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Corresponding Author: Dr. Simona Scabrosetti,

Corresponding Author's Institution:

First Author: Donatella Baiardi

Order of Authors: Donatella Baiardi; Riccardo Puglisi; Simona Scabrosetti

Abstract: The aim of this study is to examine how perceptions of food quality are explained by demographic and socio-economic features at the individual level. We analyze data from the 2010 Eurobarometer Special Survey on Risk Perception. By estimating ordered logit models, we find that women, older and more educated individuals are more interested about calories, safety and taste. Moreover, parents are more conscious about price, hunger satisfaction and safety, while managers care more about conviviality. Manual workers, house-persons and unemployed individuals are especially careful regarding prices. We also perform a Principal Component Analysis to investigate the unobserved drivers of individual responses.

Milan and Pavia, November 29<sup>th</sup>, 2015

Letter to the Editor

Professor Armand Cardello  
Editor  
Food Quality and Preference

Re: Ms. Ref. No.: FQAP-D-15-00323R1  
“Individual Attitudes on Food Quality and Safety: Empirical Evidence on EU Countries”

Dear Professor Cardello,  
We thank you for having accepted our manuscript. We cleaned up all minor formatting errors and we are submitting our revised manuscript.

With our best regards,

Donatella Baiardi  
Riccardo Puglisi  
Simona Scabrosetti

# Individual attitudes on food quality and safety: Empirical evidence on EU countries

Donatella Baiardi<sup>a</sup>, Riccardo Puglisi<sup>b</sup>, Simona Scabrosetti<sup>c,\*</sup>

<sup>a</sup>*Department of Economics, Quantitative Methods and Business Strategies, University of Milan Bicocca, Italy*

<sup>b</sup>*Department of Political and Social Sciences, University of Pavia, Italy*

<sup>c</sup>*Department of Law, University of Pavia, Italy*

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## Abstract

The aim of this study is to examine how perceptions of food quality are explained by demographic and socio-economic features at the individual level. We analyze data from the 2010 Eurobarometer Special Survey on Risk Perception. By estimating ordered logit models, we find that women, older and more educated individuals are more interested about calories, safety and taste. Moreover, parents are more conscious about price, hunger satisfaction and safety, while managers care more about conviviality. Manual workers, house-persons and unemployed individuals are especially careful regarding prices. We also perform a Principal Component Analysis to investigate the unobserved drivers of individual responses.

*Keywords:*

Individual perceptions, Food quality, Eurobarometer Special Survey on Risk Perception

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## 1. Introduction

Food quality is generally defined according to three distinct types: product-oriented, process-oriented and user-oriented quality (Grunert, 1995). Product-oriented quality refers to those physical properties of food that can be objectively measured, while process-oriented quality is related to the characteristics of the production process.

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\*Corresponding author. Address: Department of Law, University of Pavia, Corso Strada Nuova 65, 27100 Pavia, Italy. Tel.: +39 0382 984356; fax: +39 0382 98.4402. E-mail address: simona.scabrosetti@unipv.it (S. Scabrosetti).

On the other hand, user-oriented quality refers to the *perceptions* held by consumers, which are harder to measure in a replicable way (Cardello, 2015). User-oriented quality involves various attitudes about food consumption *per se* (hunger satisfaction, taste, appearance) and its convivial aspects. Interestingly, price could be also considered as a signal of quality, since it is connected with a personal judgment about whether it is affordable and fair relatively to what is purchased.

From this point of view, since food preferences about sensory attributes, convenience and conviviality are the basis of actual consumption choices, the existing literature has focused on the individual-level variables that help explain the importance attached by consumers to different aspects of user-oriented quality. More precisely, several studies investigate the role played by gender and age in explaining specific perceptions about food consumption (Rappoport et al., 2001; Dosman et al., 2001; Verbeke, 2005; Kyutoku et al., 2012), while other studies are focused on the relationship between those attitudes and some relevant socio-economic characteristics of the individual, such as income, educational level, marital status, household composition, social class and place of residence (Dosman et al., 2001; Verbeke, 2005; De Boer et al., 2007; Hearty et al., 2007).

