Consumer preferences for food labeling: what ranks first?

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Abstract:

In the EU food market, different food labeling schemes co-exist with the aim of informing customers and providing trust on different quality characteristics of food products. To understand which food labeling schemes are the most and the least important for consumers is very relevant because a labeling strategy will be useful for food companies if consumers, or at least one segment of consumers, value food labeling. The aim of this study was to measure the importance consumers attach to different labeling schemes available in the food market. Seven different food labeling schemes, some regulated by the EU (the EU organic logo, the Protected Designation of Origin (PDO) indication and the nutritional fact panel) and some of them not yet regulated at the European level (the food miles indication; the local origin; the carbon footprint information; and an improved animal welfare indication), were assessed by consumers. To do this, the direct ranking preference method was used and a rank-ordered mixed logit model was estimated with the data from a survey conducted with food shoppers in a medium-sized Spanish town. The results indicate that the most preferred labeling scheme was the PDO indication, closely followed by the nutritional fact panel and the EU organic logo. In other words, consumers clearly valued labeling schemes that are regulated by EU law. Moreover, consumer preferences for food labeling were heterogeneous and three segments of consumers based on preferences were found: PDO lovers, organic EU logo lovers and the nutritional information lovers.

Keywords: animal welfare, carbon footprint, food miles, guarantee, labeling schemes, local, nutritional fact panel, organic, PDO, Spain

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1. Introduction

During the last two decades, numerous food crises have emerged in the EU food system, including a large outbreak of bovine spongiform encephalopathy. Consumers are increasingly concerned about the apparent lack of control and the safety of agri-food products (García and Jukes, 2004). As a consequence, European food policy, the European food chain and consumers have changed substantially. A new food policy and regulatory framework was established based on risk assessment, control, management and communication with the aim of providing food products with greater food safety and health standards. This new integrated approach to providing safer and healthier food products has forced companies in the food chain to adapt their production systems to provide higher safety guarantees (Falguera *et al.,* 2012). However, at the same time, increasing consumer demands for higher quality products and more information and trust in these qualities may also be an opportunity for companies to build a competitive advantage. To get this advantage, they should offer consumers differentiated quality food products with the required information to allow consumers to make more informed product choices. This quality differentiation is mainly done using food labeling because these quality food product characteristics are credence attributes that cannot be revealed to consumers before purchase and consumption, unless additional information is provided (Caswell *et al.* 2002). Thus, the use of credible labels allows food companies to signal quality or the presence of specific unobserved desirable attributes (McCluskey and Loureiro, 2003).

As a result, different food labeling schemes are proliferating in the EU food market with the aim of informing consumers and providing trust on different quality characteristics of food products. A recent study funded by the European Commission on the functioning of voluntary food labeling schemes for consumers in the European Union (Ipsos - London Economics EAHC, 2013) found a total of 901 food labeling schemes operating in Europe. This study pointed out that more food labeling schemes were found in Spain than any other country (20% of all food labeling schemes were found in Spain), with Germany second (12.5%), and Italy, the Czech Republic, France, and Portugal having the next greatest number of schemes. These food labeling schemes were classified by the attribute claimed in the label, and the results indicated that the most claimed characteristic was the origin of production, which was covered by 60% of

all schemes (540 schemes out of 901 schemes identified). The second most prevalent characteristic on labels was organic certification (234 schemes), followed by traceability, traditional methods, taste/smell, environmental methods, safety and animal welfare.

However, this large amount of information may mislead consumers, mainly for the food characteristics that are more difficult to understand (Falguera *et al.,* 2012). To solve this problem, the EU has launched different food labeling regulations that food companies can adopt on a voluntary basis. The aim of these food labeling schemes is to establish the requirements of use and the control procedures of the labeled quality products to protect consumers from being misled. Two examples of these regulations are EEC Regulation No. 834/2007 on organic production and labeling of organic products and EEC Regulation No. 1151/2012 on a quality scheme for agricultural foodstuffs. These regulations lay down stringent requirements guaranteeing the standards of all higher-quality products in Europe. In addition, EU quality schemes ensure that food products are produced to exacting specifications by establishing control requirements. The EU also regulates the conditions and requirements for food information through EEC Regulation No. 1169/2011 on the provision of food information to consumers, which has established common definitions, principles, requirements and procedures for food information. This regulation also includes new requirements for nutritional labeling in response to the conclusions of the Commission reported in the white paper on A Strategy for Europe on Nutrition, Overweight and Obesity Health-related Issues. This white paper pointed out that nutrition labeling is an important method of informing consumers about the composition of foods, helping them to make an informed choice. This regulation established that the nutritional fact panel will be mandatory as of 2016.

