The effect of single and multilabeling on extra virgin olive oil consumer choices: the case of organic and PDO labels.

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The main aim of this study is to assess how much consumers value the presence of the European organic and Protected Designation of Origin (PDO) labels when these are presented in isolation as well as simultaneously on extra virgin olive oil package. A choice experiment has been used and a willingness-to-pay-space model was estimated to analyse the data. Results reveal that consumers positively value both EU quality labels and they are willing to pay a higher premium price for the organic farming than PDO label. Furthermore, the combination of these two labels on package can lead to a decrease in consumer WTP indicating the existence of strong substitution effects between them.

Keywords: multiple labeling; organic label; protected designation of origin (PDO) label; willingness to pay.

1 Introduction

Among the different information available on food products, those of the organic production method and designation of origin are increasingly being used among olive oil products. European Union (EU) has applied a specific rule system in order to better regulate production methods and origin (Conte et al., 2020) in the olive oil sector. Thus, the EU can provide written assurance or certification labels to products that comply with this rule system. EU labels related to organic production method and Protected Designation of Origin (PDO) were introduced to help consumers recognize unobservable characteristics of the product while also to help producers signal their products' quality and achieve a higher sales price.

Several studies have investigated the effect of certifications linked to organic production and geographical origin on consumers' preferences using the olive oil product as product of interest (Aprile et al., 2012; Del Giudice et al., 2015; Menapace et al., 2011; Panico et al., 2014; Pérez y Pérez et al., 2020; Perito et al., 2019; Scarpa & Del Giudice, 2004; Tempesta & Vecchiato, 2019).

The results are mixed regarding the degree of importance attached to each certification by consumers. For example, Aprile et al. (2012), Panico et al. (2014) and Tempesta & Vecchiato (2019) suggest that sufficient knowledge of organic production communicated through a distinctive certification label might lead consumers to pay a price premium for organic extra virgin olive oil. Conversely, Torres-Ruiz et al. (2018) and Yangui et al. (2016) investigated consumer preferences for extra virgin olive oil and report that organic certification is not highly valued among Spanish consumers.

Concerning the PDO certification, there is evidence in the literature that highlights its positive effect on olive oil consumer preferences as well as on purchases (Aprile et al., 2012; Panico et al., 2014; Perito et al., 2019). However, Ballco & Gracia (2020) and Cabrera et al. (2015) indicate that this certification does not affect extra virgin olive oil prices. Various studies regarding the EU denominations of origin conclude that although they have received increasing attention over the years, they have never fully expressed their expected potential as differentiation and protection tools (Del Giudice et al., 2015; Panico et al., 2014).

Even when both certifications are considered of high importance in terms of willingness to pay (WTP) by consumers, literature findings are conflicting regarding the most preferable. Some studies show that consumers are willing to pay comparatively more for extra virgin olive oil bearing the organic certification than the PDO (Menapace et al., 2011; Panico et al., 2014) and others report the opposite (Aprile et al., 2012; Pérez y Pérez et al., 2020). While there is an extensive literature on the impact of organic and PDO certifications on olive oil consumer preferences and demand, under the assumption that they are independent or they address different consumer needs, there is scant literature focusing on their complementarity or substitution relationship.

In this regard, a stated choice experiment survey was designed to assess and compare consumer preferences and WTP for labels pertaining to organic production and designation of origin, certified by the EU, when they are presented separately or simultaneously on extra virgin olive oil package, accounting for consumer heterogeneity. The rest of the paper is structured as follows: in the next section, we describe the experimental design, the data gathering process along with some descriptive information about the sample's characteristics and the methodology used for the analysis. The third section presents the statistical and econometric results, and the final section provides a discussion of the findings and concluding remarks.