The current paper builds upon this literature, providing original contributions along different lines. First of all, differently from the previous literature, we do not focus on perceptions about specific circumstances related to food consumption, but on consumers' perceptions on food and eating in a more general fashion. On the other hand, similarly to previous studies, we explain user-oriented quality as a function of demographic and socio-economic variables at the individual level.

We do that by using the 2010 Eurobarometer Special Survey on Risk Perception, which allows us to simultaneously analyze a large set of psychological factors generally associated to user-oriented quality. These perceptions refer to hunger satisfaction, spending time with family and friends, convenience, freshness, taste, calories and safety.

Second, we take advantage of the fact that the Eurobarometer database is a statisti-

cally representative survey which includes 26,691 citizens of 27 European countries. To our knowledge, this is actually the largest survey on food perceptions at the individual level.

Third, for the first time we analyze this publicly available dataset by means of multivariate regression analysis. In fact, to our knowledge, no systematic regression analysis has been performed before, with the only exception of Vainio et al. (2014), who focus on the subsample of Finnish respondents.

Summing up, our aim is to assess at the overall EU level the external validity of previous findings, that are based upon smaller surveys, whose participants are citizens of specific countries or cities, and are often asked about specific types of food. The generality of our approach would thus provide a more robust grounding to micro-targeted marketing strategies and public awareness campaigns.

## 2. Data and methods

### 2.1. Participants

We use data from the Eurobarometer 73.5 Special Survey on Risk Perception (European Commission, 2010). A representative sample of 26,691 individuals of 27 European countries, aged 15 years and above, is considered. Data have been collected by face-to-face interviews in mother tongue across the 27 European countries, during June 2010.

The sampled countries are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden and the United Kingdom.

### 2.2. Dependent variables

We focus on the following question: ‘To what extent do you associate food and eating with each of the following?’. The six associated perceptions of food quality –which we use as dependent variables– are respectively: (1) ‘Satisfying your hunger’ ( $Hunger_i$ ), (2) ‘Enjoying a meal with friends or family’ ( $Conviviality_i$ ), (3) ‘Selecting fresh and tasty foods’ ( $Taste_i$ ),

(4) ‘Looking for affordable prices’ ( $Price_i$ ), (5) ‘Checking calories and nutrients such as fat and sugar, etc.’ ( $Calories_i$ ), and (6) ‘Being concerned about the safety of food’ ( $Safety_i$ ). The answer ranges from ‘To a large extent’ to ‘Not at all’, and they have been recoded in a 1-4 scale where 1=‘Not at all’ and 4=‘To a large extent’. We exclude from the analysis the answer ‘Don’t know’.

Table 1 about here

On average, as shown Table 1, the most important concern of respondents is taste, while conviviality and hunger satisfaction rank second and third, respectively. Price is fourth in rank, while safety and calories are fifth and sixth.

### 2.3. Respondents’ profile

We extract from the questionnaire some demographic and socio-economic features of respondents, and create a set of indicator and categorical variables: (i) the gender ( $Female_i$ : 1 if she is a female, 0 otherwise); (ii) the place of residence ( $Rural_i$ ,  $Small_i$  and  $Large_i$  for rural area, small or large city respectively); (iii) marital status ( $Married_i$ ,  $Partner_i$  if he/she is single but living with a partner,  $Single_i$ ,  $Divorced_i$  and  $Widow_i$ ); and (iv) the employment status ( $Selfemployed_i$ ,  $Manager_i$ ,  $Whitecollar_i$ ,  $Manual_i$  if he/she is a manual worker,  $Unemployed_i$ ,  $Houseperson_i$ ,  $Student_i$ ,  $Retired_i$ ).

