Consumers' awareness of the EU's protected designations of origin logo

Alexandra Goudis and Dimitris Skuras
Department of Economics, University of Patras, Patras, Greece

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Abstract

Purpose – Protected designation of origin (PDO) and protected geographical indication (PGI) products form the core of the European Union (EU) quality food policy. Low and fragmented logo recognition perils the entire plan. This work aims to provide a "classification" of European consumers as regards logo awareness based on generic demographic and socio-economic characteristics and to test hypotheses relating PDO awareness with the purchasing behaviour of consumers.

Design/methodology/approach – The work utilises publicly available pan-European databases collected from Eurobarometer in four rolling surveys from 2012 to 2017. The statistical analysis exploits the spatially nested nature of the data.

Findings – The "logo aware" consumer is distinctively different from the average representative European consumer. A range of demographic, human capital and socio-economic characteristics and behavioural and attitudinal traits differentiate the consumers who are aware of the logo. Country and region effects are vital.

Research limitations/implications – Benefits of large and representative samples accrue by utilising available Eurobarometer surveys. This comes at a cost. The individual researcher has no control over the questions included in the questionnaire.

Practical implications – Consumer classification forms the basis of awareness-raising strategies. It reveals the numerous segments of aware and non-aware consumers and opens a discussion about tools and methods to reach out to the European consumer.

Originality/value – This analysis holds an exact pan-European perspective and incorporates consumers' characteristics, behaviour, attitudes and country and region effects.

Keywords Logo, Logo recognition, Logo awareness, Geographical indication, PDO, GI, EU

Paper type Research paper

1. Introduction

The core of the European Union (EU) quality food policy consists of protecting the names of agricultural, food and drinks products. Protection draws on the product's unique characteristics, such as their geographical origin and traditional know-how, skills and expertise embedded in the production. Geographical indication (GI) refers to the protected designation of origin (PDO), the protected geographic indication (PGI) and the GI of spirit drinks and aromatised wines. Quality logos are appraised as strong marketing intimations propping up less unique or less preeminent products. However, quality logos are equally, if more, relevant to renowned and esteemed products as they are, frequently, the only sign that distinguishes them from frauds. So undoubtedly, every successful food that commands a quality price premium attracts a wide range of fakes (Olmsted, 2016). In the last 25 years, the

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adoption of food quality labels, especially amongst Southern European producers, is spectacular (Albuquerque *et al.*, 2018; Ruiz *et al.*, 2018; Sadílek, 2020).

The Commission of the EU regularly initiated and financed promotion measures targeting the internal market and third countries, especially in North America and Asia. Repeated Eurobarometer surveys show that awareness of the EU's PDO logo is low and stagnant amongst European consumers, at an average of around 16% (European Commission, 2018) and highly biased towards specific segments of the European society. Meanwhile, 24 and 37%, respectively, of European consumers recognise the EU organic agriculture logo and the Fair Trade logo (European Commission, 2018) and 27% have seen or heard of the EU Ecolabel (European Commission, 2017). Also, the rates of logo recognition vary enormously amongst EU countries and regions of the same country. Average proportions of PDO recognition range from 5% for Denmark and the UK to around 34% for France and Italy.

These unjustifiably meagre recognition rates at the EU level called the attention of the European Court of Auditors which noted that "The means available for promotion and information about the Geographical Indications (GI) scheme are unlikely to increase it. They are used to a limited extent only and does not reside on a clear strategy on how to raise awareness of the GI scheme. Various measures are available with limited success" (European Court of Auditors, 2011, paragraph 65). However, building "a clear strategy on how to raise awareness", at the European level, necessitates that policymakers have a good understanding of the profile characteristics of the logo-aware and the logo-non-aware consumers. Differences between logo-aware and logo-non-aware consumers can point to the combination of tools that will make the strategy cost-efficient and cost-effective. The aim of this work is twofold: first, to provide a "classification" of European consumers as regards logo awareness based on generic demographic and socio-economic characteristics; second, to test hypotheses relating PDO awareness with the purchasing behaviour of consumers.

To achieve this aim, we utilise EU broad, extensive and representative samples of respondents and appropriate classification methodology that decomposes and isolates the contribution of a respondent's attributes from the place of residency, national and regional. Data are collected from Eurobarometer surveys which are publicly available at the German Social Science Infrastructure Services (GESIS) data repository. The use of Eurobarometer ensures large samples and transparent sampling procedures that are highly homogenous and professionally conducted across member states. Multilevel logistic regression is a suitable statistical method for classification able to take account of the spatial nesting of respondents in regions and member states.

This work presents results related only to the recognition of the PDO logo. Results for the PGI logo are very similar and are available from the corresponding author upon request. The analysis shows an extensive fragmentation amongst European consumers. These results call policymakers to revisit conventional methods and tools for raising awareness.

2. Research hypotheses

Several studies have considered consumers' recognition of GIs' logos and labels. Nonetheless, they do not provide a European-wide, clear and convincing answer to the observed low recognition rates. Furthermore, most of the works have a national or even regional focus and so, they cannot claim to address the "European" consumer. The definition of the "aware" consumer differs and does not allow easy comparisons. Usually, the samples are small, and the *ad hoc* sampling procedures do not make a good case for sample representativeness. Subsequently, some of the results are seemingly contradicting and their estimates are very far apart even for the same or neighbouring countries. Grunert and Aachmann (2016) identify that much of the confusion and doubt is due to the different methodologies, different definitions of the term awareness and sampling bias. Definitions of awareness span from the "recognition of certain

quality symbols, signs or logos" (London Economics, 2008) to "ever heard about PDO products" (Verbeke *et al.*, 2012) and "the knowledge of a product with a PDO label" (Skubic *et al.*, 2019). All definitions are valid, but some allow for acquiescence response bias. Sampling biases result when the sample is not representative, especially in critical characteristics such as the educational level. For example, surveys inflated with high educational-level respondents show high awareness levels. Sample selection also introduces bias. Studies carried out through the Internet exclude non-Internet users with unknown consequences. Surveys targeting consumers with a prior PDO purchase, not surprisingly, report high awareness levels.

