Assessing consumer preferences for organic vs eco-labelled olive oils

Abstract

In this study, a choice experiment has been performed to investigate consumers' preferences and willingness to pay for a set of eco-labels on extra-virgin olive oil. Specifically, we tested three possible types of eco-labels: i) a label indicating that olive oil has been obtained from ancient trees, ii) a label indicating that olive oil has been produced in mountainous areas, and iii) a label indicating that olive oil has been obtained with a sustainable water use. These eco-labels have been analysed jointly to the well-known organic label and other relevant attributes of extra-virgin olive oil. The choice experiment has been performed based on a consumer survey carried out in Italy, the largest olive oil consumer country in the world, during January-February 2017. A market research agency recruited a nationally-representative sample of 1,061 participants who have been involved in a web-based interview. Consumers' choices have been analysed by 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 even if organic label is confirmed to be the most preferred eco-label. However, high heterogeneity in consumer preferences was also detected.

Keywords: eco-labels, sustainability, olive oil, choice experiment, Italy

Introduction

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 loss (Tilman et al. 2002). On the other hand, global food system is undergone to a 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 have to improve their productivity, and this is often associated with an intensification of farming methods resulting in a significant increase of environmental impacts (Garnett et al. 2013).

Nowadays, environmental sustainability has become a matter of growing interest not only for scholars and policy makers but also for consumers (Codron et al. 2006; Nash 2009). More and more consumers are now concerned with the environmental impacts of the products they purchase, and they are also aware that own consumption choices can contribute positively or negatively to the global environmental impact (Verain et al. 2012; Vermeir and Verbeke 2006).

In this context, eco-labels emerged as an important tool to support consumers' food choices by providing information about whether a food product is more environmentally sustainable than others (Grunert et al. 2014; Thøgersen et al. 2010). This also allows producers to differentiate food products on the basis of a further quality dimension which depends on the presence of specific eco-friendly attributes (Prieto-Sandoval et al. 2016). Therefore, eco-labelling shares the objectives of generating added value for consumers and providing a competitive advantage for producers. At the same time, eco-labelling contributes in reducing environmental impacts of food production through a virtuous mechanism of 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 are being introduced into the marketplace (e.g. carbon footprint, water

footprint, rainforest alliance, etc.) (Grunert 2011). However, the level of sales of eco-labelled food products remains substantially low (Grunert et al. 2014). In fact, giving the opportunity of recognizing 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 have to understand the meaning of different eco-labels and to make inference on what they really signify for themselves (Grunert 2011). In particular, because organic and other eco-labelled products can be both 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 substitutes. 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 only certain aspects of the broader concept of environmental sustainability. Therefore, the success or failure of an eco-labelling scheme on food market may be attributed to the scheme itself, to the general contest in which it is implemented, and/or to the characteristics of consumers who use the ecolabel in their decision-making. Furthermore, there could be product-specific relationships between environmental attributes and the other features of food.
While consumers' preferences for organically produced olive oil have been largely analysed (Boncinelli et al. 2017; Del Giudice et al. 2015; Kalogeras et al. 2009; Panico et al. 2014; Roselli et al. 2018b; Tsakiridou et al. 2006), it seems that little research has been carried out to understand the trade-off between organic label and other eco-labels in food markets without exception in olive oil market.
In this study, consumers' preferences and willingness to pay for a set of eco-labels, including organic label, have been jointly analysed by using extra-virgin olive oil as case study. We focused on olive oil because this product has a relevant economic importance, particularly in Mediterranean countries such as Spain, Italy, Greece and Portugal, where olive farming covers a large share of agricultural land. In addition, depending on the level of production intensity, olive farming provides relevant environmental externalities, both positive and negative (Gómez-Limón et al. 2012; Pienkowski and Beaufoy 2000; Weissteiner et al. 2011). It should be noted that, although the increasing dominance of "intensive modern plantations", a large share of European olive farming is still represented by "low-input traditional plantations" with the following characteristics: i) low-density plantation with large-sized and ancient trees; ii) localization in hilly or mountainous areas, frequently on terraces; iii) not irrigated; iv) spare use of agro-chemicals; v) soil management with minimal tillage and/or grazing. As a result of their particular physical characteristics and farming practices, low-input traditional plantations have high natural value (biodiversity and landscape), high positive environmental impacts (i.e. prevention of soil erosion on sloping lands) and low negative environmental impacts (i.e. no exploitation of water resources and low use of agro-chemicals) (Pienkowski and Beaufoy 2000). However, these plantations are also the least viable in economic terms and hence most vulnerable to abandonment. Therefore, taking into account the growing consumer interest in environmental sustainability, it may be valuable to introduce an eco-label for differentiating olive oil obtained from low-input traditional plantations in order to support and preserve them for their important environmental benefits. However, this raises at least three main questions. First, how to formulate a specific eco-label for this purpose so that it is likely understandable and appealing for consumers? Second, are consumers really willing to pay a premium for this eco-label? Third, can there be a possible competition between organic label and another eco-label on olive oil market? A preliminary investigation of the potential that possible eco-labels on olive oil can have before their introduction into the marketplace may be extremely useful in order to prevent failures and subsequent waste of resources.

