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Do consumers care about European food labels? An empirical evaluation using best-worst method

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Received 25 November 2016
Revised 24 May 2017
Accepted 25 May 2017

Abstract

Purpose – The purpose of this paper is to investigate Spanish consumer preferences for several food-labelling schemes on semi-cured, pasteurised sheep milk cheese. In particular, the authors used three labels regulated by the European Union regulation (European organic logo, protected denomination of origin (PDO) and nutritional fat content), and the remaining four have been introduced to the European food market by private initiatives (local, carbon footprint, food miles and animal welfare).

Design/methodology/approach – A Best-Worst Discrete Choice approach was applied in Spain during Fall 2011 by administrating a survey to 549 consumers.

Findings – The results suggest that the most valued labels are the PDO, followed by the organic logo and the nutritional panel. The least valued are food-miles labelling and carbon foodprint labels, while local-origin labels and animal welfare are in the middle position.

Originality/value – This study is the first to value consumer preferences for cheese products bearing several public and private European food-labelling schemes since literature on consumer preferences for food labels has only dealt with a comparison of a few (two or at most three) food-labelling schemes. In addition, the added value of this paper is also the use of the BWC approach that has the advantage of providing the best way to discriminate the degree of importance given by respondents to each food labels by overcoming the problem of bias caused by differences in the use of rating scales.

Keywords Food labels, Preferences, Best-worst approach

Paper type Research paper

1. Introduction

Generally, lack of information about the nutritional content, origin and method of production of food products represents one of the greatest concerns of European consumers when shopping (Grunert, 2006). To illustrate this, demand for nutritional information could be linked to the high level of obesity around the world, leading to the coining of the now popular term "obesity epidemic". In particular, obesity contributes to an increased risk of Q1 cardiovascular disease, hypertension and type 2 diabetes, which represent some of the major causes of death, accounting for 75 per cent of deaths in the world by 2020 (WHO, 2006). Therefore, following a healthy diet by limiting salt consumption and saturated-fat intake is considered some of the main determinants to prevent the obesity epidemic and its related non-communicable diseases (Popkin, 2003). In addition, standardisation owing to globalisation, the increase in greenhouse gas emissions, as well as food scandals have contributed to an intensified search for quality food attributes (e.g. protected designation of origin (PDO)), sustainable attributes (e.g. local, organic, food miles) and method of production (e.g. animal-welfare standards), perceived by individuals as being higher quality, healthier and fairer socially and economically (de-Magistris and Gracia, 2016a).

In this context, to guarantee that consumers have access to complete information on the content, origin and composition of products, as well as to protect their health, the European

This study has been funded by the EU Marie Curie Project, FOODLABELS_PIOF-GA-2009-253323.

0007-070X
DOI 10.1108/BFJ-11-2016-0562

Union has a significant amount of legislation, laying down rules on foodstuff labelling schemes. Examples of these regulations are EEC No. 2091/92 on organic production EEC No. 2081/91 on PDO, and EEC Regulation EEC No. 194/2006, on the provision of nutritional food information.

However, areas not covered by European legislation have been tackled via more or less coordinated private initiatives. New types of private labelling schemes have been proliferating in the food market thanks to modern processors and retailers, who have created and adopted private standards in order to establish themselves as the main market standard, and which could work better than, or even make public initiatives redundant. For example, the industry has developed private and voluntary labels such as carbon footprint labels, indicating the total carbon dioxide emission created by the manufacturing, transporting, or disposing of a product, and food-miles labels identifying the number of miles that a product has travelled from its place of production to the place of consumption. These labels provide information to consumers about the climate and environmental impact of the food products they eat. Finally, the provision of animal welfare practices beyond the legal minimum required by current regulations is normally left to private initiatives, even though the EU has been developing animal-welfare legislation comprising different regulations at the farm, transport and slaughter stages of the supply chain.