The literature shows that several demographic, human capital and economic characteristics of consumers may be related to PDO awareness. Grunert and Aachmann (2016) review studies which provide evidence that consumers of average or older age have a preference for PDO-labelled products. Riivits-Arkonsuo *et al.* (2016) find higher awareness related to middle-aged and female consumers and Verbeke *et al.* (2012) to older aged and male consumers. Sadílek (2019) finds that the segment of Czech consumers who primarily seek for quality contains people who are mostly male and over 40 years of age. Skubic *et al.* (2019) find no age or gender differences. Likoudis *et al.* (2016) studied the consumers' intentions to buy PDO and found no gender differences and weak age effects. Also, they show that respondents who are aware of the term PDO score higher on the intention to buy PDO products.

Evidence on differences regarding family size and structure is sparse and indicates that consumers living in a family household show actual search behaviour for informational labels (Sadílek, 2019). Kaczorowska *et al.* (2019) did not find clear evidence of differences in family size between "mindful" and "sceptical" urban adult consumers of food marked by sustainability labels. Of course, family size and structure, i.e. a single or two-parent family with or without children, may be related to PDO logo awareness through budget constraints or search capacity, concepts that are the subject of mainstream food purchase decision literature. The place of residence can differentiate the level of PDO awareness inconclusively in one way or another. Rural consumers have a higher probability of being aware of a PDO product primarily if this is local but have a narrow choice set as concerns food outlets. In contrast, urban consumers are more likely to shop in outlets that hold a greater variety of products and thus, higher chances to come across PDO labels.

H1. PDO logo awareness levels differ amongst consumers with different socio-demographic characteristics.

H1a. PDO logo awareness is higher amongst middle- and old-aged consumers.

H1b. PDO logo awareness is higher amongst female consumers.

H1c. PDO logo awareness is lower amongst larger families.

H1d. PDO logo awareness is higher amongst two-parent families.

H1e. PDO logo awareness is lower among rural and small-town residents.

Human capital characteristics capture the knowledge, skills and ability of an individual consumer to search for food quality information. The literature is unanimous that higher educational levels are related to a preference for regionally denominated food (Pícham and Skořpa, 2018; Riivits-Arkonsuo *et al.*, 2016; Sadílek, 2019; Skubic *et al.*, 2019). Education is a paramount factor related to a consumer's ability to search and retrieve information, perceive and understand knowledge. Surprisingly, the literature has not examined the role of access to the Internet and the frequency of its use as factors differentiating the PDO logo awareness.

H2. PDO logo awareness is higher amongst highly educated consumers.

H3. PDO logo awareness is higher amongst frequent Internet users.

Consumers come across food logos not only when they actively search for or passively receive information about food but also when they are engaged in food purchasing. However, not all consumers are equally likely to come across a product with a quality logo while shopping since not all food outlets store the same variety and number of PDO-certified products. Jantyik and Török (2020) show, for the Hungarian market, that the number of GI products in discount retailers was less than 1% of their total food supply. Also, only a small amount of food quality-certified items are included in the food discounters offers. Therefore, whether consumers shop at a convenience store, a low-end discount supermarket, a mass merchandiser, a high-end supermarket or a speciality/gourmet store, it affects the probability of coming across products carrying the PDO logo. The choice of outlet, in turn, influences the likelihood that a search process will be triggered and that the logo will be recognised.

Occupation is not only related to income-generating capacity but also to the time available for searching food information. Riivits-Arkonsuo *et al.* (2016)contend that awareness of quality labels amongst Estonian consumers is higher for certain occupations, including entrepreneurs, managers and white-collar. Also, those in charge of housekeeping may pay more attention to food labels, including quality logos. Retired consumers may have more time to search for food and probably show a higher awareness level. The ownership of durables, such as a car or a house, is a sign of wealth. Besides, car ownership also signals a consumer's ability to search for food and source it from distant outlets.

H4. PDO logo awareness is higher amongst certain occupations that are related either to higher earnings (employed in the management, white-collar or self-employed) or a higher responsibility for food sourcing (housekeeping) or imply time availability (retired consumers).

H5. PDO logo awareness is higher amongst consumers of wealthier and financially unconstrained households.

With very few exceptions, PDO products achieve a price premium over similar conventional products. This price premium may range from 2–5% up to double or even triple the price of the same non-certified product (AND-International, 2012; Areté, 2013; London Economics, 2008). Also, the overwhelming proportion of studies find that consumers are willing to pay a price premium for PDO-registered products (Cei *et al.*, 2018; Deselnicu *et al.*, 2013; Grunert and Aachmann, 2016; Leufkens, 2018). Only a few studies point to inconclusive or opposite results. For example, Hassan *et al.* (2011) find PDOs being as price elastic as or more than standard products. Also, income is associated with a product's price. Even though most studies provide evidence of a relation between logo awareness and middle or high income, certain studies found a small effect (Verbeke *et al.*, 2012) or no association (Skubic *et al.*, 2019).

H6. Price-sensitive consumers are less likely to be aware of the PDO logo.

H7. PDO logo awareness is associated with higher household income.

Of course, quality alone cannot explain price premiums and possible lower awareness levels. A range of non-quality associations such as uniqueness, social image, origin, environmental and sustainability beliefs and perceptions may drive awareness and food purchasing decisions. Anselmsson *et al.* (2014) take one step further to suggest that even willingness to pay for a price premium is, first and foremost, guided by such factors. The Eurobarometer data used in this work consistently report the respondent's self-placement to a social class. These data provide an excellent opportunity to examine if consumers that identify themselves with specific social categories are also more aware of PDO logos.