Moreover, empirical studies on consumer preferences for several types of food quality labeling in Europe have indicated that the most prevalent food labeling schemes in Europe were also the most analyzed and found to provide the most value to European consumers. Most empirical studies conducted in Europe have focused on assessing consumer preferences for processed methods (organic, animal welfare) and the origin of production (regional, local) (Andersen, 2011; Aprile *et al.,* 2012; Denver and Jensen, 2014; Gracia *et al.*, 2014; López-Galán *et al.*, 2013; Olesen *et al.,* 2010; Pouta *et al.,* 2010; Resano *et al.,* 2012; Yangui *et al.,* 2014 to name only few of the most recent ones). However, several empirical studies have also analyzed preferences for these two

claims together with other attributes such as health (nutritional information, health claims) and environment/sustainability (food miles, footprint) (de-Magistris and Gracia, 2014; Koistinen *et al.,* 2013; Øvrum *et al.,* 2012). These papers used different choice-based experiments (hypothetical and non-hypothetical) to assess consumers' willingness to pay for the different attribute signals. Their results indicated that, in general terms, European consumers positively value labels informing about the method of production, origin and health benefits because they are willing to pay extra for food products with these attributes. In addition, it was also pointed out that consumer preferences for these labeling schemes are heterogeneous across consumers. However, none of these papers provided evidence on which of several food labeling schemes are the most and least preferred by consumers. To understand which food labeling scheme is the most and least important for consumers is very relevant because a labeling strategy will be useful for food companies if consumers or at least a segment of consumers value the food labeling scheme they are using or intent to use.

The aim of this paper was to determine which of different labeling schemes are most relevant for consumers; in other words, to measure the importance consumers attach to different labeling schemes available in the food market. In particular, we assessed consumer preferences for the most prevalent food labeling schemes in the food market, previously determined to be relevant to consumers in empirical studies.

Apart from the previously described food labeling schemes regulated by the EU, the EU organic logo[1], the Protected Designation of Origin (PDO) indication[2] and the nutritional fact panel[3], we included other food labeling indications that have emerged on the European food market and have being studied in previous empirical papers on food labeling preferences, i.e. the food miles indication[4]; the local origin[5]; the carbon footprint information[6]; and an improved animal welfare indication[7]. In this study, seven different food labeling schemes, some regulated by the EU and some not yet regulated at the European level, were assessed by consumers. Because we expected, based on previous research, that consumer preferences for different food labeling schemes would

[1] Regulated by EEC No. 834/2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91
[2] Regulated by EEC No. 1151/2012 on quality scheme for agricultural and foodstuffs.
[3] Regulated by EEC No. 1169/2011 on the provision of food information to consumers
[4] Indicating the kilometers that the food product travel from the production to the consumption area
[5] Informing that the food product is locally produced and directly sold by the farmer
[6] Indicating the CO2 emissions in the production and commercialization of the food product
[7] Claiming that the animals have been raise, transport and slaughter following improved animal welfare standards than minimum required by the EU regulation

be heterogeneous, the source of this heterogeneity was also investigated. Moreover, consumers were segmented into groups with homogeneous preferences for food labeling and the segments were profiled based on the consumers' personal characteristics, label use and beliefs, food-related lifestyles and environmental and ethical beliefs.

To achieve our aim, following Lagerkvist (2013), the direct ranking preference method was used. Lagerkvist (2013) utilized two different methods, i.e. direct ranking and best-worst scaling, to measure attributes important to consumers for beef labeling. He concluded that the ranking of attribute importance derived by both methods was similar, as was the participants' understanding of the task required by the methods. Thus, we selected direct ranking, as respondents needed only to rank seven different food labeling schemes, which is not a complicated task. Moreover, one of the stated shortcomings of this method was that when aggregate measures (such as probabilities of first rank, second rank, etc., and/or rank means) are used to analyze the data, consumers' heterogeneity in preferences cannot be studied. However, if the direct ranking for each of respondents are re-coded as sequential choices, new data could be used to estimate choice models and account for heterogeneity (Train, 2003). This approach was used in this study.