Although several studies have extensively investigated consumer preferences and willingness to pay for different quality attributes of olive oil, including organic label (Aprile et al. 2012; Carlucci et al. 2014; Casini et al. 2014; Chan-Halbrendt et al. 2010; Del Giudice et al. 2015; Di Vita et al. 2013; Krystallis and Ness 2005; Menapace et al. 2011; Roselli et al. 2016; Salazar-Ordóñez et al. 2018; Tsakiridou et al. 2006) empirical investigations on consumer preferences and willingness to pay for eco-labels on olive oil are particularly limited.

Materials and methods

Methodology

In order to investigate consumers' preferences and willingness to pay for different eco-labels on extra-virgin olive oil, we performed a choice experiment which consists of creating a hypothetical market situation where real consumers are asked to make choices between different product alternatives. The roots of choice experiments can be traced back to the theoretical framework proposed by Lancaster (1966), assuming that consumers 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 that are independently valued by consumers at the time of purchase. Accordingly, we assumed that consumers choose olive oil by considering different quality attributes, including possible eco-labels. In addition, according to Random Utility Theory (Thurstone 1927) consumers express individual preferences for product characteristics and maximize their utility under budget constraint. Therefore, consumers purchasing choices are assimilated to the solution of maximization problems for the utility that can be obtained from a set of available alternatives.

Specifically, we assume that 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 a stochastic component [ε_{nit}]:

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

Considering a finite set of J alternatives, the individual n maximizes his utility by selecting the alternative that provides the highest utility. Specifically, the individual n will choose the preferred alternative by operating a pairwise comparison over the full set of alternatives: the alternative i will be preferred to the alternative j if the alternative i provides higher utility than the 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 J alternatives, the probability that the individual n chooses the alternative i (P_{nit}) is equal to the probability that the alternative i provides the highest utility:

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

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

The choice experiment

In this study, a choice experiment has been performed based on a consumer survey carried out in Italy, the largest olive oil consumer country in the world, with about 20% of global consumption (IOC, 2016). In particular, during January-February 2017, a market research agency administered the choice experiment and a questionnaire by means of web-based interviews. The inclusion criteria for the target population were: i) being household responsible for food purchasing, and ii) have bought olive oil at least once in the last year. A total of 1,061 participants were recruited with a stratified quota sampling based on geographical area, municipal size, age, gender, and education, in order to ensure the representativeness of the sample at national level. Table 1 summarises participants' socio-demographics.

The choice experiment has been primarily designed to compare organic label, which is an eco-label already existing on olive oil market, with three hypothetical eco-labels which were formulated by taking into account the main eco-friendly characteristics of low-input olive plantations. Specifically, these hypothetical eco-labels are: *i*) a label indicating that olive oil has been obtained from ancient trees, *ii*) a label indicating that olive oil has been produced in mountainous areas, and *iii*) a label indicating that olive oil has been obtained with sustainable use of water. In addition, as shown in a recent literature review (Del Giudice et al. 2015), country-of-origin indication plays a key role in consumer choice behaviour for extra-virgin olive oil. Therefore, 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 shelf at the time of the study. It should be taken in mind that consumers purchasing behaviour can result in a very complex pattern, which is the case of extra-virgin olive oil market (Del Giudice et al. 2015). The explorative aim of this study led the final choice sets during the choice experiment to be as simple as possible. As matter of fact, each eco-friendly attribute was assumed mutually exclusive while other relevant attributes such as geographical indications were excluded. The selected attributes with related levels are reported in Table 2.

Table 1. Socio-demographic characteristics of the sample.

	Sample		Italian population*
	N.	%	%
Total	1,061	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
5001-20000	313	29	30
20001-100000	315	30	30
>= 100000	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 litre)	€3.90; €5.90; €7.90; €9.90; €11.90; €13.90

Attributes and their levels have been combined to create hypothetical products to be presented at participants as "choice sets". In order to avoid excessive fatigue of participants and to optimize the research work, a D-optimal design was performed to select the best subset of all possible combinations of choice sets (Kanninen 2002). This allowed to select only six choice sets among all possible combinations, each including four product alternatives to be presented to all participants. Each choice set has been presented in the form of a choice card with photo-realistic images showing four hypothetical olive oils (option A, B, C, D), as well as the "no-choice" option that allows to avoid constrained choices when none of the proposed alternatives are considered sufficiently attractive to be purchased. An example of choice card is shown in Figure 1. Prior to making their choice, 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 the own preferred brand and packaged in 1 litre glass bottle. So, participants were asked to choose the preferred alternative from each choice set.