H8. PDO logo awareness is associated with consumers identified with middle and upper social classes.

Tregear (2007) identifies consumers of products that have a unique territorial character concerning their distance from the place of production in two categories. Consumers of "close typicity" are the consumers who are proximate to the individual products which they consume. In contrast, consumers of "distant specialty" are distant to the place of production. The first category, i.e. consumers of "close typicity" is part of local and regional markets and as Tregear (2007) points out, the role of the PDO logo and label may be redundant or, at worst, may impose an industrial identity. For "distant specialty" systems, PDO labels have the potentially most influential role to play. This consumer typology, however, may be viewed through the food miles and environmental perspective, which adds a degree of complexity. Local, food miles-sensitive consumers may be aware of the PDO logo as part of climate-friendly consumption behaviour. Distant, consumers may be mindful of the PDO logo to avoid consumption.

H9. Food miles-sensitive consumers are more aware of the PDO logo.

High logo awareness is shown by countries that have registered many GIs and have made use of the policy, such as France, Italy, Spain, Greece from the older member states and the Czech Republic and Slovakia from the newer (Albuquerque *et al.*, 2018; Sadílek, 2020). On the other hand, countries like Germany, which have made use of the PDO scheme show a weighted average of PDO-logo-aware respondents well below the EU's grand average (European Commission, 2018). Thus, it is not clear whether registered PDO products are a decisive factor, differentiating aware and non-aware consumers.

H10. The number of registered PDO products increases the probability that consumers are aware of the PDO logo.

Besides a direct fixed effect of the country of residence on awareness through the number of registered products, countries also may absorb unobserved heterogeneity that is due to their culinary heritage, rural institutions or even the expression of national food identity. One-quarter of all PDOs are of an Italian origin. Arfini and Capelli (2009) report that 15 designations represent 90% of Italian PDO products. Thus, intraregional inequalities still exist even in countries with a tradition in registering PDO products.

H11. Country and region membership exercises a random effect that, depending on a country's culture and institutions, may increase or decrease PDO logo awareness.

Theoretical and empirical pieces of evidence support all the hypotheses mentioned above. The next section details the data and methodology used to test the hypotheses.

3. Data and methods

Data for this work were collected from four Eurobarometer surveys conducted in March 2012, November 2013, October 2015 and December 2017 across all EU member states. The Eurobarometer surveys showed a card of logos and asked the participants to respond to the following question: "Which of the logos on this screen are you aware of?" (European Commission, 2012, 2014, 2016, 2017). The procedure followed by Eurobarometer provides an estimate for one type of consumer awareness called "logo recognition" or "aided recall". The logos shown to Eurobarometer survey participants were the labels adopted by the European Commission for Organic Agriculture, for PDOs, PGIs and traditional specialty guaranteed (TSG). The Fair Trade logo completed the set of logos.

All surveys recorded a range of respondent-specific characteristics in the same way. These characteristics include demographics (age, gender, household size, etc.), human capital (education, Internet use, etc.) and economic characteristics (occupation and ownership of durables). A question capturing whether the respondents had difficulties in paying household bills at the end of the month depicted households with cash flow and financial stress issues.

Some of the surveys also included psychographic and behavioural characteristics. The questionnaires recorded the respondents' place of residence in terms of the European hierarchy of spatial administrative units called NUTS (from the French – Nomenclature des Unités Territoriales Statistiques). Within countries, some regions may have a proportion of aware respondents well below or well above the national and EU averages. From a purely descriptive perspective, it seems that besides the variability at the individual (respondent) level, there is some variability that may be due to either the regional or national clustering of consumers, which deserves some consideration. Eurobarometer also provides population stratification weights for each of the participating countries. These weights ensure sample representativeness regarding a series of socio-demographic criteria and the NUTS region.

Some of the surveys included additional questions which provide useful information for hypotheses testing. In the 2012 study, there is the question "When buying food, how important are the following for you personally…?" with potential answers for the price, quality and geographical origin on a four-scale variable from very important to not at all important. Price-sensitive respondents are those respondents who choose the answer "price is very important". In the 2013 survey, there is a question recording if the respondent buys locally produced and seasonal food whenever possible as an action against climate change that was recorded only in this survey. We name this "Food miles". In the 2017 study, a question reports the income quintile in which the respondent's household belongs. The 2015 and 2017 studies document the respondents' self-placement to a social class.

This work aims to classify European consumers into PDO logo aware or non-aware based on a series of characteristics portrayed by hypotheses 1 to 9. Our data analysis strategy is to test each one of the hypotheses by examining the relationship between the PDO logo recognition dependent binary variable and the independent variables. To this end, we utilise all four surveys by pooling them into one large data set containing all common questions and corresponding socio-demographic variables to test hypotheses 1 to 5. In this way, we can benefit from the statistical power of large samples and extract very safe conclusions that are representative for the whole EU and the individual member states. Then, to examine hypotheses 6 to 9, we utilise data only from the survey that contains the particular question that corresponds to the hypothesis under consideration. Table 1 describes the variables that are common across the four surveys and the variables that are included only in specific studies. Descriptive statistics are weighted using the population stratification weights provided by Eurobarometer.

Logistic regression is a fundamental and accessible and thus widely understood algorithm, especially for binary classification problems. Amongst the various statistical models that can potentially take account of the hierarchical clustering of the data, we adopt the multilevel logistic regression analysis (three-level) with random intercept that is of extensive use in market research (Hox *et al.*, 2017; Wieseke *et al.*, 2008). This model acknowledges that two randomly chosen European consumers in the same area of the same country will tend to be more alike in their awareness of the PDO logo, adjusted for their characteristics. Thus, country and region effects can condition the level of PDO logo awareness by equally influencing all residents. These country and region impacts may be a result of several factors, including those associated with an area's culinary heritage and culture, food trade networks, institutions, for example, how active they are in reaching out to the general public and any other unobservable, to this study, factor. The significance of country and region effects will assist us in testing hypotheses 10 and 11.