In the current literature, there are several studies focussed on consumers preferences towards public and private labels (Scarpa and Del Giudice, 2004; Olesen *et al.*, 2010; Pouta *et al.*, 2010; Andersen, 2011; Gracia *et al.*, 2014; Aprile *et al.*, 2012; Resano *et al.*, 2012; Øvrum *et al.*, 2012; Koistinen *et al.*, 2013; Schröck, 2014; Van Loo *et al.*, 2014; de-Magistris and Gracia, 2014; Denver and Jensen, 2014; de-Magistris and Lopez-Galán, 2016; de-Magistris and Gracia, 2016a, b; Gracia and de-Magistris, 2016; Rimpeekool *et al.*, 2017; Kumar and Kapoor, 2017; Lin *et al.*, 2017). In general, these studies reported that public labels are more valued than private labels. In particular, within public labelling schemes, PDO labels are more valued than organic labelling and nutritional claims are more valued when compared to organic labelling. In addition, carbon footprint and food-mile labelling are the least valued. Finally, most studies also pointed out those preferences for food-labelling schemes are heterogeneous across consumers (among others Rimpeekool *et al.*, 2017; Kumar and Kapoor, 2017; Lin *et al.*, 2017). For example, Platania and Privitera (2006), Vecchio and Annunziata (2015) and de-Magistris and Gracia (2016b) reported that gender was positively associated with the likelihood of using organic or typical food products. In addition, other authors like Cicia *et al.* (2002), de-Magistris and Gracia (2009, 2012, 2016b), Honkanen *et al.* (2006), Loureiro and Hine (2002), Radman (2005), Tarkiainen and Sundqvist (2005), Thøgersen (2007) and Zepeda and Li (2007) showed that the main determinants of positive valuation of organic food products were the education, lifestyle and environmental attitudes towards organic products.

In addition, Govindasamy and Italia (1999), Guthrie *et al.* (1995), Kim *et al.* (2001a, b) and McLean-Meyinsse (2001), Rimpeekool *et al.* (2017) reported that consumers with a higher education level used nutritional labels more often because they were able to process the information included in the label better Finally, while women used nutritional labels more than men, older individuals preferred to buy products with a reduction of the fat content (Guthrie *et al.*, 1995; Wang *et al.*, 1995; Shine *et al.*, 1997; Neuhouser *et al.*, 1999; Kim *et al.*, 2001a; McLean-Meyinsse, 2001; Cowburn and Stockley, 2005; Godwin *et al.*, 2006; Bates *et al.*, 2009; de-Magistris *et al.*, 2009, 2010; Baglioni *et al.*, 2012; Kumar and Kapoor, 2017).

In the context of multiple food-labelling schemes, the objective of this study is to contribute to the debate on consumers' preferences for food labelling, by assessing the most preferred and the least preferred food label, using seven European food labels carried by semi-cured cheese products. In particular, we are interested in investigating the extent to which Spanish consumers valued these food labels, where three labels are regulated by the European Union regulation (European organic logo, PDO and nutritional fat content), and the remaining four have been introduced to the European food market by private initiatives (local, carbon footprint, food miles and animal welfare). Moreover, given the increasing complexity of consumer preferences for different food-labelling schemes, we also investigate heterogeneity in preferences, based on the consumer's socio-demographic and personal characteristics.

We undertake this study using data from a survey conducted in Spain among 540 cheese consumers, where a best-worst choice (BWC) task was used to measure consumer preferences. The current study presents several novelties. First, to our knowledge, our study is the first to value consumer preferences for cheese products bearing several public and private European food-labelling schemes. Generally, although the literature on consumer preferences for food labels is large it has only dealt with a comparison of a few (two or at most three) food-labelling schemes. For example, Scarpa and Del Giudice (2004), Aprile *et al.* (2012) and Schröck (2014) compared consumer preferences for only two labels (organic and PDO), while Øvrum *et al.* (2012) compared PDO and low saturated-fat content. Likewise, in Gracia and de-Magistris (2016) several food labels were analysed, but without any association with a real food product. In addition, the added value of this paper is also the use of the BWC approach. Most studies assessed consumer preferences using a rating scale and/or the hypothetical discrete choice experiment approach (DCE). However, in this study the use of BWC task has the advantage of providing the best way to discriminate the degree of importance given by respondents to each item, by overcoming the problem of bias caused by differences in the use of rating scales (Finn and Louviere, 1992; Goodman, 2009). In fact, the BWC answers present less variability than ranking alternatives since individuals are able to identify extreme options. This has a direct effect on diminishing confidence internally, thus parameters become more accurate and it is possible to make more precise inferences about consumer preferences. Hence, the BWC approach is very useful for measuring overall preferences, as well as the degree of preference heterogeneity across individuals.

