CONSUMER PREFERENCES FOR EXTRA VIRGIN OLIVE OIL WITH PROTECTED DESIGNATION OF ORIGIN (PDO)

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ABSTRACT: Olive oil is one of the main components of the Mediterranean diet[1], considered worldwide as one of the healthiest food diets. The consumption of olive oil provides important health benefits because it has been clinically proven that decreases the risk of heart attack and stroke (Kolata, 2013), reduces cholesterol, and prevents cancer mortality (Lopez-Miranda *et al.,* 2010). As result, the consumption of olive oil has increased not only in producing countries (Mediterranean) but also in non-producing countries. However, the trends in consumption differed between them because in non-producing countries, the consumption has enormously increase since low levels, while in Mediterranean countries, consumption was relatively high but it has been a shift towards the consumption of higher quality olive oils. In particular, extra virgin olive oil and olive oil with some quality differentiations have faced an increase of consumption in Mediterranean countries such as Spain. One of the quality differentiations that have received increasing attention by consumers and producers is the Protected Designation of Origin (PDO) indication. Several empirical papers on olive oil consumption focused on analyzing the consumption of extra virgin olive oil (EVOO) and, in particular, extra virgin olive oil with PDO (Fotopoulus and Kristalis, 2001; Van der Lans *et al.,* 2001; Scarpa and Del Giudice, 2004; Espejel *et al.,* 2008; Menapace *et al.,* 2011; Erraach *et al.,* 2014; Yangui *et al.,* 2014). They found that apart from the price that it is an important attribute for consumers, the origin of the olive oil, mainly, the Protected Designation of Origin is of great importance. This paper analyses consumers' preferences for extra virgin olive oil in one Spanish region and assesses their willingness to pay (WTP) using a real choice experiment to mitigate possible hypothetical bias. In particular, preferences for two origin of production attributes are evaluated the geographical origin and the PDO indication. Error Component Random Parameter Logit model (EC RPL) was used to estimate the effect of the attributes on consumers' utility and derive their WTP.

KEY WORDS: *Extra virgin olive oil, choice experiment, utility, Aragon – Spain.*

[1] The principal aspects of this diet include high olive oil consumption, high consumption of pulses, fruits and vegetables as well as moderate consumption of dairy products, moderate to high consumption of fish and low consumption of meat products.

MATERIALS AND METHODS

Choice experiment

To achieve the objective, a choice experiment method was used because of its ability to value multiple attributes simultaneously, it is the consistent with the random utility theory (RUM), and the task ask to participants is similar to consumers purchase decisions (Lusk and Schroeder, 2004). The choice experiment asked consumers to choose between alternative products that contain a number of attributes with different levels based on the Lancaster maximization utility model (Lancaster, 1966) with the subject selecting the alternative which better reflects his/her preferences. To avoid hypothetical bias, a non-hypothetical choice experiment was implemented including economic incentives in the design as suggested by Alfnes *et al.* (2006). Then, participants received 15 euros to ensure that they behave as in a real purchase, and put them into the real purchase decision. At the end of the experiment, one of the choice tasks was randomly selected as binding and participants had to buy the olive oil they have chosen in this binding situation at the corresponding price.

The first step to implement a choice experiment is to select the specific product to be analyzed and attributes and the levels to be used. This selection was based on information on the extra virgin olive oil sell in the market (in different supermarkets), findings in the literature review on consumers and olive oil and from results for an online pilot survey. First, all extra virgin olive oils sold in several supermarkets[2] were inspected and information on price, bottle size, type of bottled, presence of PDO and geographical origin was gathered. Based on this information, we selected one liter bottle of extra virgin olive oil. Second, results of the literature review and the online pilot survey indicated that the three most important olive oil attributes for consumers were geographic origin of production, price, and the PDO indication. Then, the three attributes included in the choice design were price (to allow also the calculation of the WTP), the geographic origin of the EVOO and whether the EVOO is produced under a PDO indication. To establish the price levels, information on the EVOO sold in those supermarkets was used and three price levels were set: 3€/L, 5€/L and 8€/L, taking into account that the average price of one bottle was around 4.50€ with a minimum of 3 and a maximum of 8. For the geographic origin of production also three levels were established: The EVOO was produced in the Bajo Aragón (BAJOARAGON), in the rest of Aragon (ARAGON), or in the rest of Spain (reference category). Finally, the PDO indication had two levels, indicating the presence (PDO) or absent of this characteristic (reference category).