Data from this study comes from a survey administrated in a mid-sized town in Spain. This town was selected to be representative of Spain because their socio-demographics are similar to those of the Spanish Census of Population. The target population was food buyers in the household and the final sample was randomly selected stratified on the basis of gender and age. The survey was conducted through personal interviews using a structured questionnaire.

The paper is structured as follows. The next section describes the materials and methods and section 4 presents the results. Finally, section 5 presents a summary of the conclusions, a discussion of the implications and suggested further research.

2. Materials and methods

To assess consumer preferences for different food labeling schemes, a direct ranking method was used. Direct ranking is a non-forced choice method by which preference intensity is obtained by directly comparing the different alternatives. This method provides the respondent with different products and they are asked to rank-order them from most preferred to least preferred. This method has been recently used in

several applications to measure preferences for different food products (Hein *et al.,* 2008; Lagerkvist, 2013). To measure the importance of the products with the information obtained using this method, different aggregate indicators of product importance can be used such as *i)* probabilities of first rank, second rank, etc., and, *ii)* rank means. These indicators allow for identifying the order of preferences, but because of their aggregate nature, they are not able to address heterogeneity across respondents. To avoid this disadvantage, rank ordering can be broken into different choice situations making some *ad hoc* assumptions. This transformation into a sequence of choice behavior allowed for using the information to estimate choice models that account for heterogeneity (mixed logit). Then, the source of consumer preference heterogeneity could be investigated.

In this study, we first calculated from the original data the probabilities and means of ranks to investigate consumer preferences for different food labeling schemes. Next, data were re-coded by treating each rank as a sequential choice process where respondents make a discrete choice between alternatives. Then, rank orderings were broken down into sequences of choice situations as defined by Train (2003) and a rank-ordered mixed logit was estimated. Finally, estimated parameters of the importance of the different food labeling schemes for each of the respondents were used to segment consumers into groups. These consumer segments were characterized using personal consumer characteristics, label use and beliefs, food-related lifestyles and environmental and ethical beliefs.

2.1. Utility theory framework

In the direct ranking, respondents are asked to rank the alternatives from the most to the least preferred; therefore, we obtained a ranking of the alternatives that presumably reflects the utility that the respondent obtained from each alternative. To use this ranking information within the usual utility theory framework defined by the random utility model (RUM), each individual *n* faces a choice among J alternatives, and he/she obtains utility (U_{nj}) from choosing alternative j over other specific alternatives. First, we have to transform the original full ranking of the different alternatives into "pseudochoices" or "pseudo-observations" to maximize information on preferences (Train, 2003). Thus, for the first pseudo-observation, the choice set includes J (J = 7) alternatives, and the dependent variable identifies the alternative ranked as the most

preferred; for the second pseudo observation, the alternative ranked first is discarded, leading to a choice set composed of J-1 alternatives, and the option ranked second becomes the chosen alternative. The process continues until the choice set is comprised only by two alternatives. Therefore, the ranking of J alternatives can be represented as J-1 independent choices, and the new dataset will include J-1 choices for each individual.

Then, utility (U_{nj}), has two components: one, observed by the researcher (V_{nj}) and another unobserved and random (ε_{nj}) distributed iid extreme value (as for a logit model).

2.2. Rank-ordered mixed logit

The data was then analyzed by estimating a mixed rank-ordered logit (MRL), which combines the statistical flexibility of the mixed logit and its ability to investigate heterogeneous preferences, with the adequacy of the rank-ordered logit for ranking observations.

Under the assumptions of a standard logit, the probability of individual n ranking J alternatives from best to worst as $j_1; \ldots; j_m; \ldots; j_J$, where j_m represents the alternative chosen at the ranking order m, can be expressed as the product of logit choice probabilities:

$$\Pr ob(ranking \quad j_1,...,j_m,...,j_J) = \quad \Pr ob(U_{j_1} > ... > U_{j_m} > ... > U_{j_J}) = \prod_{m=1}^{J-1} \frac{e^{V}_{nj_m}}{\sum_{k=m}^{J} e^{V}_{nj_k}} \qquad (1)$$

where $V_{nj} = \beta'_n X_{nj}$

The β'_n coefficients represent heterogeneous preferences across individuals by specific coefficients or taste parameters in β for each individual. Rather than being fixed, as occurs in a standard logit model, the vector of parameters β is random, with a density g(β/θ) where θ represents the parameters of the distribution (i.e. mean and standard deviation). Expression (1) still provides the probability for an individual n of choosing a specific ranking, but is conditional on β. The unconditional probability is the integral of that product of probabilities over the density of β:

$$\Pr ob(ranking \quad j_1,...,j_m,...,j_J) = \int \prod_{m=1}^{J-1} \frac{e^{V_{njm}}}{\sum_{k=m}^{J} e^{V_{njk}}} \times g(\beta|\theta) d\theta \qquad (2)$$