We also include the age of the respondent ( $Age_i$ ) which is coded on a 1-4 ordered scale, where a value of 1 is for those who are between 15 and 24 years old, 2 for those between 25 and 39, 3 for those between 40 and 54, and 4 for respondents aged 55 and above. The respondent’s self-assessed level in society ( $Income_i$ ) is measured on an increasing [1, 10] scale, where 1 stands for the lowest level and 10 for the highest: because of the lack of an objective classification of income along a discrete scale of thresholds, we use this variable as a proxy for household income. The family composition of the respondent ( $Children_i$ ) is captured by the number of children less than 10 years living in the household. This variable takes on values from 0 (no children) to 4 (four children or more). The respondent’s education

level is measured by years of schooling ( $Schooling_i$ ) and frequency of internet use at home ( $Internet_i$ ). In the case of  $Schooling_i$ , a value of zero indicates that the respondent finished his/her studies till an age of 15, up to a value of three if he/she finished his/her studies at an age of 26 or more.  $Internet_i$  ranges from 1 (never) to 7 (everyday).

Summary statistics of these variables are reported in Tables 2 and 3.

Tables 2 and 3 about here

The majority of respondents are women (53.91%), while the median age group is the one between 40 and 54 years. The median number of children is zero (80.54% of respondents have no children below 10 years old). Respondents mostly live in rural areas or in a small town, while only 28.26% live in a large city. Most of respondents are married (52.33%), but there is a sizeable proportion of singles (19.02%). Regarding occupational status, most of the respondents are retired (27.93%), followed by manual workers (19.94%), white collars (11.19%) and managers (10.15%).

#### 2.4. Statistical Procedure

We estimate a set of ordered logit models: the latent response variables are (linearly) modeled as follows:

$$Y_i^* = \beta_0 + \beta_1 Female_i + \beta_2 Age_i + \beta_3 Income_i + \beta_4 Children_i + \beta_5 Education_i + \beta_6 Community_i + \beta_7 Marital_i + \beta_8 Occupation_i + \mu_c + \epsilon_i, \quad (1)$$

where the subscript  $i$  is referred to the  $i$ -th respondent.  $Y_i^*$  is the latent response variable behind each observed categorical variable about food perceptions, i.e.,  $Hunger_i$ ,  $Conviviality_i$ ,  $Taste_i$ ,  $Price_i$ ,  $Calories_i$  and  $Safety_i$ . In order to save space,  $Education_i$  refers to  $Schooling_i$  and  $Internet_i$ ,  $Community_i$  indicates the respondent's place of residence ( $Rural_i$ ,  $Small_i$  and  $Large_i$ ); analogously,  $Marital_i$  and  $Occupation_i$  refer to the variables regarding marital ( $Married_i$ ,  $Partner_i$ ,  $Single_i$ ,  $Divorced_i$  and  $Widow_i$ ) and occupational status ( $Selfemployed_i$ ,

$Manager_i$ ,  $Whitecollar_i$ ,  $Manual_i$ ,  $Unemployed_i$ ,  $Houseperson_i$ ,  $Student_i$  and  $Retired_i$ ). Finally,  $\mu_c$  is a country-specific effect and  $\epsilon_i$  is the error term. In order not to inflate the precision of our estimates, ordered logit models are estimated by clustering the standard errors at the country level (Bertrand et al., 2004).

Statistical analysis is performed by using the STATA 12.0 software.

### 3. Results

#### 3.1. Main results

The estimated proportional odds ratios are shown in Table 4.

Table 4 about here

Cut1, Cut2 and Cut3 differentiate between the adjacent levels of each dependent variable when explanatory variables are at zero. Cut1 is the estimated cutpoint on the latent variable to differentiate ‘Not at all’ from the other responses. Cut2 differentiates ‘Not at all’ and ‘Not very much’ from ‘Somewhat’ and ‘To a large extent’. Cut3 differentiates the first three more negative responses from ‘To a large extent’.

First, we find that women are significantly more interested than men in conviviality, taste, price, calories and safety, while they are less focused on hunger satisfaction. In the case of food calories the odds of higher versus lower values answers is 1.73 times greater for women than for men, while the odds ratio for food safety is 1.5. On the other hand, the odds for women to be more concerned about hunger satisfaction *vis a vis* men is 0.91.