2 Materials and methods

2.1 Product and Attributes

Olive oil was chosen as a product of interest since it is considered an important fresh product in terms of supply and demand in Greece, as well as it shows prevalent use of production and origin certifications. Specifically, the survey is undertaken for the "extra virgin" olive oil as it is estimated that 80 per cent of olive oil production in Greece is extra virgin and it is quite essential to the sustainability of the rural economy of Greece (National Bank of Greece, 2015). In terms of demand, olive oil is associated with daily usage in almost all food purposes and 70% of Greeks that consume olive oil, use extra virgin olive oil (Siskos et al., 1995). Finally, the extra virgin olive oil represents a value-added product for which additional labeling information regarding the production method and/or the designation of origin is an important marketing tool.

Three extrinsic attributes were included in the study which were chosen based on results from two in-depth interviews investigating different aspects of EU labeling among Greek olive oil consumers: (i) price, (ii) organic method of production (ORG) certified by the EU, and (iii) protected designation of origin (PDO)[1] certified by the EU. The selected price vector reflected price levels for 1-liter bottle of extra virgin olive oil in Greek supermarkets shortly before the survey was conducted, with the upper bound including a 50% premium. Regarding the latter two attributes, two levels were used in the design. Either there was no label on the bottle or the European logo for each attribute was used. We also considered the interaction between both labels (OPDO) by the inclusion of organic and PDO labels simultaneously on the bottle. Olive oil profiles are characterized by unbalanced levels which is a commonly used method by other related studies (Aprile et al., 2012; Liebe et al., 2019; Van Loo et al., 2014). Other attributes such as nutritional labels, taste, color and packaging were fixed since they were not the objective of this research. Table 1 shows the attributes and levels used in the choice design.

[1] We have chosen PDO over PGI because PDO certification is prevalent among Greek products according to the official European database of agricultural products and foodstuffs, wine, and spirit drinks that are registered and protected across the EU for their geographical indications. Specifically, 69 percent of the certified products in Greece are protected for the designation of origin and in the specific case of olive oil, 63 percent of the certified olive oils has a PDO certification. Furthermore, results from the in-depth interviews revealed that Greek consumers recognize more the PDO certification than the PGI. Literature confirms that Italian olive oil consumers (who reveal similarities in food consumption with Greek consumers due to the fact that olive oil is part of the traditional diet for both countries) are willing to pay more for PDO than PGI label (Aprile et al., 2012; Menapace et al., 2011).

Table 1. Extra virgin olive oil attributes and levels used in the choice design.

Attributes	Levels	Visual Logo
Organic (ORG) label	Present/Absent	
Protected Designation of Origin (PDO) label	Present/Absent	
Price (€ per 1 liter)	€5.5 €7.7 €9.5 €12.5	

2.2 Experimental design

The core section of the survey consisted of a stated choice experiment (SCE) designed to estimate how consumers choose extra virgin olive oil that varied in labeled attributes. The SCE was used to conduct the analysis because of its ability to value multiple attributes simultaneously, be consistent with the random utility theory as well as Lancaster's characteristics theory of value, and mimic real consumer purchase decisions (Lusk & Schroeder, 2004). It has long and widely been employed in different applied fields such as transport, market research, health, environmental and food economics. The choice experiment was hypothetical (i.e., it did not include exchange of actual money or olive oils).

During the experiment, respondents were asked to make a series of choices where they could choose between two unlabeled[2] alternative extra virgin olive oil bottles (1 liter each) that carried different attributes and a no-purchase option in the event that they did not prefer any of the products[3]. Respondents had to select one of the three alternative scenarios in each choice set, based on the premise that they visit a food store for the purpose of buying a bottle of extra virgin olive oil. Each participant answered twelve choice scenarios in total. The twelve choice scenarios followed in random order to avoid order effects. An example of a choice card is shown in Figure 1.

[2] Removing brand influences from the choices, can make respondents focus the tradeoffs upon the attributes' levels.

3 According to Louviere & Street (2000), in order to make the choice experiment more comparable to real food shopping situations, consumers must have the opportunity to decide not to buy any item.

	Alternative A	Alternative B	Alternative C
	  **7.5 €/l**	  **9.5 €/l**	If these were the only options available, I would not buy any
I prefer	○	○	○

Figure 1. Example of a choice set question.