Then, the mixed logit model on ranked alternatives is estimated using the transformed data set-up as described above where the $J-1$ pseudo-observations for each ranking are treated as $J-1$ choices in a panel. The mixed logit incorporates the fact that each respondent has his own coefficients and, importantly, that the respondent's coefficients affect his entire ranking such that the pseudo-observations are correlated (Train, 2003).

In our application, the consumer's utility (V_{nj}) is a function of the characteristics ranked by respondents and the estimated parameters are assumed to be random following a normal distribution.

2.3. Preference heterogeneity

Estimated parameters for the rank-ordered mixed logit for each of the participants were then utilized to segment consumers using a cluster k-means procedure. The obtained segments were characterized by consumer personal characteristics, label use and beliefs, food-related lifestyles and environmental and ethical beliefs. This characterization was done using a chi-square or Bonferroni test (Hair et al., 1998), depending on the nature of the variable.

2.4 Data gathering and variable definition

Survey data were collected through personal face-to-face interviews using a structured questionnaire in a medium-sized Spanish town in 2011. This town was selected to be representative of Spain because its socio-demographics are similar to those of the Spanish Census of Population (Table A in the Appendix). In order to ensure that respondents had shopping experience, the target population included the primary food buyer in the household.

The sample of participants was randomly selected and stratified on the basis of gender and age. Interviewers randomly selected the individuals and first asked them whether they were the main household food shopper[8]. In the case that the consumer never bought food, the interviewer selected at random another consumer belonging to the same age group, and asked the screening question until a participant matching this

[8] We questioned whether interviewees always, almost always, occasionally, hardly ever or never buy the food for the household; consumers who indicated never were not selected.

265 requirement was found. A total of 540[9] consumers were interviewed, which, for an
266 infinite population and assuming a confidence level of 95.5% (k=2) and p=0.5, the
267 sampling error is lower than the usual ±5%.
268 The questionnaire included one question to measure consumer preferences for
269 different food labeling schemes. Respondents were asked to rank the seven schemes
270 from most to least preferred (1 indicate the most preferred and 7 the least preferred). To
271 explain consumer preferences, several questions on *i)* label use and beliefs, *ii)* food-
272 related lifestyles and *iii)* environmental and ethical beliefs were included. Finally, some
273 personal consumer characteristics (gender, age, household size, education and income),
274 the frequency of buying food and whether they follow a food diet were also questioned.
275 Prior to the final administration of the questionnaire, it was validated using 20
276 consumers for understanding and interview length. We were aware of whether the
277 respondent knew of the different labeling schemes, so respondents were informed about
278 the main characteristics of the labeling schemes.
279 To measure label use, respondents were asked two questions, to determine if
280 they pay attention and read labels when shopping (Table 1). To know consumers
281 attitudes (beliefs) towards the labels on food products, the items of the scale used by
282 Loureiro *et al.,* (2006) for the nutritional label were adapted and used. Respondents
283 were asked the level of agreement or disagreement with different sentences related to
284 food label information (see Table 1 for the definition of the statements).
285 Some items of the scale validated by Brunsø and Grunert (1995) were used to
286 measure food-related lifestyles and the validated scale by Lindeman and Vaänänen
287 (2000) was used to measure environmental and ethical beliefs (see Table 1 for the
288 definition of the statements).
289 Respondents were also asked about their frequency of food shopping, from
290 always to hardly ever and whether they or other people in the household followed a
291 special food diet (Table 1).
292 INSERT TABLE 1
293
294 Summary statistics for the socio-demographic and economic characteristics of
295 the sample are presented in Table 2 together with the population information for some
296 demographic profiles for comparison. Around half of the respondents were female

[9] Some respondents did not answer to the ranking question of interest and were discarded, then finally only 522 interviews were used in this paper.