4. Results

The three-level random intercept logistic regression was estimated five times on five different samples. One sample pooled all surveys together and assessed the contribution of demographic and socio-economic variables which are common across them. A total of four

Variable name	Description	Mean	Standard deviation	Sample size
Dependent variable				
PDO logo	Dummy variable taking the value of 1 if the respondent recognised the PDO logo and 0 otherwise	0.16	0.37	110,365
Independent variables				
Demographics				
Gender	Dummy variable taking the value of 1 if the respondent is female and 0 if the respondent is male	0.52	0.50	110,365
Age	The respondent's age measured in years. In the analysis, the centred variable is used	47.56	18.62	110,365
Household size	The respondent's size of household in number of person including herself. In the analysis, the centred variable is used	2.70	1.41	110,364
Rural	Dummy variable taking the value of 1 if the respondent lives in a rural area and 0 otherwise	0.31	0.46	110,296
Small town	Dummy variable taking the value of 1 if the respondent lives in a small town and 0 otherwise	0.43	0.50	110,296
Large town	Dummy variable taking the value of 1 if the respondent lives in a large town and 0 otherwise	0.25	0.44	110,296
Single no children	Dummy variable taking the value of 1 if the respondent is single without children and 0 otherwise	0.30	0.46	108,991
Single with children	Dummy variable taking the value of 1 if the respondent is single with children and 0 otherwise	0.06	0.24	108,991
Married no children	Dummy variable taking the value of 1 if the respondent is married without children and 0 otherwise	0.31	0.46	108,991
Married with children	Dummy variable taking the value of 1 if the respondent is married with children and 0 otherwise	0.32	0.47	108,991
Human capital				
Education basic	Dummy variable taking the value of 1 if respondent finished education before the age of 14 and 0 otherwise	0.13	0.33	108,812
Education medium	Dummy variable taking the value of 1 if respondent finished education at the age of 15–18 years and 0 otherwise	0.40	0.49	108,812
Education high	Dummy variable taking the value of 1 if respondent finished education at the age of 19–22 years and 0 otherwise	0.23	0.42	108,812
Education very high	Dummy variable taking the value of 1 if respondent finished education after the age of 22 years and 0 otherwise	0.16	0.37	108,812
Education student	Dummy variable taking the value of 1 if respondent is still studying and 0 otherwise	0.09	0.29	108,812
Internet high use	Dummy variable, taking the value of 1 if respondent uses the Internet almost every day and 0 otherwise	0.63	0.48	110,365

(*continued*)

Table 1.
Name, content and descriptive statistics of variables in the data set

Variable name	Description	Mean	Standard deviation	Sample size
Internet medium use	Dummy variable taking the value of 1 if respondent uses the Internet two or three times in a week and 0 otherwise	0.08	0.27	110,365
Internet low use	Dummy variable taking the value of 1 if respondent uses the Internet once a week or less often and 0 otherwise	0.05	0.23	110,365
Internet no use	Dummy variable taking the value of 1 if respondent does not use the Internet and 0 otherwise	0.23	0.42	110,365
Economic and financial				
Retired	Dummy variable taking the value of 1 if respondent is retired or unable to work and 0 otherwise	0.27	0.44	110,365
Self-employed	Dummy variable taking the value of 1 if respondent is self-employed and 0 otherwise	0.08	0.27	110,365
Manager	Dummy variable taking the value of 1 if respondent is employed as manager and 0 otherwise	0.10	0.31	110,365
White collar	Dummy variable taking the value of 1 if respondent is employed as white collar and 0 otherwise	0.11	0.32	110,365
Blue collar	Dummy variable taking the value of 1 if respondent is employed as a blue collar or manual worker and 0 otherwise	0.21	0.40	110,365
House keeping	Dummy variable taking the value of 1 if respondent is a house person and 0 otherwise	0.07	0.25	110,365
Unemployed	Dummy variable taking the value of 1 if respondent is unemployed and 0 otherwise	0.07	0.26	110,365
Student	Dummy variable taking the value of 1 if respondent is a student and 0 otherwise	0.09	0.28	110,365
House	Dummy variable taking the value of 1 if respondent owns a house or is paying a mortgage for it and 0 otherwise	0.68	0.47	110,365
Car	Dummy variable taking the value of 1 if respondent owns a car and 0 otherwise	0.74	0.44	110,365
Financial stress	Dummy variable taking the value of 1 if respondent never had difficulties paying her bills and 0 otherwise	0.63	0.48	108,387
Survey 2012	Dummy variable taking the value of 1 if respondent is in the 2012 survey and 0 otherwise	0.24	0.43	110,365
Survey 2013	Dummy variable taking the value of 1 if respondent is in the 2013 survey and 0 otherwise	0.25	0.43	110,365
Survey 2015	Dummy variable taking the value of 1 if respondent is in the 2015 survey and 0 otherwise	0.25	0.43	110,365
Survey 2017	Dummy variable taking the value of 1 if respondent is in the 2017 survey and 0 otherwise	0.25	0.44	110,365
Country level				
Registered PDOs and PGIs	The average number of registered PDO and PGIs that are produced in a respondent's country in the year of the survey	32.11	46.28	110,365

Table 1. (*continued*)