The allocation of attribute levels to alternatives was designed using a sequential Bayesian approach (Scarpa et al., 2007) executed in two steps and derived assuming a multinomial logit probability specification (Bliemer & Rose, 2010). The first stage was a D-optimal design, which was generated following Burgess & Street (2005) and Street & Burgess (2007) and used to collect preliminary data among a limited number of virgin olive oil consumers not selected for the final survey. It resulted in 36 choice tasks arranged in 3 blocks of 12 each with a D-efficiency of 96.7%. The data from this pilot were then used to estimate a multinomial logit model, whose coefficients were used as Bayesian priors to perform the final design. Both the D-optimal design and efficient designs were executed using Ngene software version 1.0 (Choice Metrics 2009).

Prior to the choice questions, respondents were informed about the product attributes that were included in the study (meaning of the two EU quality labels and price). To encourage and motivate respondents to reveal their preferences and minimize any hypothetical bias in the WTP

estimates we used a cheap talk script where we discussed the propensity of respondents to exaggerate stated willingness to pay[4]. The cheap talk script (see Appendix A) was set up similar to one used by Van Loo et al. (2014). In addition to the SCE task, the survey also included questions regarding attitudes and buying habits towards olive oil and socio-demographic characteristics of the respondents.

2.3 Data collection and Sample characteristics

Due to limited budget and human resources we opted to use an online-based survey. The survey was hosted in SurveyMonkey, an on-line survey platform. Since several studies indicate no differences in responses between web and mail surveys (Griffis et al., 2003; Loomis & Paterson, 2018; Lusk & Schroeder, 2004), web surveys are increasingly gaining popularity among researchers due to their ease of use, comparative low cost, automatic data entry and quick completion times (Canavari et al., 2005; Couper, 2000; Evans & Mathur, 2005). In the specific case of choice experiments conducted by mail surveys versus web based surveys, literature also reports that data are very similar and WTP values are possibly the same (Fleming & Bowden, 2008; Olsen, 2009).

Participants were excluded a priori if they were younger than 18 years old. In addition, they were screened for inclusion in the study based on one question. Whether they had purchased and consumed extra virgin olive oil in the previous six months preceding the survey. Only those who answered positively to this question were allowed to access the survey. A total of 318 questionnaires qualified the criterion above, but 46 were incomplete. Thus, the valid sample size consisted of 272 participants.

2.4 Model specification

We assume that a sampled individual ($n = 1,\ldots, N$) faces a choice among i alternatives in each of s choice tasks. The utility associated with each alternative i, as evaluated by each individual n in choice task s, is represented by the following model:

$$U_{nis} = V_{nis} + \varepsilon_{nis} \qquad (1)$$

[4] Since the introduction of "cheap talk" script by (Cummings & Taylor, 1999), several studies have used it as a way to minimize hypothetical bias in online surveys (Carlsson & Kataria, 2008; Tonsor & Shupp, 2011; Van Loo et al., 2011).

where V_{nis} is the systematic component of the utility function determined by the selected attributes and ε_{nis} is the unobserved error term. The key assumption in choice modelling is that each individual will choose the alternative in the choice set which will maximize his/her utility.

Since preference and scale heterogeneity across consumers are expected in this study and realistic WTP values is the goal of this paper, a mixed logit model in WTP space is specified. Following the methods of Train and Weeks (2005) and Scarpa et al. (2008) the utility function is reparametrized through the specification and estimation of the price coefficient distribution and the corresponding vector of the consumer WTP for each label. Therefore, the utility associated with each alternative *i*, as evaluated by each individual *n* in choice task *s* can be represented as follows:

$$U_{nis} = \theta_n \left(-Price_{nis} + \beta_1 ORG_{nis} + \beta_2 PDO_{nis} + \beta_3\, OPDO_{nis} + Nobuy\right) + \varepsilon_{nis} \qquad (2)$$