297 (53%), living in households of 2.9 members on average. In addition, the average age
298 was around 46 years and nearly 20% had completed primary studies while more than
299 40% had completed university studies (this group is slightly over-represented, which is
300 a common characteristic of surveys). Around 25% of the respondents belonged in each
301 of the four income categories.
302
303 INSERT TABLE 2

304 **3. Results**
305
306 Table 3 shows the percentage of respondents that ranked the different labeling
307 schemes as first, second, third, fourth and fifth, together with the mean of the ranks.
308 Because we asked participants to order from most preferred to least preferred, a lower
309 value of the mean indicates the highest preference for this labeling scheme.
310 The results from the probability of ranks first shows that the most preferred
311 labeling schemes were the nutritional fact panel information, the PDO indication and
312 the EU organic logo because most of the respondents ranked these labels first. In
313 particular, 35% of respondents ranked the nutritional fact panel first, 30%, the PDO
314 indication and 25% the organic logo. However, if we take into account the second and
315 third rankings and the rank means, the most preferred label was the PDO indication
316 (2.51), very closely followed by the nutritional fact panel information (2.59) and the
317 organic logo in third position (2.85). On the other hand, the two sustainability labels,
318 more recently introduced in some EU countries, the food miles and carbon footprint
319 labels were the least preferred.
320 As mentioned above, we expected that the consumer preferences for food
321 labeling schemes would be heterogeneous. However, this heterogeneity was not
322 observed in the aggregate results in Table 3. Then, we estimated a ranked-order mixed
323 logit as described in section 3 to test if heterogeneity in consumer preferences for food
324 labeling exists. The estimation of the ranked-order mixed logit was done using NLOGIT
325 5.0 (the carbon footprint indication was used as the reference and not included in the
326 final specification of the model to avoid multicolinearity).
327 Table 4 presents the mean and the standard deviation of the estimated
328 parameters for the ranked-order mixed logit. The standard deviations of the mean
329 estimated coefficients were statistically significant at the 5% significance level,
330 indicating that consumer preferences for food labeling schemes were indeed

heterogeneous. The mean of the estimated parameters were statistically significant and positive, indicating that these six labeling indications were more preferred than the carbon footprint used as the reference. Related to this, the most preferred label was the PDO indication, followed very closely by the nutritional fact panel information and the organic logo ranked third (similar results as when using the rank means). The order of preference for local origin and animal welfare was similar and they ranked in the middle, while the food miles and the carbon footprint indications were in the last position in terms of consumer preferences. These results indicate that consumers prefer having information on the geographical origin (PDO indication), the nutritional content of the product (nutritional fact panel), and on the production method (organic logo), in this case a more environmentally friendly production system.

This rank of preferences corresponds to the average consumer, but as mentioned before, heterogeneity exists across consumers. Thus, we used the estimated coefficients for each of the participants (β'_n) to segment them into homogeneous groups using a k-means cluster analysis (Hair *et al*., 1998). From the cluster analysis, we obtained three segments of similar sizes. Segment 1 consisted of 36.6% of respondents, segment 2 of 38.3% and segment 3 of 25.1%. First, we checked if the three segments really differed in terms of estimated parameters using ANOVA (Bonferroni test)[10]. Table 5 indicates that, except for the food miles indication and the local origin, the estimated parameters were statistically different across clusters. The mean values of these parameters were used to name the different clusters according to consumer preferences for the food labeling scheme. Thus, cluster 1 was named "PDO lovers" because this segment attached more value than the other two segments to this indication. In the same way, cluster 2 was named "organic lovers" because they ranked the organic logo and the animal welfare higher than the rest of the segments. It must be taken into account that the EU organic regulation was established as a requisite to certify that an animal product is organic, meaning that it should follow specific animal welfare standards. Finally, cluster 3 was named, "nutritional information lovers", because they attached the highest importance to the nutritional fact panel. Table 5 also presents the ANOVA and chi-square test results for the three clusters for the different consumer characteristics to profile them (personal, label use and beliefs, food-related lifestyles and environmental and ethical beliefs).