For these attributes and their levels, a full factorial design would contain a large number of possible combinations which would be excessive in administering cost and permit confusion of respondents. Thus, to reduce the number of choice sets to a more effective manageable size, a subset was generated using efficient designs, more specifically the Bayesian efficient design with the Random Parameter Logit (RPL) model with the NGENE software. From the Bayesian design, 12 choice sets were created which still remain tiring for respondents. For this reason they were divided into three blocks. Thus, each respondent was asked to make choices for four choice sets. Each choice set included three alternatives: two designed alternatives consisting of different products and a non-buy scenario.

[2] In particular, 8 supermarkets in Zaragoza were analyzed: Mercadona, Carrefour, El Corte Ingles, Dia, El Arbol, Eroski, Simply and Alcampo for a period of 2 weeks during October 2014.

Implementation of the experiment: data collection

A total number of 216 consumers participated in the experiment in working sessions of around 10-12 people. Respondents were stratified by age, gender and education level. The experiment consisted of two different tasks: choice experiment and a brief questionnaire on socio-demographic consumers' characteristics (i.e. gender, family size and composition, age, educational level and income range) and EVOO purchase and consumption habits. Table 1 shows the characteristics of the final sample of respondents.

Table 1. Descriptive analysis of the sample and socio-demographic characteristics.

	Sample	Population
Sample Size	216	-
Gender		
Male	31.75%	50%
Female	68.25%	50%
Age		
Age of responders (average, standard deviation)	47.26 (16.22)	-
From 18 to 34 years	23.08%	24%
From 35 to 44 years	18.08%	20%
From 45 to 54 years	19.07%	18%
More than 55 years	37.06%	38%
Education Level		
Primary studies	18.35%	17%
Secondary studies	44.50%	50%
University studies	37.16%	33%

Specification and estimation

In the empirical application and for the selected attributes and levels, the utility function specified for individual *n*, alternative *j* at choice situation *t*, is defined as follows:

$$U_{njt}=\alpha+\beta_1 PRICE_{njt}+\beta_2 BAJOARAGON_{njt}+\beta_3 ARAGON+\beta_4 PDO+\varepsilon_{njt} \quad (1)$$

Where *n* is the number of respondents, *j* which represents the available choices of choice sets (alternative A, B and the non-buying option) and *t* the number of choice sets. The constant α represents the alternative specific constant coded as a dummy variable that takes the value of 1 for the non-buying option and the value 0 otherwise. It is expected that the constant α gets a negative value and significant, indicating that consumers obtain a lower level of utility when they select the non-buying option than the rest of two alternatives (A and B). The price is defined by the price levels in the design (3€ – 5€ and 8€). The other three variables (BAJOARAGON, ARAGON and PDO) are defined as dummy. Instead of assuming homogenous preferences, heterogeneity is allowed and the Error Component Random Parameters Logit model (RPL) with correlated errors was estimated using the NLOGIT 5.0.

RESULTS AND DISCUSSIONS

Equation (1) was estimated assuming that price is a fixed coefficient and that the coefficients for the three dummy variables (BAJOARAGON, ARAGON and PDO) are random following a normal distribution. Estimated parameters for the RPL model and WTP are presented in table 2.

Table 2. Estimated parameters of the EC RPL model with correlated errors.

Attribute Level	Estimation	Std Err	T-ratio (z)
Random parameters in utility functions			
Bajo Aragon	1.14207***	0.24726	4.62
Aragon	0.61716**	0.24376	2.53
DOP	1.54745***	0.21372	7.24
Nonrandom parameters in utility functions			
ASC	3.10448***	0.43267	7.18
Price	-0.77922***	0.06901	-11.29
Standard deviations of parameters distribution			
Ns Bajo Aragon	1.00798**	0.27084	3.72
Ns Aragon	0.91438***	0.28334	3.23
NsDOP	1.46580***	0.21275	6.89
WTP	Estimation	Std Err	T-ratio (z)
Bajo Aragon	1.46565***	0.36094	4.06
Aragon	0.79202**	0.33750	2.35
DOP	1.98588***	0.27834	7.13

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

All the estimated parameters and WTP are statistically significant at the 5% significance level and positive, except for the price that as expected negatively influence the utility. Then, we can conclude that consumers positively value the BAJOARAGON and ARAGON origin of the oil and the PDO indication in relation to the rest of Spain origin and the absence of PDO. Moreover, consumers' preferences are indeed heterogeneous because the standard deviations of estimated parameters are statistically different from zero. WTP estimates indicate that consumers' valuation for the DPO is higher followed by the BAJOARAGON origin and the ARAGON origin. In particular, consumers are willing to pay an extra premium of 1.98€ for a bottle of EVOO with PDO respect to one without this indication, 1.46€ for an EVOO that comes from Bajo Aragon and 0.79€ for an EVOO that comes from the rest of Aragon in relation to an EVOO from the rest of Spain.

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