Variable name	Description	Mean	Standard deviation	Sample size
Survey-specific variables				
Price	Dummy variable taking the value of 1 if respondent considers price to be a very important factor and 0 otherwise, recorded in the 2012 survey	0.65	0.48	26,541
Food miles	Dummy variable taking the value of 1 if respondent buys locally produced and seasonal food whenever possible as an action against climate change and 0 otherwise, recorded in the 2013 survey	0.36	0.48	27,919
Income low	Dummy variable taking the value of 1 if respondent's household income is in the lower-income quintile and 0 otherwise, recorded in the 2017 survey	0.28	0.45	22,763
Income second quintile	Dummy variable taking the value of 1 if respondent's household income is in the second income quintile and 0 otherwise, recorded in the 2017 survey	0.27	0.44	22,763
Income third quintile	Dummy variable taking the value of 1 if respondent's household income is in the third income quintile and 0 otherwise, recorded in the 2017 survey	0.20	0.40	22,763
Income fourth quintile	Dummy variable taking the value of 1 if respondent's household income is in the fourth income quintile and 0 otherwise, recorded in the 2017 survey	0.14	0.35	22,763
Income upper	Dummy variable taking the value of 1 if respondent's household income is in the upper income quintile and 0 otherwise, recorded in the 2017 survey	0.11	0.31	22,763
Social class working	Dummy variable taking the value of 1 if the respondent places herself in the working class and 0 otherwise, recorded in the 2015 and 2017 surveys	0.29	0.45	53,715
Social class low	Dummy variable taking the value of 1 if respondent places herself in the low class and 0 otherwise, recorded in the 2015 and 2017 surveys	0.18	0.38	53,715
Social class medium	Dummy variable taking the value of 1 if respondent places herself in the middle class and 0 otherwise, recorded in the 2015 and 2017 surveys	0.45	0.50	53,715
Social class upper	Dummy variable taking the value of1 if respondent places herself in the upper middle or high class and 0 otherwise, recorded in the 2015 and 2017 surveys	0.09	0.28	53,715

Table 1.

samples, one for each survey, assessed the contribution of additional variables which are not common amongst surveys. All continuous variables, e.g. age and family size, are centred to the sample's mean and from all categorical variables, the analysis excludes one category to avoid complete multicollinearity. The appropriateness of the proposed three-level structure was tested by estimating models without any covariates, i.e. a "null" model, as a single-level logistic regression, as a two-level model with respondent nested in countries, i.e. no cluster (regional) effects, as a two-level model with respondents nested in regions, i.e. no supercluster (country) effects and as a three-level model with respondents clustered in regions and regions clustered in countries. Due to the nested sample structure of the models, log-likelihood ratio

tests provide substantial evidence that the three-level structure is superior to both, the two-level and the single-level structures. Results are robust against various sample structures which exclude certain countries or regions. *Ad hoc* tests for multicollinearity, including a comparison of standard errors under the inclusion of seemingly correlated variables did not reveal any notable problem. All test results are available from the corresponding author upon request. Table 2 shows the estimated odds ratios.

The interpretation of the odds ratios is straightforward. The odds show the probability that a randomly chosen respondent will recognise the logo, to the probability that the respondent does not recognise the logo. The odds ratio is the ratio of the odds under two different conditions. The odds ratio indicates how much the odds that a consumer recognises the PDO logo increase (odds ratio higher than 1) or decrease (odds ratio less than 1) between the two values of a dummy variable or by increasing a continuous variable by one unit. For example, the odds ratio of the variable "Education Very High" in model 1 is 1.821. If the consumer has a high educational level, the odds that he/she recognises the PDO logo are 1.821 times higher or 82.1% higher than the odds of a consumer who only has compulsory education, which is the educational category excluded from the analysis. Of course, with all other variables held constant and no random effects. For the continuous variable household size, the odds ratio in model 1 is 0.973. For an increase of one member above the household's sample average of 2.70, the odds that the consumer recognises the PDO logo decreases by 2.7% [i.e. (1–0.973) × 100%], holding constant all other variables and random effects at 0.

Hypothesis 1 (1a to 1e) tests the effects of demographic variables across all models. Age shows a consistently statistically significant quadratic inverted *U*-shape relation across all models. The odds that a consumer is aware of the PDO logo increase up to middle age and then slightly decrease. Thus, hypothesis 1a is accepted to the part of middle-aged consumers. There is a definite answer of no "gender" effects and therefore, hypothesis 1b is rejected. Household size reduces the odds that the consumer is PDO logo conscious, but this is not consistent across models. So, hypothesis 1c is accepted. From all marital status categories, only married without children have higher odds of PDO logo awareness, but this is not consistent. Accordingly, hypothesis 1d is rejected. Place of residence effects are consistently not statistically significant across all models; therefore, hypothesis 1e is rejected. The quantitative impact of all demographic factors, even when statistically significant, is minimal.

Education is consistently significant with a considerable quantitative effect across all models. As the educational level of the respondent increases, the odds that the consumer is PDO logo aware increase significantly. Therefore, hypothesis 2 is accepted. The effect of Internet use is impressive. Table 1 shows that, across Europe, almost one-quarter of consumers do not use the Internet or do not have access to it. This fact raises some concerns about Internet-based surveys. All Internet use categories have statistically significant odds ratios indicating that Internet use increases the probability that consumers are PDO logo aware. Thus, hypothesis 3 is accepted. However, there is not a clear linear relationship between the intensity of Internet use and awareness as there is for education.

Self-employed, white-collar or those involved in the management have statistically significant higher odds ratios of being PDO aware. This result may just reflect the fact that these occupational categories address more educated and skilful consumers. The same holds for retired consumers, but this may be due to more time available for food search. Therefore, hypothesis 4 is only partly accepted because for those consumers who deal with housekeeping is rejected. Consumers who own a house, a car or do not face financial issues are more likely to be PDO logo aware. So, hypothesis 5 is accepted.