[10] The cluster analysis and the ANOVA and chi-square tests were performed using STATA 10.0

The "PDO lovers" segment consisted of a higher proportion of older male consumers who had completed primary studies and had a higher income than the other two segments. Consumers in this segment comprised a greater proportion of frequent shoppers. A higher percentage of consumers in this segment stated that they read labels while shopping and they highly believe that labels provide useful information and to lesser extent that labels prevent fraud, guarantee quality and safety, are not easy to understand and provide too much information. They considered to greater extent that labels are useful and a source of easy information. However, they believed to lesser extent that labels prevent from fraud and are means of guarantee the quality and safety of the food product. According to food-related lifestyles, consumers in this segment considered to greater extent that they need to know the nutrition content of their food, check prices when shopping and plan their shopping in advance more often than consumers in the other two segments. Finally, they were less concerned about animal welfare and the environmental aspects of producing and packaging the food products than the other two segments.

The "organic lovers" and the "nutritional information lovers" segments consisted of a higher percentage of younger women who had completed university studies and had a lower income level than cluster 1. Fewer of them stated that they read labels when shopping and they considered labels to greater extent to be a way of preventing fraud and guaranteeing quality and safety than consumers in cluster 1. However, they believed to lesser extent that food labels provide useful information but to a greater extent that there is too much information and it is not easy to understand. According to food-related lifestyles, they usually decide what to buy in the shop and they check prices to a lesser extent than consumers in cluster 1. However, they usually take more time in the kitchen. Cluster 2 and cluster 3 differed in terms of their environmental and ethical beliefs. Both clusters were more concerned with animal welfare and the environmental aspects of producing and packaging the food products than consumers in cluster 1, but consumers in cluster 3 were more concerned than consumers in cluster 2.

4. Conclusions and discussion

In the EU, a great number of food labeling schemes exist (901) with the highest prevalence in Spain (accounting for 60% of all schemes). However, food labeling will be useful for food companies only if they are relevant to consumers or at least for a group of consumers. The results from this study provide evidence as to which food

398 labeling schemes are most preferred for consumers in one European country (Spain), the
399 one with the highest prevalence of schemes. Moreover, it gives information on the
400 heterogeneity among consumers and the relevance they attached to the different food
401 labeling schemes.

402 It was found that the most preferred labeling scheme was the PDO indication,
403 closely followed by the nutritional fact panel and the EU organic logo. The other four
404 labeling schemes were much less preferred, as the local origin and animal welfare
405 ranked in the middle while the two sustainable indications (food miles and carbon
406 footprint) occupied the last positions in consumer preference.

407 The findings show that consumers highly value labeling schemes that are
408 regulated by EU law. The results indicate that if the food labeling is based on
409 regulations that lay down stringent requirements to guarantee the standards of the
410 labeled food product and ensures that those standards match specifications by
411 established control requirements, consumers will prefer products carrying these labels.
412 In fact, the labeling schemes not already regulated at the EU level, perhaps also because
413 they are less known by consumers, received less consumer valuation. Based on these
414 results, we could speculate that if the EU decides to include in their regulations new
415 food labeling schemes such as local farming and direct sales, it can be expected that
416 consumer valuation for local food products directly marketed by farmers will increase.
417 This is an important result, considering that EEC Regulation No. 1151/2012 on the
418 quality for agricultural and foodstuffs established in their final provisions that the
419 Commission shall present a report, no later than 4 January 2014, on a new local farming
420 and direct sales labeling scheme to assist producers in marketing their produce locally.
421 That report shall, if necessary, be accompanied by appropriate legislative proposals on
422 the creation of a local farming and direct sales labeling scheme. The results from this
423 report show that a voluntary labeling scheme on local farming could be a helpful
424 additional tool for protecting locally produced food products and for informing
425 consumers about them (ECC, 2013).

426 Moreover, from our results, we can suggest that food companies should be
427 willing to differentiate their products by using one of the regulated labeling schemes
428 because they are more valued by consumers. However, and this is not our objective,
429 they should take into account the extra cost of implementing the stringent production
430 and control requirements established by the regulation. Moreover, because we found
431 that consumer preferences for food labeling were heterogeneous and we detected three

segments of consumers, we can give food companies information on the consumer characteristics of the three segments that they could use in the design of their communication campaign to consumers. One of the segments valued the PDO indication, while another segment valued the organic EU logo and the third one valued the nutritional fact panel. However, because the nutritional fact panel is now mandatory (in a few months' time), only the first two segments of consumers are important for food companies.