2. Material and methods

2.1 Data gathering and questionnaire

Data were collected from a survey conducted in Zaragoza, in Spain during the Autumn of 2011. Prior to the main survey, this questionnaire was validated using a pilot survey of 20 consumers to test for understanding and interview length. The technique chosen for framing the sample was probabilistic proportional sampling, stratified by age and sex and, consumers were selected randomly across the city A total sample of 549 individuals was collected.

Target respondents were food shoppers, and interviews were carried out face to face. The questionnaire contained questions about socio-demographic characteristics (i.e. gender, age, education and income), health-related lifestyles, environmental and ethical beliefs, and the BWC task. Specifically, seven choice sets with different combinations of food labels were included. Some importance of the validated scale Lindeman and Vaänänen (2000) were used to measure environmental and ethical beliefs. Respondents were asked their level of agreement or disagreement with different sentences related to food-label information. Summary statistics for the socio-demographic and economic characteristics of the sample are presented in Table I. About half the respondents were female (53 per cent) living in households of three members on average. The average age in Zaragoza is 47 years, nearly 18 per cent of the sample belonged to high-income groups and 42 per cent of the subjects had a university degree.

2.2 BWC method

The BWC methodology was introduced by Finn and Louviere (1992) and formalised more recently by Marley and Louviere (2005). Generally, the BWC consists of a task where respondents are asked to choose the most preferred (or important) and the least preferred (important) items from a series of choice sets (or named also best-worst questions) that contain a combination of the items Laureiro and Dominguez Arcos (2012). In our case, the items are the food labels attributes.

Table I.
Sample characteristics (percentage) and definition of variables

Variable definition	Sample
Gender	
Male	47.0
Female	53.0
Age	
18-35 years	27.8
35-54 years	38.2
55-64 years	14.9
Over 64 years	19.1
Education	
Primary School	20.0
High School	37.7
University	42.0
Average household monthly net income	
Between 900 and 1,500 euros	28.7
Between 1,501 and 3,500 euros	53.5
More than 3,500 euros	17.8

As showed in Table AI, the experimental design in this study consisted of seven food labels present in the European market: EU organic logo; designation of origin (PDO); nutritional fact panel; local origin; carbon footprint; food-miles indicator; and improved animal-welfare label. These were shown and explained to respondents before the choice task. Moreover, semi-cured cheese was selected as the carrier product for the labels. A cheese product was chosen because of its importance in Spanish consumption: annual per capita cheese consumption is 9.3 kg, with an associated expenditure of 60 euros per year, which represents 30 per cent of the total per capita expenditure on dairy products (Mercasa, 2014).

The total number of choice sets in the experiment was designed a 7 and "Sawtooth MaxDiff Designer" software was employed to carry out simulations with different combinations of the food labels to obtain the best experimental design properties. An example of one of the best-worst questions used in our study is presented in Table II. The respondent was asked to tick the "best" option and the "worst" option when shopping for cheese with different food labels.

2.3 Econometric analysis

Best-worst choice experiment (BWCE) is routed on the Random Utility Theory of Thurstone's (1927). This theory suppose that one person (*q*) has a determined utility with an alternative (*i*) and this utility can be separated in a systematic component (V_{iq}), that can be observed and measured by the researcher, and the random component (ε_{iq}), that captures the measurement errors of the model is shown in the following equation:

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

Table II.
Example of BW choice set as presented to respondents

Most important		Least important
☐	Carbon footprint	☐
☐	Organic	☐
☐	Denomination of origin	☐

Additive functions consider that total utility of the systematic term is influenced by all products' characteristics. These influences are captured by the β's of the following equation, where the total utility of alternative i is the sum of the partial utility from each attribute-level:

$$V_{iq} = \sum_{k=1}^{K} \beta_{ik} X_{ikq} \tag{2}$$

Finn and Louviere (1992) presented the first publication dealing with Best-Worst method at beginning of 1990s, nevertheless the formal statistical and measurement properties were presented by Marley and Louviere (2005). Basically, in a BWCEs, respondents have to state what are the best (the most preferable or important) and the worst (the least or less important) options in a choice set.