where θ_n is the random positive scalar representing the price/scale parameter; β_s are the marginal WTP estimates for the various attributes; $Price_{nis}$ is a continuous variable derived from the four price levels determined for the experiment (described in Table 1); ORG, PDO and $OPDO$ are dummy variables taking the value "1" if the corresponding label is present on the bottle of the olive oil, and "0" if it is absent; $Nobuy$ is the alternative-specific constant representing the no-buy choice alternative; and ε_{nis} is the error term that follows a type-one extreme value distribution. The price coefficient is assumed to be random following a log-normal distribution, while the WTP coefficients are assumed to be normally distributed. In the simulation, Halton draws instead of random draws were used because they have been shown to provide more efficient distribution of draws for numerical integration (Bhat, 2003). The econometric model and statistical analysis were estimated with NLogit software (version 6).

3 Results

The results obtained from the mixed logit model in WTP space which relax the assumption of a fixed price coefficient (Scarpa et al., 2008) are reported in Table 2. As mentioned above, the attribute coefficients are to be interpreted as WTP values and the price coefficient has no direct economic interpretation. The psudo-R^2 is used as a goodness-of-fit measure to prove the explanatory power of the model. Table 2 shows a pseudo-R^2 of 0.39 which according to Hensher et al. (2005, p. 338) represents an appropriate model fit for a discrete choice model.

Results show that consumers are found to be willing to pay more for choosing one of the proposed alternative products than for choosing none of them (Nobuy alternative), which is perhaps a foregone conclusion for the extra virgin olive oil, but it is nevertheless confirmed by our model. Also, the WTP for the organic and the PDO European labels are both positive and statistically significant at the 1% level. This suggests that consumers' willingness to pay for extra virgin olive oil increases when one of these two EU certification labels is present on the product. This result is consistent with several empirical application on olive oil (Aprile et al., 2012; Menapace et al., 2011; Panico et al., 2014; Roselli et al., 2018). Specifically, respondents in our survey are willing to pay on average 2.16 €/L more for a bottle of extra virgin olive oil with an organic label certified by the EU in relation to one without this label, and 1.79 €/L more for a bottle of extra virgin olive oil with PDO label certified by the EU in respect to one without this label. Hence, although consumers are willing to pay a premium price for both attributes, organic label is valued higher than PDO. This finding is in line with Menapace et al. (2011) and Panico et al. (2014) who found that the WTP for the organic label is higher than the WTP for the PDO, though differs from Aprile et al. (2012) and Pérez y Pérez et al. (2020) who concluded the opposite.

Table 2. Model estimates.

	Coefficients	Std. Error
Means		
Nobuy	-7.99***	0.22
ORG	2.16***	0.20
PDO	1.79***	0.21
OPDO	-1.33***	0.36
Standard deviations of parameter distributions		
ORG	2.86***	0.18
PDO	2.51***	0.17
OPDO	2.85***	0.28
Scale heterogeneity		
Tau	0.52***	0.03
Goodness of fit measures		
McFadden Pseudo-R^2	0.39	
Log Likelihood	-2184.11	
Akaike information criterion	4386.2	
Participants/Observations	272/3,264	

*Note: *** denotes statistical significance at the 1% level*

The negative value of the WTP estimate for the interaction between organic and PDO labels indicates that the inclusion of both certification labels yields lower WTP than the sum of providing each of them in isolation. Thus, the total WTP for a bottle of extra virgin olive oil bearing both certification labels simultaneously is 2.62 €/L instead of 3.95 €/L. This suggests that either both types of EU labels are partial substitutes because the benefits associated with the organic label are already implied by the PDO label and vice versa, or information overload generates label mistrust and/or reduce the ability to process label information. This is in line with previous research by Pérez y Pérez et al. (2020) on extra virgin olive oil.

