi-squared: 6366.84	
	Significance level: < 0.0001		Significance level: < 0.0001	
	McFadden pseudo R-squared: 0.310		McFadden pseudo R-squared: 0.311	

***, **, * Significance at 1%, 5%, and 10% levels

Table 5 Heterogeneity in taste parameters (Model 2)

	Attributes				
Socio-demographics	ORGANIC	WATER	MOUNTAIN	ANCIENT	ITALY
GENDER	− 0.01644 (0.074)	0.00499 (0.079)	0.01113 (0.090)	− 0.08671 (0.081)	0.10013 (0.090)
AGE	− 0.01406*** (0.003)	− 0.01337*** (0.003)	− 0.01493*** (0.003)	− 0.01282*** (0.003)	0.01693*** (0.003)
LOW_EDUCATION	− 0.22771** (0.116)	− 00.00605 (0.123)	0.22643 (0.138)	0.24782** (0.125)	− 0.39807*** (0.140)
NORTH_WEST	− 0.06804 (0.106)	0.1068 (0.114)	− 0.17349 (0.128)	− 0.0512 (0.117)	0.12031 (0.129)
NORTH_EAST	− 0.15702 (0.114)	0.1064 (0.124)	− 0.06996 (0.138)	− 0.06022 (0.126)	− 0.05135 (0.136)
SOUTH	− 0.24591** (0.099)	0.04013 (0.107)	− 0.16481 (0.120)	− 0.15789 (0.109)	− 0.20464* (0.119)
MUNICIPAL_SIZE	− 0.00645 (0.073)	0.0016 (0.079)	0.0277 (0.088)	− 0.10122 (0.080)	− 0.04276 (0.091)

***, **, * Significance at 1%, 5%, and 10% levels. Values in brackets denote standard errors

parameters. In other words, Model 2 still explains some of the heterogeneity in consumer preferences. This heterogeneity is probably mainly driven by differences in the psychographic characteristics of consumers.

However, the results of Model 2 could be useful in to some extent explaining, the correlation matrix of taste parameters estimated in Model 1, in terms of the whole sample (Table 6).

Some correlations in the heterogeneity of individual preferences between different attributes are statistically significant. The parameter of the attribute ORGANIC is inversely correlated with the parameter of the attribute ITALY. This means that consumers who express a high preference for the organic label also express a low preference for Italian origin and vice versa. Indeed, the results of Model 2 confirm that organic label is appreciated more by younger consumers, while Italian origin is valued more by older consumers. In addition, the parameter of the attribute ORGANIC is highly correlated with the parameters of the attributes WATER and MOUNTAIN, but is not correlated with the parameter of the attribute ANCIENT. This means that consumers who express a high preference for the organic label also express a high preference for the labels "sustainable water use" and "mountain product." Also in this case, Model 2 confirms that a common characteristic of the consumers who attach more utility to the labels "organic", "sustainable water use", and "mountain product" is young age. Conversely, consumers who express a high preference for the organic label and consumers who express a high preference for the eco-label "from ancient trees" seem to be different. Results of Model 2 show that these two consumer segments have young age in common but are differentiated in terms of education: consumers more attracted by the label "from ancient trees" are less educated than those who appreciate the organic label.

A deeper understanding of the role of each attribute in consumer choices is provided by results of the WTP estimations of Model 1 which are reported in Table 7. Following Menapace et al. (2011), the table also shows the share of respondents with a positive WTP for each attribute.

The highest average WTP values are shown for the organic label (7.1 €/L) and Italian origin (6.1 €/L), both well-known and familiar to consumers. The average

Table 6 Correlation matrix of taste parameters (Model 1)

	ORGANIC	WATER	MOUNTAIN	ANCIENT	ITALY
ORGANIC	–				
WATER	5.739***	–			
MOUNTAIN	4.194***	− 2.027	–		
ANCIENT	1.038	− 3.427***	8.928***	–	
ITALY	− 4.154***	− 3.762***	0.185	− 1.289	–

***, **, * Significance at 1%, 5%, and 10% levels

Table 7 Willingness to pay

Attribute	WTP	Standard Error	z	Prob. |z| > Z*	95% Confidence Interval		S > 0[a]
ORGANIC	7.14***	1.376	5.190	0.000	4.447	9.839	70%
WATER	4.16***	0.983	4.240	0.000	2.238	6.091	66%
MOUNTAIN	3.92***	1.156	3.400	0.001	1.660	6.190	60%
ANCIENT	5.79***	1.278	4.540	0.000	3.292	8.300	68%
ITALY	6.12***	1.291	4.740	0.000	3.591	8.651	74%

***, **, * Significance at 1%, 5%, and 10% levels

[a] S > 0 denotes share of respondents with positive WTP

WTP value is only moderately lower for the label “from ancient trees” (5.8 €/L), but considerably lower for the labels, “sustainable water use” (4.2 €/L), and “mountain product” (3.9 €/L). In addition, a positive preference for both the organic label and Italian origin was expressed by a large majority of respondents (70% and 74%, respectively). Regarding the other tested eco-labels, a large share of respondents also expressed a positive preference for all of them, but with lower values than the organic label: 68% for “from ancient trees”, 66% for “sustainable water use”, and 60% for “mountain product”.