Formally, BWCE in this study assumes that subject (q) identifies and calculates the difference in utility for every pair of ($U_{q,j}$–$U_{q,k}$) available food labels in the choice set and select that pair that maximise utility difference between food labels ($U_{q,j}$–$U_{q,k}$). Note that, besides to maximise the utility difference, respondents are also stating what food label is the best and the worst in the following equation:

$$Y_{q,jk} = U_{q,j} - U_{q,k} + \varepsilon_{q,jk} \text{ for } j,k = 1, \ldots, n \text{ and } j \neq k \tag{3}$$

Hence, when individuals are asked to answer best-worst questions, they choice those two food labels that maximise their difference on an underlying scale of importance. If a choice set has J food labels, then there are J (J–1)–1 possible best-worst combinations of food labels that an individual could choice. The specific pair of food labels chosen by the individual as best and worst, then, represents a choice out of all J (J–1)–1 possible pair that maximises the differences in importance.

In accordance with Lusk and Briggeman (2009), λ_j represents the location of value j on Q2 the underlying scale of importance, and let the latent unobserved level of importance for individual i be given $I_{ij} = \lambda_j + \varepsilon_{ij}$, where ε_{ij} is a random error tem.

The probability that respondent choices a food label j and another food label k, as the best and worst, respectively, out of a choice set with J items, is the probability that the difference in I_{ij} and I_{ik} is greater than all other J (J–1)–1 possible differences in the choice set. If the ε_{ij} are independent and identically distributed across j food labels and q individuals with extreme value type I (EVI) distribution, then the probability takes the multinomial logit (MNL) form.

The probability of consumer q choosing best j and k chosen worst is given:

$$\text{Prob}\{q \text{ is chosen}\} = \frac{\exp(\lambda_j - \lambda_k)}{\sum_{l=1}^{J} \sum_{m=1}^{J} \exp(\lambda_l - \lambda_m) - J - 1} \tag{4}$$

The parameters λ_j are estimated by maximinization of the log-likelihood function based on the probability in Equation (4). The dependent variable of choice takes the value of 1 for the pair of food labels chosen by respondents as best and worst, and 0 for the remaining J (J–1)–1 pairs of food labels in the choice set that were not chosen as best and worst. The estimated λ_j represents the importance of food label j relative to that food label that was normalised to zero (Lusk and Briggeman, 2009).

The MNL model assumes preference homogeneity in the sample, is to say all individuals in the sample place the same level of importance on each externality, implying that all coefficients of the utility expression in Equation (4) are the same across individuals. In contrast, in the Latent Class Model (LCM) model, consumers are assumed to belong to different segments, each of which is characterised by unique class-specific utility parameters.

In other words, within each segment, consumer preferences are homogeneous but preferences vary between segments, allowing for a more in-depth understanding of heterogeneity (Hynes *et al.*, 2008). Thus, for the given segment membership, the choice probability that individual q, conditional on belonging to class s ($s = 1, \ldots, S$), chooses food labels j and k as the most and the least important food labels from a particular set J, is represented as:

$$P_{q,jk|s} = \prod_{t=1}^{T} P_{q,jk,t|s} \tag{5}$$

where $P_{q,jk|s}$ is the allocation of individual q to the s class (probability of class s) and $P_{q,jk|s}$ is the choice probability that individual q, conditional to belonging to class s ($s = 1,\ldots,S$), selects the attribute i and the attribute k as the most and the least important attributes, respectively, out of a choice set with J food labels, on a particular choice occasion t (Greene and Hensher, 2003).