The odds ratio of the "price-sensitive" consumer in the column for model 2 of Table 2 is 0.795. In other words, the odds of being logo aware are 20.5% less than the odds of a consumer who has not stated price as a critical determinant. Therefore, hypothesis 6 is accepted. Results

	Model 1 (all surveys together)	Model 2 (2012 survey)	Model 3 (2013 survey)	Model 4 (2017 survey)	Model 5 (2015 and 2017 surveys)
Fixed effects					
Gender	0.974	1.035	0.932	0.867***	0.958
Age_centred	0.995***	0.996**	0.991***	0.993**	0.995***
Age_ centred squared	1.000***	1.000***	1.000**	0.999***	1.000***
Household size	0.973**	0.965	0.953*	1.005	0.973
Rural	0.964	1.130	1.013	1.033	0.877
Small town	1.033	1.039	1.009	1.061	0.963
Single with children	0.922	1.034	1.153	0.962	0.759*
Married no children	1.090***	1.144***	1.165**	0.933	1.028
Married with children	1.023	1.080	1.115	0.943	0.976
Education medium	1.180**	1.329***	1.044	1.053	1.192***
Education high	1.608***	1.532***	1.472***	1.613***	1.732***
Education very high	1.821***	1.782***	1.762***	1.738***	1.827***
Education student	1.690***	1.526***	1.942***	1.719**	1.553***
Internet high use	1.471***	1.469***	1.253*	1.731***	1.588***
Internet medium use	1.535***	1.591***	1.231	1.576***	1.618***
Internet low use	1.517***	1.663***	1.389**	1.230	1.483***
Retired	1.124*	1.256**	1.172	1.322***	1.053
Self-employed	1.292***	1.106	1.382**	1.461**	1.284***
Manager	1.175***	1.254*	1.174	1.098	1.072
White collar	1.156**	0.928	1.345**	1.252	1.152*
Blue collar	1.012	0.881	1.301	0.892	0.958
House keeping	0.945	0.828	1.071	0.829	0.948
House ownership	1.139**	0.980*	1.146	1.276**	1.187**
Car ownership	1.107**	1.149*	0.904	1.108	1.164**
Financial stress	1.125**	0.983	1.143	1.022	1.131***
Survey 2012	0.825				
Survey 2013	0.688**				
Survey 2015	1.139				1.205***
Registered PDOs and PGIs	1.005	1.012***	1.010***	1.010***	1.010***
Price		0.795***			
Food miles			1.613***		
Income second quintile				1.000	
Income third quintile				1.288***	

(*continued*)

Table 2.
Estimated odds ratios from the three-level logistic models

	Model 1 (all surveys together)	Model 2 (2012 survey)	Model 3 (2013 survey)	Model 4 (2017 survey)	Model 5 (2015 and 2017 surveys)
Income fourth quintile				1.441**	
Income upper				1.281***	
Social class low					1.015
Social class medium					1.129**
Social class upper					1.137
Constant	0.057***	0.050***	0.036***	0.044***	0.047**
Random effects					
Estimated variance of country effect	0.339*	0.266***	0.290***	0.458***	0.404***
Estimated variance of regional effect	0.163***	0.268***	0.248***	0.602***	0.340***
ICC (%)	13.24	13.96	14.05	24.37	18.44
Statistics					
Log-likelihood	−40,817.502	−8,945.247	−8,960.361	−8,397.939	−21,343.830
Observations	105,657	25,323	26,515	22,315	52,010
Regions	208	206	208	205	206
Countries	28	27	28	28	28

Table 2.

Note(s): Three, two and one asterisk indicate significance at 1, 5 and 10%, respectively

in the column for model 4 of Table 2 provide supporting evidence that household income is positively related to PDO logo recognition. The odds ratios that a respondent whose household income is in the third-, fourth- and upper-income quintiles recognises the logo are 1.288, 1.441 and 1.281, respectively. So, hypothesis 7 is accepted. Social class self-placement was coherently measured only in the 2015 and 2017 surveys. Consumers who identify themselves as being "middle class", show a statistically significant odds ratio that the logo is recognised as 1.129 as shown in the column for model 5 of Table 2. Therefore, hypothesis 8 is partly accepted for consumers identified as "middle class" and rejected for those identified as "upper class". Food miles sensitive is a consumer who considers buying local food as an action against climate change. The column for model 3 in Table 2 shows that the odds ratio that a "food miles sensitive" respondent recognises the PDO logo is 1.613. This odds ratio means that the "food miles sensitive" respondent has 61% odds higher to be logo aware. So, hypothesis 9 is accepted.

The number of registered products at the national level is statistically significant in all but model 1. The relationship between this variable and logo recognition is statistically significant and quantitatively prominent but still ambiguous due to its failure in the large sample of model 1. Therefore, hypothesis 10 is inconclusive. However, the analysis of the random effects that follows sheds light on the country and region variation in the levels of logo recognition.

Table 2 also shows the effects of living in specific countries and regions on logo recognition. The estimated intraclass correlation coefficients (ICCs) show that a very significant part of the data variation is due to their clustering in regions and countries. Predicted random effects for countries and regions average to 0. We call a "typical" region or a

"typical" country, the region or country whose random effects are 0, respectively. If a respondent lives in a "typical" country, the odds ratio of recognising the logo is determined only by individual characteristics. Contrarily, if the respondent lives in a country whose random effects are significantly different from 0, the odds ratio of recognising the logo is determined by the consumer's characteristics plus the effect of the country.

Panel (a) of Figure 1 shows a caterpillar of the predicted country random effects. Random effects for countries range from −1 for the UK and Denmark to +1 for France. Thus, a respondent who lives in a typical region of France has almost triple the odds of recognising the PDO logo from a respondent with precisely the same personal characteristics who lives in a "typical" region of a "typical" country. It is important to note that for 17 out of the 28 EU countries, random effects are not statistically different from 0 as their confidence intervals include 0. From the rest of the countries, four have negative random effects and seven have positive random effects. Of course, positive effects refer to countries like France or Greece, which excel in consumers' PDO logo recognition. For Slovakia and the Czech Republic whose random effects are around 0.65, the corresponding odds ratio is 1.91 or almost double the odds of recognising the PDO logo. The exciting story to tell out of the regional effects is outside the space limits and scope of the present work. The interested reader can observe the panel (b) of Figure 1. Thus, hypothesis 11 is accepted especially for those countries and regions whose estimated country and region random effects are statistically different from 0.