The "PDO lovers" were characterized by being older males who had completed primary studies and had a higher income level than the other two segments. They are frequent food shoppers who considered to a greater extent that food labels are useful and a source of easy information and to lesser extent that they prevent fraud and are means of guaranteeing the quality and safety of the food product. Consumers in this segment highly believed that they need to know the nutrition content of the food, check prices when shopping and plan their shopping in advance. Finally, they were less concerned about animal welfare and the environmental aspects of producing and packaging the food products than the rest of the consumers. The "organic lovers" were characterized as having a lower income, and considered to a greater extent that food labels guarantee the quality and safety, are not easy to understand and provide too much information. Thus, although food labels provide more confidence in the food product, they believed that the label provides too much information as is not easy to understand.

The results of this study also show that the new obligation to use a nutritional fact panel on food products is not only a desired tool for the public administration but is also demanded by consumers because this nutritional labeling was one of the most preferred schemes.

Finally, it must take into account that the data was collected in 2011 and nowadays the scenario could be different. Moreover, this study has some limitations that constitute areas of further research. The first limitation is that it was carried out in only one European country and should be replicated in other countries to provide more evidence. Another limitation is that only a direct ranking method was applied, so it would be interesting to use other preference valuation methods. Moreover, the ranking question was asked for food products in general, but it would be very interesting to value the different labeling schemes on specific products to see if the ranking of preferences is product-specific. Finally, heterogeneous preferences were analyzed and the different consumer segments were profiled using some characteristics; however, we

did not include all the possible characteristics that could explain this heterogeneity. For instance, consumer knowledge on the different labeling systems and consumer lifestyles could also be investigated as sources of preference heterogeneity.

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635 Table 1. Question descriptions

Question description
Label use
Do you pay attention to labels when shopping?
Do you read labels when shopping?
Label beliefs
Labels prevent fraud in food products
Labels provide useful information
Labels guarantee food quality and safety
Labels are not easy to understand
Labels provide too much information
Food-related lifestyles
I compare labels to select the most nutritious food
I need to know what nutrients the product contains
I used to check prices when shopping for foods
Before I go shopping for food, I make a list of everything I need
I do not usually decide what to buy until I am in the shop
I like to try new foods that I have never tasted before
I like to try out new recipes
I like to have ample time in the kitchen
Environmental and ethical beliefs
Food should be produced in a way that maintains the welfare of animals
Food products should be produced in an environmentally friendly way
Food products should be packaged in an environmentally friendly way
Food products should come from a country I approve of politically
Food products should come from a country in which human rights are not violated
Do you or some people in your household follow a food diet?
How often do you do the food shopping?

636 *Could you please indicate your level of agreement and disagreement with the following statements?

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Table 2. Sample characteristics (%, unless stated)

Variable definition	Sample	Population
Gender[1]		
Male	47.1	49.9
Female	52.9	50.1
Age of respondent[1]		
From 18 to 34 years	29.3	28.0
From 35 to 44 years	21.1	20.5
From 45 to 54 years	18.6	17.4
From 55 to 64 years	13.8	13.3
More than 65 years	17.2	20.8
Household size (average)	2.9 (1.3)	NA
Education of respondent[2]		
Primary studies	19.1	17.0
Secondary studies	38.6	50.0
University degree	42.7	33.0
Household net income		
Less than 1,500 €/month	26.8	NA
Between 1,500 and 2,500 €/month	27.6	NA
Between 2,500 and 3,500 €/month	23.8	NA
More than 3,500 €/month	21.8	NA

[1] INE (2012) and [2] OECD (2014).

Standard deviations are in parentheses; NA: not available

661 Table 3. Probability of ranking and rank means (%, mean)

	Rank1	Rank2	Rank 3	Rank4	Rank5	Mean
Organic (EU logo)	24.33	22.99	23.18	13.6	8.05	2.85
PDO indication	30.27	33.91	13.79	9.00	5.75	2.51
Nutritional fact panel	35.25	18.97	19.16	12.84	7.66	2.59
Food miles (km)	1.53	6.13	11.88	18.01	19.73	4.95
Local origin	2.68	6.51	14.56	22.03	23.18	4.62
Carbon footprint	0.77	1.92	4.02	7.66	17.05	5.88
Animal welfare	5.17	9.58	13.41	16.86	18.58	4.58

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Table 4. Estimates for the rank-ordered mixed logit