2.4 Preference heterogeneity

Estimated parameters for the LCM for each of the participants were then utilised to segment consumers. The obtained segments were characterised by the consumer's personal characteristics, beliefs, food-related lifestyles and environmental and ethical beliefs. This characterisation was done using a χ^2.

3. Results

3.1 Descriptive analysis

The first step in our descriptive analysis was to calculate the number of times each food label was chosen as the most (B) and least (W) important by Spanish consumers. The best-worst score for each attribute and each respondent was calculated.

The results are shown in Table III. It is noted that Spanish consumers consider the denomination of origin (PDO) the most important attribute, followed by the nutritional panel (NUTRI) and the organic logo (ORGANIC). Similarly, animal welfare (WELFARE) and locally produced (LOCAL) labels present negative values and were very close to zero. This finding implies that Spanish consumers are indifferent towards them. Finally, food-miles (NMILES) and carbon footprint labels (CARBON) show negative signs, with values less than 0. This result means that consumers value carbon footprint the least among food labels, followed by those for food miles.

3.2 Consumers heterogeneity from LCM

In order to take into consideration heterogeneity across individuals towards food labels, different Latent Class (LC) models were estimated. Moreover, to select the number of segments to be considered in LC modelling, different criteria were calculated. As shown

Table III. Preference for food labels by Spanish consumers ranked by B-W score

	Total best	Total worst	B-W score
Organic	432	165	1.483
PDO	443	147	1.644
Nutri	435	164	1.505
Carbon	80	477	−2.205
Local	319	362	−0.238
Miles	157	460	−1.683
Welfare	238	258	−0.11

in Table IV, the minimum Akaike Information Criterion (AIC), the modified Akaike Information Criterion (AIC3) and the minimum Bayesian Information Criterion (BIC) were calculated for two, three, and four LC specifications, but we found that they were constantly increasing or decreasing. We noticed that when considering three classes, the value of the estimated parameters started to deteriorate, owing to larger standard error, which is considered an indication to stop looking for more classes (Louviere *et al.*, 2000). In the model with three classes, we noticed that some food-label attributes were not statistically different from zero. Finally, we calculated the negentropy statistic following Ramaswamy *et al.* (1993) to measure the separation of segments. This statistic is similar to the R^2 statistic in that the model is said to "better" identify the segments, the closer the value is to unity. A negentropy value of 0.8 or higher indicates that the segments are well separated. Based on the negentropy values (0.83, 0.35 and 0.30 for the two, three and four segments models, respectively) we selected the two-segment model. The results for the LC model with two segments are presented in Table IV, and the parameter estimates for the one-segment model are included for comparison.

Results for the one-segment and two-segment models are presented in Table V. In all models the carbon footprint label is set as a reference. Looking at the one-segment model, we see that all estimated parameters are statistically different from zero. Consumers considered the designation of origin (PDO) the most important label, followed by the nutritional fact panel and the organic label. The local and animal-welfare labels were next in terms of preference, and food miles presented an estimate coefficient close to zero, implying that consumers did not express a preference for this label. Since the carbon footprint label is the reference attribute, however, which has a negative sign, this means that this label is the least important, and it is statistically significant at 5 per cent. On the other hand, results from the one-segment model are not the best representation of consumer behaviour, as the LC model with two classes was found to have better statistical properties.

Number of segments	Number of parameters (p)	Log-likelihood (LL)	AIC	AIC3	BIC	Negentropy statistic
1	6	−5,627.46	11,266.92	11,272.92	5,635.657	
2	13	−5,432.29	10,890.58	10,903.58	5,450.051	0.83
3	20	−5,381.57	10,803.14	10,823.14	5,408.894	0.35
4	27	−5,327.57	10,709.14	10,736.14	5,364.457	0.30

Notes: Log-likelihood evaluated at zero is −6,767.47. T, Number of choices. AIC (Akaike Information Criterion) calculated using −2(LL − p); AIC3 (Bozdogan Akaike Information Criterion) calculated using −2LL + 3p; BIC (Bayesian Information Criterion) calculated using −2(LL − (p/2)ln(T))