5. Conclusions and discussion

The introduction chronicled the recommendation of the European Court of Auditors' (2011, paragraph 65) to the Commission of the EU for building "a clear strategy on how to raise awareness". The classification of European consumers is a baseline and starting point for creating such a strategy. Each one of the hypotheses provides material and ideas for discussion. However, there are three "take-home messages" useful in designing future awareness-raising efforts. First, consumers are highly fragmented to numerous segments. This fact calls for more targeted and "tailor-made" reaching-out activities. Second, the segmentation requires multiple tools and methods and an increase in European collaborative activities. Third, quality products and their labels and logos already face and should continue to look out on new challenges.

The numerous consumer segments are evident by observing the alluvial diagrams of Figure 2. These diagrams portray the concurrent relationship between PDO logo recognition, Internet use and other personal characteristics.

The panel at the top left utilises the full sample of 110,000 respondents and is indicative of the real opportunities to enlarge the "logo awareness" segment. From the segment of the 19,942 well-educated respondents, 18,608 use the Internet frequently or infrequently. The top light and dark grey alluvials connecting, from left to right, the "Very High" education category to the Internet "Yes" use category depict this relation. From those 18,608 respondents, 15,570 (84%) did not recognise the PDO logo as illustrated by the grey alluvial connecting the "Very High" education category to the "Yes" Internet category and the "No" logo recognition category. These 15,570 respondents form a suitable segment to be targeted by promotion efforts aiming to increase logo recognition. Almost 6,000 (38%) of these respondents live in Sweden, Denmark, Finland and The Netherlands, and 10% live in France, Italy, Spain, Greece and Portugal. As a result, it is plausible to think of reaching out efforts based on collaborative activities between south-European producers that will aim to target the Scandinavian educated and Internet-literate consumer.

The plethora of segments and evidence provided by this work should make marketing designers reconsider the marketing research methods and tools for reaching out to the European consumer. Almost a quarter of the European consumers never use the Internet, and this proportion is highly variable amongst countries. Thus, conventional information

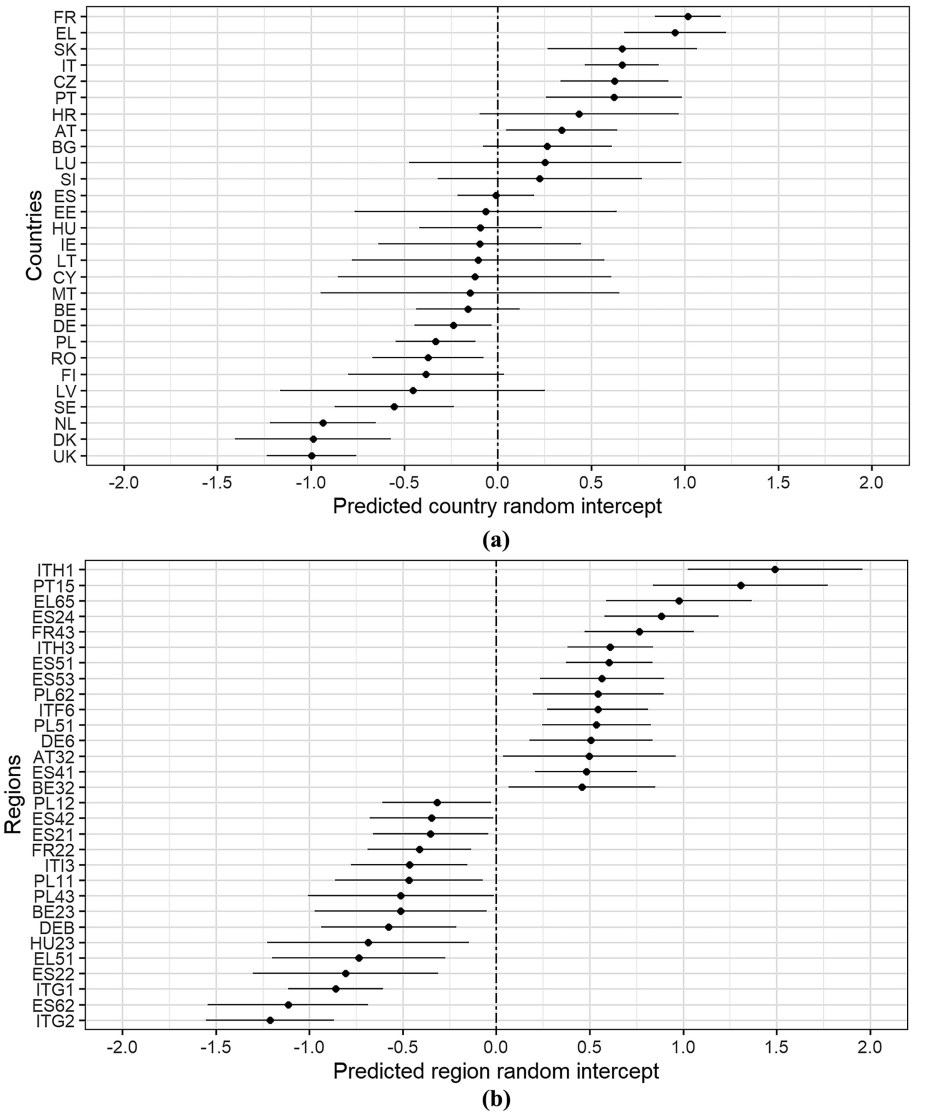

Figure 1.
Predicted random effects

Note(s): In both panels, the vertical dashed line is the sample mean. Dots represent point estimates, and horizontal lines show the 95% confidence intervals. In panel (b), appear only the regions with the 15 lowest and the 15 highest random scores

dissemination tools or marketing research methods can have a place alongside Internet-based tools. In the top-left panel of Figure 2, there is a very small dark grey alluvial of 692 respondents connecting the "Basic" education category with the "No" Internet use and the "Yes" PDO logo recognition category. Similar to this, at the top-right panel of Figure 2, a very small alluvial (dark grey alluvial) captures 158 "low" quintile income respondents who do not