Additionally, in the results reported in Table 4 all the estimated standard deviations of the coefficients in the model are generally high and significantly different from zero. Therefore, the hypothesis of preference heterogeneity for all attributes cannot be rejected which means that consumers weigh the attributes differently. To visualize the underlying distribution of WTP across individuals and attributes, two centipede plots are presented along with the 95% comparison intervals (Figures 2 and Figure 3). The plots show how the confidence limits vary from participant to participant. Each vertical line shows the conditional confidence interval for the WTP value for that person and the dot is the midpoint of the interval. The horizontal bar at the center shows the mean of the conditional means which for the organic label is 2.18 €/L and for the PDO label is 1.79 €/L (premium price). The upper and lower horizontal bars show the unconditional population range of variation which is estimated to be about -3.6 €/L to 8 €/L for the organic label and about -3 €/L to 6.6 €/L for the PDO label. Both plots highlight that there is much variation across respondents' preferences.

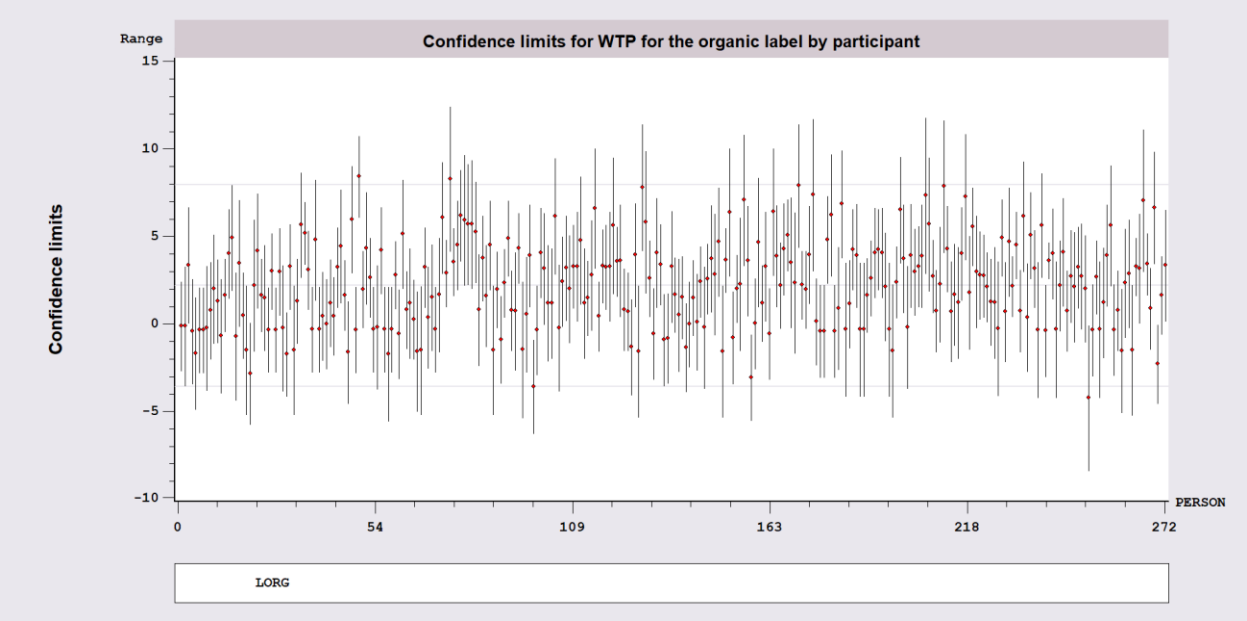

Figure 2. Centipede plot of estimated WTP for the organic label and 95% comparison intervals