Fig. 1 – Example of choice card.

Estimation and willingness-to-pay

In this study, consumers' choices have been modelled using a Random Parameter Logit model (RPL) which is a highly flexible model capable of approximating any Random Utility Model (RUM) by relaxing the assumption of homogenous individual preferences (McFadden and Train 2000). In fact, as highlighted in previous studies (Scarpa and Del Giudice 2004), 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, and, in particular, the utility function of the individual n for the alternative i at given situation t is specified as follows:

$$U_{nit} = \beta' X_{nit} + \varepsilon_{nit}$$

where β' is a vector of random parameters, with known mean and variance, that represents heterogeneity in individual preferences, X_{nit} is the vector of product attributes embedded in the i^{th} alternative, and ε_{nit} is the error term.
Following Train (2009), the probability for the individual n of choosing the alternative i at given situation t is computed as follows:

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

where the distribution $f(.)$ of the random parameters β is specified by the analyst.
Specifically, for the model formulation, we assumed that all parameters have a triangular distribution. In addition, the price (PRICE) was treated as a continuous variable, while the other product attributes were coded as dummy variables. Specifically, for the eco-labelling attribute, five dummy variables were created (ORGANIC, ANCIENT, MOUNTAIN, SUST_WATER_USE, NO_ECOLABEL); the option "NO_ECOLABEL" has been used as reference level. Likewise, for the country-of-origin attribute, two dummies were created (ITALY and EU), keeping EU origin as reference. Finally, a dummy variable (ASC) was also included in the model in order to capture respondents' preferences for the "no-choice" option.
The parameter estimates are interpreted in relative terms and they 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) has been computed through the ratio of the estimate for each attribute and the estimate for the price:

$$WTP_k = -\frac{\beta_k}{\beta_p}$$

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

Results and discussion

Estimation results of the RPL model are shown in Table 3. The model was estimated through the software package NLOGIT 6 with simulated maximum likelihood using Halton draws with 1000 replications. The model is statistically significant (Chi-squared statistic equal to 6375.68 with a p-value much lower than 0.01) and shows a good capability in fitting data (McFadden Pseudo R-squared equal to 0.31).
The price coefficient is negative in sign and statistically significant. As expected, all other characteristics being equal, increasing price is associated to a lower utility, and this implies a lower choice probability. Similarly, the "no-choice" option is negative in sign and statistically significant. Effectively, not choosing any of the four possible olive oils presented in the choice sets decreases the probability that a product alternative is chosen. The country-of-origin indication has a large impact on consumers' choices, and, in particular, a home bias effect is detected considering 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 from EU countries, in line with Del Giudice et al. (2015) findings. Regarding the impact that our selected eco-labels have on consumers' choices, estimates reveal that all of them have a positive and statistically significant effect, even though different in terms of magnitude. This means that the presence of an eco-label on extra-virgin olive oil is associated to higher utility compared to the alternative without any eco-label, and this also imply that when an olive oil shows an eco-label its choice probability increases.

Estimates of the RPL model also provides insights on the heterogeneity of consumers' preferences, and, in particular, it is possible to observe that, for all parameters, standard deviations are statistically significant. This confirms that there is heterogeneity in individual preferences for all attributes, and the relative high magnitude of standard deviations for all parameters also implies that, for each attribute, consumers may have reverse preferences. In particular, country-of-origin indication reported the highest standard deviation of parameter distribution.

A better understanding of the role of each attribute in consumer choice is provided by results of WTP estimations reported in Table 4. The highest values of WTP are observed for organic label (7.1 €/L) and Italian origin (6.1 €/L), both well-known and familiar to consumers. However, results also reveal that consumers are willing to pay a premium for the other tested eco-labels, even though lower compared to that consumers are willing to pay for organic label. In fact, the label "from ancient trees" gains a premium price of 5.8 €/L, the label "sustainable water use" gains a premium price of 4.2 €/L, and the label "mountain product" gains a premium price of 3.9 €/L.

Table 3 – Estimation results of RPL model.