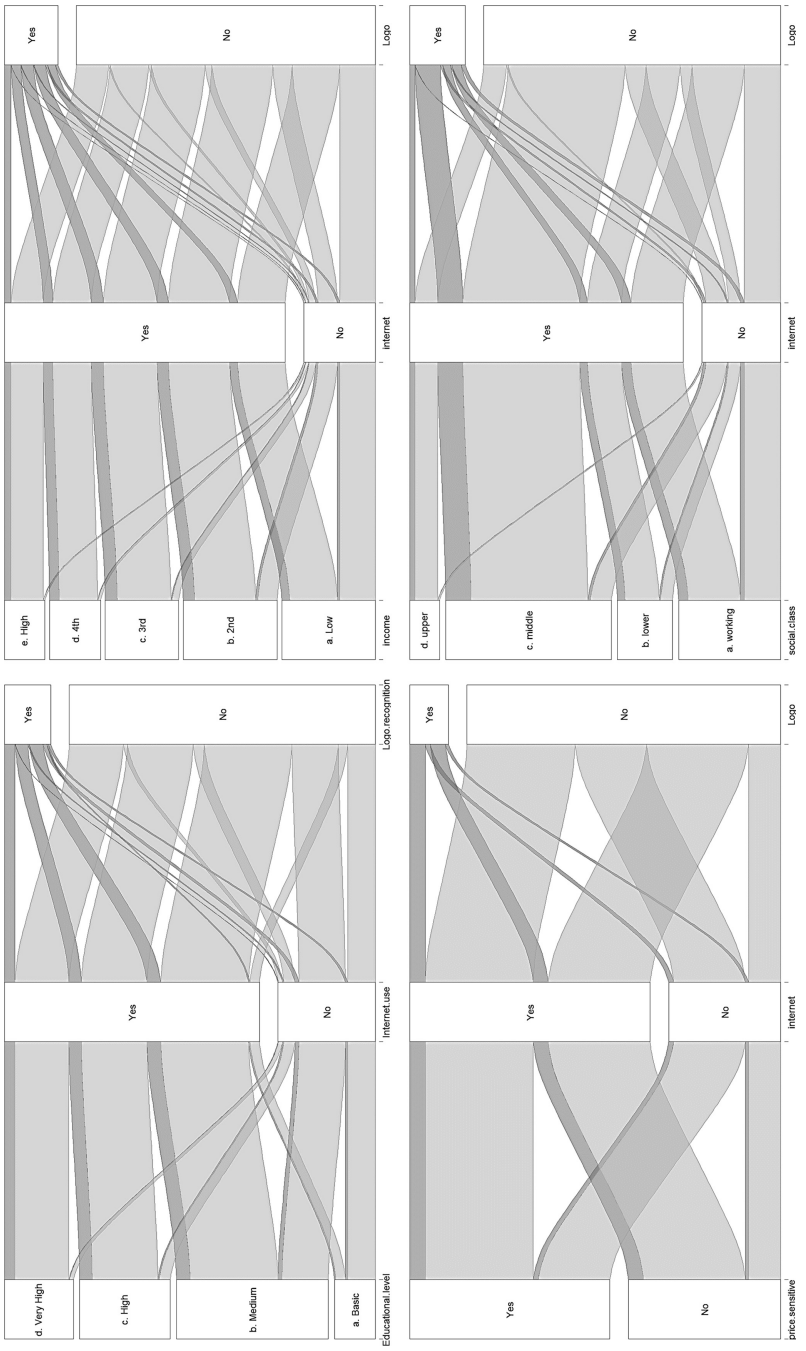

Figure 2.
Segments of logo-aware and non-aware consumers

have access to the Internet but they recognise the PDO logo. These two groups of respondents behave "against the odds" of this work's classification rules. It may be very informative to know the conditions which defy the odds for two reasons. First, to guide the design of very targeted awareness-raising campaigns and second, to support the make-up of market research focus groups with "outliers". The panel at the bottom left of Figure 2 unfolds some logo recognition segments of the price-sensitive respondents. One explanation is that the price-sensitive consumer usually shops at outlets that do not hold a large number and variety of PDO products. So, the chance to be exposed to the PDO logo through actual shopping is small. In this case, marketing efforts should consider targeting directly discount and similar outlets rather than the consumer.

Finally, evidence from this work shows that food miles-sensitive consumers are more likely to be PDO logo aware. Nevertheless, food-mile-thoughtful consumers may be consumers of local or of distant PDO products. In the first case, logo awareness will have a positive effect on purchasing decisions. However, in the case of the distant consumer, PDO logo awareness may prevent purchase. Marketing efforts should face this challenge by reforming the PDO logo to a sustainability and climate change friendly assurance label and calling attention to the low total carbon footprint of local products and their support to the natural environment and the rural landscape. In general, quality food labelling and the voluntary or compulsory use of logos together with the emergence and growth of many alternative food supply chains should meet consumer concerns about the environment, climate change and a range of ethical or political issues spanning over fair trade, work conditions, animal welfare and the political economy of local and rural development.

This work categorised European consumers as concerns their PDO logo awareness. A total of four consecutive Eurobarometer surveys from 2012 to the end of 2017 drawing up a cumulative sample of over 110,000 European consumers reaffirm the indisputably low recognition rates in comparison to organic and Fair Trade logos. This work revealed the significant demographic, human capital, socio-economic characteristics, price considerations and attitudes that differentiate aware from non-aware consumers. It also exposed the influence of geography on awareness, in terms of country and region effects.

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Corresponding author
Dimitris Skuras can be contacted at: skuras@econ.upatras.gr