Table IV. Statistics for determining optimal number of consumer segments

	One-segment model		Latent classes: Segment 1		Latent classes: Segment 2	
Variable	Coef.	*z*-Ratio	Coef.	*z*-Ratio	Coef.	*z*-Ratio
Organic	1.447	28.00	2.056	20.97	0.926	9.44
PDO	1.657	31.2	2.87	22.31	0.476	3.73
Nutri	1.628	30.87	2.639	20.79	0.635	6.01
Local	0.862	17.74	1.251	14.38	0.502	5.30
Miles	0.332	6.12	0.649	6.96	0.013	0.14
Welfare	0.828	17.99	1.022	12.37	0.735	7.93
Class probability (%)			65		35	

Table V. Parameter estimates: latent class choice model with two segments

The two-class LC model identified a first segment that included 65 per cent of respondents who considered the designation of origin the most important label, followed by the nutritional fact panel and the organic label. The second segment consists of 35 per cent of consumers. Contrary to the first segment, consumers consider the organic label most important, followed by animal welfare and the nutritional panel. For this segment, the food-miles label was not significantly statistically different from zero at the 5 per cent significance level. This last result suggests that Spanish consumers are indifferent towards this label because they do not perceive it as either best or worst.

Consumers in the second segment value the labels that provide information on process of production process (organic and animal welfare) and health characteristics (nutritional panel) more highly. On the other hand, the least valued labels were those related to the geographic origin of production (local and regional DOP).

Finally, to profile the two consumer segments, we conducted a χ^2 or analysis of the variance tests for some consumer socio-demographic characteristics and lifestyles. The characteristics found to differ statistically between segments are included in Table III.

From the consumer socio-demographic characteristics only age and income were found to be statistically different between clusters. Segment 1 consists of older consumers and Segment 2 consists of better-off consumers. Some health-related lifestyles and environmental beliefs were also statistically different between segments: while Segment 1 showed healthier lifestyles than Segment 2, the latter presented more environmental concerns (Table VI).

4. Discussion

The results from this study indicated that consumers value the different analysed food labels positively, but they value the public labels more highly than the private ones, since the most valued labels were the designation of origin followed by the organic logo and the nutritional panel. Food-miles labelling and carbon footprint labels were the least preferred, occupying the last positions, and the local-origin and animal-welfare labels were in the middle position. These results are in accordance with the existent literature (de-Magistris and Gracia, 2016a, b; de-Magistris and Gracia, 2014; Aprile *et al.*, 2012; Gracia *et al.*, 2014; Scarpa and Del Giudice, 2004), which reported that consumers valued PDO certification more than organic, local or other private labels. On the other hand, our results are also in accordance with Cavaliere *et al.* (2015) and Schuldt and Hannahn (2013), who reported that consumers preferred products with hedonic labels (e.g. PDO label) in comparison to products bearing health labels (e.g. nutritional claims and organic). Moreover, our study also

	Segment C1	Segment C2
Segment size	65%	35%
Older	67%	33%
High income	32.9%	67.1%
*Health-related lifestyles***		
Health: "I try to avoid snacking"	4.01	3.80
Health: "I try to follow a healthy diet"	4.12	3.92
*Environmental concerns***		
Food products would be produced respecting animal welfare	4.1	4.45
Food products would be produced in environmentally friendly way	4.38	4.67
Food products would be packed with environmentally friendly material	4.28	4.49

Notes: *Health-related lifestyles** used a Likert scale, where 5 means "I am totally in agreement"; **Environmental concerns* used a Likert scale, where 5 means "I am totally in agreement"*

Table VI.
Factors explaining segment differences

reported that Spanish consumers valued locally grown products positively, and we can affirm that these findings are in agreement with Yue and Tong (2009), Hu *et al.* (2009) and James *et al.* (2009). The findings are also similar to Grebitus *et al.* (2013), de-Magistris and Gracia (2014, 2016a) who indicated that people negatively valued goods that had travelled longer distances.