	Coefficient	Z-ratio
Mean value		
Organic (EU logo)	2.949	16.75
PDO indication	3.454	17.6
Nutritional fact panel	3.353	17.34
Food miles (km)	0.843	8.31
Local origin	1.108	10.66
Animal welfare	1.134	9.86
Standard deviation		
Organic (EU logo)	1.459	9.51
PDO indication	1.665	10.65
Nutritional fact panel	1.700	10.37
Food miles (km)	0.709	4.10
Local origin	0.504	2.28
Animal welfare	1.097	6.98

Number of observations: 3,132; Number of participants: 522

Log likelihood at convergence: -3,732.8; McFadden Pseudo R-square: 0.3875

Table 5. Segmentation of consumer preferences: characterization

	Cluster1	Cluster2	Cluster3	Total
Estimated coefficients				
Organic (EU logo)**	2.98[a]	3.59[b]	2.50[c]	2.96
PDO indication**	4.43[a]	2.50[b]	3.10[c]	3.45
Nutritional fact panel**	2.95[a]	2.25[b]	4.55[c]	3.36
Food miles (km)	0.83	0.88	0.82	0.83
Local origin	1.12	1.13	1.10	1.12
Animal welfare**	0.93[a]	1.50[b]	1.03[a]	1.12
Personal characteristics				
Gender				
Female	48.74	55.30	55.50	52.9
Age**	51.13[a]	47.56[a]	39.08[b]	45.8
Household size**	2.71[a]	2.83[a]	3.07[b]	2.9
Education level**				
Primary studies	30.65	24.24	3.66	19.1
Secondary studies	39.20	34.85	39.27	38.6
University degree	30.15	40.91	57.07	42.7
Household Net Income **				
Less than 1,500 €/month	32.16	38.64	13.09	26.8
Between 1,500 and 2,500 €/month	29.65	23.48	28.27	27.6
Between 2,500 and 3,500 €/month	19.10	18.18	32.46	23.8
More than 3,500 €/month	38.12	19.7	26.18	21.8
Respondent follows a food diet	23.12	30.30	27.23	26.4
Respondent always does the food shopping**	38.19	34.09	25.13	32.4
Label use and beliefs				
Consumers				
pay attention to labels when shopping	86.43	87.12	85.34	86.21
read labels when shopping	23.62	20.45	17.28	20.50
Labels				
prevent fraud in food products**	3.89[a]	4.07[b]	4.05[b]	4.00
provide useful information**	4.41[a]	4.23[b]	4.26[b]	4.31
guarantee food quality and safety**	3.98[a]	4.20[b]	4.08[b]	4.09
are not easy to understand**	3.26[a]	3.46[b]	3.11[a]	3.30
provide too much information**	2.76[a]	3.23[b]	3.01[b]	3.00
Food-related lifestyles				
I compare labels to select the most nutritious food	4.03	4.07	4.05	4.05
I need to know what nutrients the product contains**	4.04[a]	3.78[b]	3.78[b]	3.88
I use labels check prices when shopping for foods*	4.58[a]	4.44[b]	4.41[b]	4.48
Before I go shopping for food, I make a list	4.08	3.95	3.93	4.00
I do not usually decide what to buy until I am in the shop*	2.89[a]	3.13[b]	3.12[b]	3.04
I like to try new foods that I have never tasted before	3.64	3.5	3.40	3.52
I like to try out new recipes	3.91	3.78	3.74	3.82
I like to have ample time in the kitchen**	3.40[a]	3.70[b]	3.76[c]	3.60
Environmental and ethical beliefs				
Food should be produced in a way that maintains the welfare of animals**	4.23[a]	4.27[b]	4.49[c]	4.31
Food products should be produced in an environmentally friendly way**	4.47[a]	4.50[b]	4.74[c]	4.54
Food products should be packaged in an environmentally friendly way**	4.21[a]	4.34[b]	4.56[c]	4.35
Food products should come from a country I approve of politically	3.76	3.86	3.88	3.83
Food products should come from a country in which human rights are not violated	4.24	4.26	4.34	4.28

Appendix. Population in Spain and in the town

Table A. Population by sex and age in Spain and in the town (%)

		Sex		Age				
	Total	Female	Male	0-19	20-34	35-54	55-64	More than 64
Spain	46,148,605	50.99	49.01	19.88	20.80	31.10	11.05	17.14
Town	952,383	50.90	49.10	18.46	19.63	30.83	11.64	19.42

Source: INE (2012).