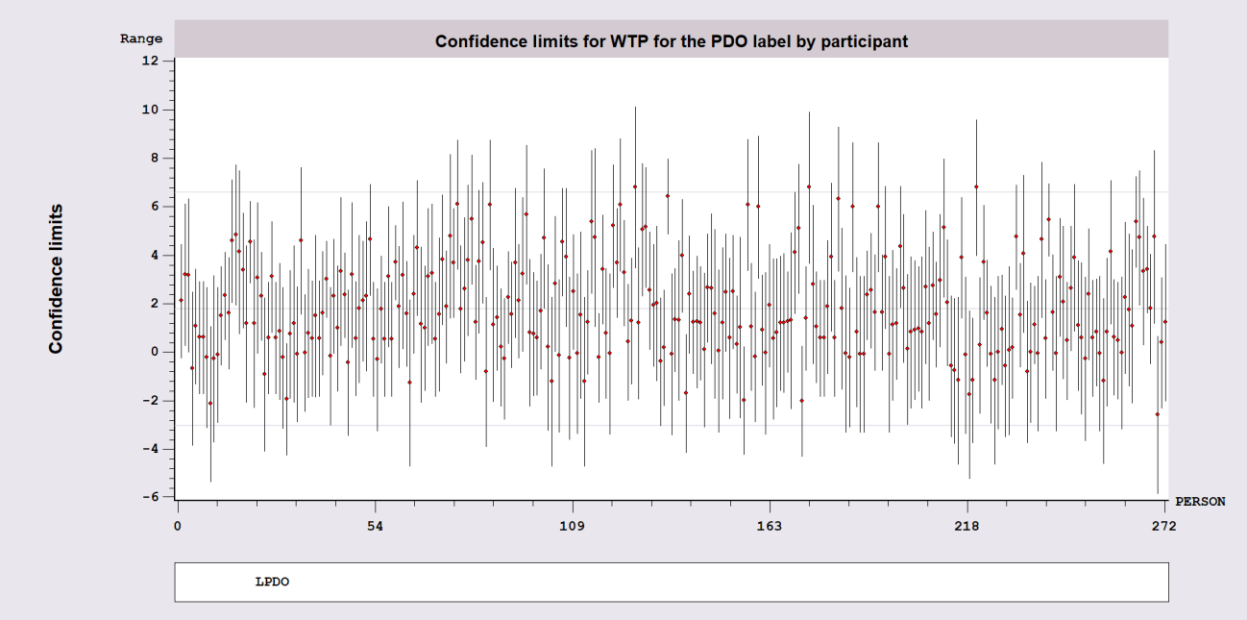

Figure 3. Centipede plot of estimated WTP for the PDO label and 95% comparison intervals

4 Conclusions

In this study, we used a stated preference valuation methodology to address two research questions. Firstly, would the market reward extra virgin olive oil producers through an increased WTP for a 1-litre bottle bearing an EU organic or a PDO certification label and if yes, for which label the WTP is comparably higher? Second, what happens to the WTP when both certification labels are presented simultaneously on the extra virgin olive oil bottle.

Results confirm positive willingness to pay for both organic and PDO labels certified by the EU, considering them to be an element of product quality. Furthermore, consistent with previous research our respondents are willing to pay on average a higher premium price for the organic farming attribute (€2.16) than the PDO attribute (€1.79). It thus seems that the two labels satisfy the need for quality on extra virgin olive oil however, consumers find information related to environmental impact (e.g., EU organic label) more attractive than information related to rural development (e.g., EU PDO certification).

Another significant finding is that WTP decreases when these labels are present simultaneously on extra virgin olive oil package for most respondents. Specifically, the joint presence of EU organic and PDO labels leads to a total WTP that is lower than the sum of WTP for each label taken in isolation. This suggests that either both types of EU labels are partial substitutes because the benefits associated with the organic label are already implied by the PDO label and vice versa, or information overload generates mistrust and confusion in processing the label information.

This study has some limitations that must be considered. Given the hypothetical nature of the experimental design it would be advisable to use real money or actual products to test the robustness of our findings (although all the necessary steps described in the literature to eliminate hypothetical bias have been taken). The sample used is not sufficiently representative since the greater proportion consists of people with university and master studies. Although this is common in this kind of study because more educated people tend to respond to questionnaires, it might have led to an overestimate of the WTP values. Generalizability of our results to other countries and product categories should also be avoided since the overlapping relationship of organic and PDO characteristics might not hold for non-producer countries and food products not so closely related to the unique country's climate and geography.

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