Overall findings show that consumers value labelling schemes that are regulated by EU law highly, suggesting that if food labelling is based on regulations that lay down stringent requirements to guarantee the standards of the labelled food product and ensures that those standards match specifications by established control requirements, then consumers prefer products carrying these labels. Since the most preferred food labels in this study are also those found to be the most prevalent in the European market (Ipsos and London Economics, 2015) where this result suggests that the prevalence of public food-labelling schemes in the European context could influence European citizens to prefer them because they are more known than private ones.

Finally, our findings revealed that consumer preferences for food labels are heterogeneous across consumers since two segments were identified. Therefore, we can give food companies useful information on the consumer characteristics of the segments when their marketing strategies are implemented.

The first segment consists of older people showing more healthy lifestyles and preferring more products carrying PDO and nutritional information. However, the second segment is a small group of younger consumers with stronger environmental concerns who, regardless of the regulation behind the label, value more highly those labels related to the way the product has been produced (organic and animal welfare) and the nutritional content. Results suggest that the most preferred labels for the largest segment are those which are regulated by European Union legislation. There is also a smaller group of younger consumers with environmental concerns who prefer the labels that provide information on the way the products have been produced and on the nutritional content, placing less preferred on the geographical origin of the production. On the other hand, as the nutritional fact panel is one of the most preferred labels for both consumer segments, our study confirms that the decision made by the European Commission in regulation (EU) No. 1169/2011, on the provision of food information to consumers to make the nutritional panel mandatory, was appropriate in order to meet the needs of European citizens.

5. Conclusion

The demand for food has undergone profound changes over the last two decades, with high heterogeneity in consumer preferences. This has led to a strong differentiation of experiential eating quality and credence attributes related to environmental and other social outcomes. In particular, there is increased demand for those food labels related to health, environmental conservation, product origin, support local rural communities, animal welfare, and so on. While consumer preferences towards some public and voluntary food labels have been studied extensively using DCE, there is no empirical work on consumer preferences, which investigates whether European consumers value public or private food labels more highly, using a best-worst approach. This is the aim of our study, taking into account the valuation of the joint provision of the seven food labels for the same food product (semi-cured cheese). Three out seven are under European regulation, such as the organic logo, denomination of origin and nutritional content. However, the other four food labels are private initiatives: local, carbon footprint, food-miles and animal-welfare labelling. The results from this study indicate that consumers value the different analysed food labels positively, but they value the public labels more highly than the private ones, since the most valued labels are the designation of origin followed by the organic logo and the nutritional panel.

Moreover, two segments were identified: the first consists of older people who follow a healthy lifestyle and prefer PDO and organic cheese products, while the second belongs to younger people who are more concerned about environmental and ethical issues, and so prefer organic and welfare labels.

Since this study was carried out in only one European country and in 2011, to check whether these results hold further studies should be replicated also in other countries and on other food products to provide external validity for our results. Moreover, the use of pictures of the products instead of real products could drive a possible bias because the use of real products evoke a pleasure hedonic response to participants owing to an associated cue (e.g. smell), and increase attention towards hedonic labels rather than other ones. Therefore, further studies could use real products instead of pictures and test whether differences exist in preferences between conventional BW methods and a "real" BW approach.

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Appendix

Organic logo indicates a way of producing food that respects natural life cycles. It indicates that the product contains no chemicals, and that these products come from animals for which drugs, hormones and genetically modified organisms are prohibited	Local-origin label "product from my farm" indicates that local farmers sell the products directly, without any intermediary
Denomination of origin (PDO) label indicates that the product is produced, processed and prepared in a given geographical area using recognised know-how, which defines the quality or characteristics of the product	Carbon footprint label reports all greenhouse gases (GHG) that have been released into the atmosphere (measured in units of carbon dioxide (CO_2) equivalent dioxide) in the production and marketing of food
Food-miles label indicates the number of kilometres that the product has travelled from area of production to area of consumption	Animal-Welfare label "more respectful of the animal welfare product" indicates that farm animals have been well reared, treated, transported and slaughtered, with everything respecting their welfare
Nutritional fact panel indicates the amount of calories and nutrients in a serving of food	

Table AI. Food-labelling schemes used in experiment

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