	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Random parameters in utility functions						
ORGANIC	2.68186***	0.315	8.520	0.000	2.065	3.298
SUST_WATER_USE	1.56366***	0.334	4.680	0.000	0.909	2.218
MOUNTAIN	1.47375***	0.386	3.820	0.000	0.717	2.230
ANCIENT	2.17615***	0.357	6.090	0.000	1.476	2.877
ITALY	2.29820***	0.381	6.040	0.000	1.552	3.044
PRICE	-0.37545***	0.061	-6.140	0.000	-0.495	-0.256
Non-random parameters in utility functions						
ASC	-1.41942***	0.098	-14.420	0.000	-1.612	-1.227
Standard deviations of parameter distributions						
ORGANIC	2.86979***	0.310	9.25	0.000	2.261	3.477
SUST_WATER_USE	2.54050***	0.314	8.07	0.000	1.923	3.157
MOUNTAIN	3.64484***	0.310	11.73	0.000	3.035	4.254
ANCIENT	3.23696***	0.278	11.63	0.000	2.691	3.782
ITALY	5.36211***	0.242	22.08	0.000	4.886	5.838
PRICE	0.94693***	0.051	18.45	0.000	0.846	1.047
Log likelihood function		-7056.23				
Chi-squared		6375.68				
Significance level		.00000				
McFadden Pseudo R-squared		0.31				

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Table 4 – Willingness to pay.

WTP	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
ORGANIC	7.14***	1,376	5,190	0,000	4,447	9,839
SUST_WATER_USE	4.16***	0,983	4,240	0,000	2,238	6,091
MOUNTAIN	3.92***	1,156	3,400	0,001	1,660	6,190
ANCIENT	5.79***	1,278	4,540	0,000	3,292	8,300
ITALY	6.12***	1,291	4,740	0,000	3,591	8,651

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Another interesting finding can be detected in the correlation matrix of random parameters (Table 5). It shows that there are significant correlations in the heterogeneity of individual preferences between attributes. In particular, it should be noted that the parameter of the attribute ORGANIC is inversely correlated with the parameter of the attribute ITALY. This means that consumers who express high preference for organic label on extra-virgin olive oil also express low preference for Italian origin and vice versa. In addition, the parameter of the attribute ORGANIC is highly correlated with the parameters of the attributes SUST_WATER_USE and MOUNTAIN, while it is not correlated with the parameter of the attribute ANCIENT. This means that consumers who express high preference for organic label on extra-virgin olive oil also express high preference for the labels "sustainable water use" and "mountain product". Conversely, consumers who express high preference for organic label on extra-virgin olive oil and consumers who express high preference for the label "from ancient trees" seem to be different. Therefore, the label "from ancient trees" seems to be not in competition with organic label and, at the same time, this eco-label gains the highest premium price after that for organic label.

Table 5 – Correlation matrix of random parameters

	ORGANIC	SUST_WATER_USE	MOUNTAIN	ANCIENT	ITALY
ORGANIC	-				
SUST_WATER_USE	5.739***				
MOUNTAIN	4.194***	-2.027			
ANCIENT	1.038	-3.427***	8.928***		
ITALY	-4.154***	-3.762***	0.185	-1.289	-

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Conclusions

In this study, we conducted a choice experiment to investigate consumers' preferences and willingness to pay for different eco-labels on extra-virgin olive oil. Specifically, we tested on Italian market three possible types of eco-labels: i) a label indicating that olive oil has been obtained from ancient trees, ii) a label indicating that olive oil has been produced in mountainous areas, and iii) a label indicating that olive oil has been obtained with a sustainable water use. These eco-labels have been analysed jointly to the well-known organic label and country-of-origin indication affecting consumers' choices for extra-virgin olive oil.

The main result of the study is that, on average, Italian consumers appreciate all these eco-labels on olive oil and they are willing to pay a significant premium price for them even if , organic label is confirmed to be the most preferred eco-label. Currently, the only eco-label used for olive oil is the organic label while olive oil obtained from other types of extensive and more eco-friendly olive groves is mixed to the conventional olive oil without any differentiation and valorisation.

This study also demonstrated that, among the possible eco-labels that can be used to differentiate olive oil obtained from low-input traditional plantations, the label "olive oil obtained from ancient trees" seems to have the greatest probability of success for two reasons: first, it seems to be the eco-label for which consumers are willing to pay the highest premium price after organic label; second, it seem to be not in competition with organic label, which is the most preferred eco-label on olive oil.

Introduction of this eco-label into the marketplace could provide relevant benefits: producers who have the possibility of using this eco-labels could achieve a competitive advantage, consumers could be more aware in choosing their preferred olive oils, and the olive groves with positive externalities could be preserved from the abandonment or the progressive substitution with intensive production systems with higher environmental impact. Obviously, before the introduction of such eco-label, it is necessary to create a specific voluntary scheme that should clearly describe the characteristics of olive groves that can be actually considered as “ancient”.

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