Conclusions

In this study, we conducted a choice experiment to investigate consumer preferences and willingness to pay for different hypothetical eco-labels specifically formulated to differentiate the olive oil obtained from low-input traditional plantations in order to support them and preserve their important environmental benefits.

We tested the following three eco-labels indicating that the olive oil was (i) obtained from ancient trees, (ii) produced in mountainous areas, and (iii) obtained with sustainable water use. These eco-labels were analyzed alongside the organic label, as this already exists on the olive oil market, although it is not specific for differentiating the product obtained from extensive olive groves.

The main result of the study is that a large share of Italian consumers appreciate all the tested eco-labels on olive oil, and, on average, are willing to pay a significant premium price for all of them. The study also shows that the organic label is the most preferred eco-label gaining, on average, the highest premium price. A possible explanation for this is that the organic label is already established on the market and is strengthened by more knowledge, familiarity and trust on the part of consumers. It should also be noted that the organic label is multifaceted covering not only environmental aspects, as is the case of the other tested eco-labels, but also additional safety, health and taste benefits (Aertsens et al. 2009; Schleenbecker and Hamm 2013; Naspetti and Zanoli 2009).

The results of the study also highlight that although there is a wide consumer sensitivity regarding environmental sustainability for olive oil production, there is also high heterogeneity in consumer preferences. Consumers may express a very different willingness to pay for the same eco-label, and, at the same time, each consumer may express a very different willingness to pay for different eco-labels.

In order to differentiate and promote the olive oil obtained from extensive and more eco-friendly olive groves (low-input traditional plantations), considering that there are no substantial technical problems in using all the tested eco-labels, including the organic label, a positive result is expected by using at least one eco-label.

However, the findings of this study also provide detailed insights into how the tested eco-labels could be used in order to better promote olive oil obtained from low-input traditional plantations.

First, comparing the organic label with the eco-labels, “sustainable water use” and “mountain product”, we found that these labels were more appreciated by a rather homogeneous (significant correlation of relative taste parameters) consumer segment that is characterized by young and medium-high educated individuals. Considering that the average willingness to pay is, instead, quite different (considerably higher for the organic label compared to the labels “sustainable water use” and “mountain product”), a mutually exclusive use of these eco-labels would not be beneficial because they would act as substitutes/competitors, which would reduce the possibility of obtaining the highest premium price. Consequently, it would be advisable to differentiate the olive oil obtained from low-input traditional plantations using the organic label which would lead to a higher premium price, without overloading the market with new labelling schemes.

Conversely, comparing organic label with the eco-label "from ancient trees" revealed that the most interested consumer segments in these two eco-labels were quite differentiated (no significant correlation of relative taste parameters). The level of education was also found to be one of the main elements of differentiation: consumers who mostly opted for the organic label were far more educated than consumers who were more attracted by the label "from ancient trees". In this case, a mutually exclusive use of these eco-labels would not have negative effects because they would not act as substitutes/competitors, but would attract consumers with different preferences.

Therefore, among the eco-labels specifically formulated to differentiate the olive oil obtained from low-input traditional plantations, the label "from ancient trees" seems to have the greatest probability of success for two reasons. First, it does not seem to be in competition with the organic label, which is the most preferred eco-label on olive oil; second, consumers are willing to pay, on average, an only slightly lower premium price for it compared the organic label.

Another interesting option is the simultaneous use of the organic label and "from ancient trees" label on the same product. This association, resulting in a combined label such as "organic olive oil obtained from ancient trees" would differentiate the organic olive oil obtained from "low-input traditional plantations" and the organic olive oil obtained from "intensive modern plantations." This would thus have a strong eco-friendly connotation and would be able to attract a wide target market including both consumers attracted by the organic label and those interested in "from ancient trees" label. Even though a possible synergistic effect of the combined label in terms of WTP should be analyzed more in depth in further studies, our findings exclude possible antagonistic effects considering that a large majority of consumers express positive preferences for both the two labels.

Finally, before the label "from ancient trees" is introduced into the market, it would be necessary to create a specific voluntary scheme that should clearly describe the characteristics of the olive groves that can be actually considered as being "ancient."

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