Hunger satisfaction and conviviality are relevant for the youngsters, while taste, calories, price and safety are important for the elderly. For a one unit increase in the age variable scale, the odds of higher score versus lower score answers are 0.90 and 0.95 times lower in the case of hunger satisfaction and conviviality respectively. On the contrary, regarding calories and safety, the odds of higher versus lower answers are 1.16 and 1.13 times greater.

An increase in socio-economic status is positively and significantly related to conviviality and taste. Not surprisingly, hunger satisfaction and prices are instead more worrisome for low income respondents.

Individuals living with children are more concerned about price, hunger satisfaction and safety. For a one unit increase in the number of children, the odds of higher versus lower answers are 1.09, 1.07 and 1.04 times greater in the case of price, subsistence and safety respectively.

Moreover, more educated people are especially interested in calories, conviviality, taste and safety, while they are less concerned about prices.

Respondents living in rural areas are less concerned about prices and calories than the excluded category of those living in large cities, while those living in small towns are less worried about safety.

Taking singles as benchmark, we find that prices are a matter of concern to married individuals, those living with a partner and divorced individuals. We also find that people who are married or living with their partner are significantly more interested in conviviality and in taste. Moreover, married people are more focused on safety and calories.

Taking white collars as benchmark, managers and retirees are less concerned about hunger satisfaction. Self-employed, managers and manual workers are more interested in conviviality, while the opposite holds for retirees. Self-employed individuals appreciate food taste the most. Manual workers, unemployed individuals and house-persons are significantly more concerned with prices. For example, for unemployed individuals the odds of higher versus lower score answers are 1.64 times greater than for white collars. Calories are significantly less relevant to self-employed, manual workers and the unemployed. Finally, self-employed individuals and students are less interested in price and safety.

### *3.2. Unobserved patterns of attitudes*

To check the unobserved patterns which drive perceptions about food quality we perform a Principal Component Analysis.

Table 5 near here

Table 5 shows the explained and cumulative variance for the first three components ( $PC_1$ ,  $PC_2$  and  $PC_3$ ), together with the item loadings, as obtained after orthogonal rotation. The optimal number of components is chosen according to Kaiser’s Criterion, which picks up those components whose eigenvalue is greater than one (see Table 5). We thus focus on the first two components. This choice also satisfies the ‘explained variance criterion’, according to which the optimal number of components must explain more than 50% of the variance.

$PC_1$  displays positive weights on all perceptions, with the only exception of calories, while  $PC_2$  displays positive and large loadings on calories and safety. Consequently, these two components reveal a dichotomy between those aspects related to the primary dimension of food (hunger satisfaction, conviviality and taste), as captured by  $PC_1$ , versus those related to the secondary, ‘post-modern’ dimension, which refers to calories and safety ( $PC_2$ ).

By multiplying each loading by the row data of each respondent, we generate two new variables ( $PC_{1,i}$  and  $PC_{2,i}$ ), and regress them against the explanatory variables used in the previous analysis. Here we estimate OLS regressions, with standard errors again clustered at the country level.

Table 6 near here

Results are shown in Table 6. We focus on those explanatory variables that display statistically significant coefficients with opposite signs in the two regressions, or that are significantly related with only one of the two components.

Manual workers and unemployed individuals have a significantly higher first component and a significantly lower second component. Respondents living with children have a significantly higher first dimension. The second component is positively and significantly related to age, income, internet use, and being divorced, while it is negatively related to being a student, self-employed or retired.

Finally, some explanatory variables (schooling, and the female, married and partner indicators) show positive and significant coefficients for both components.

## 4. Discussion

### 4.1. *Perceptions and socio-economic characteristics of European citizens*

Our purpose is to examine how perceptions of food quality are explained by demographic and socio-economic features of respondents. As discussed by Rappoport et al. (2001) and Kyutoku et al. (2012), food choices are based upon the conceptualization of ‘*what people desire to eat, what they believe they ought to eat and what they usually consume across food properties*’. The generality of our study is not only related to the representativeness of the sample, but also to the fact that we refer to food perceptions overall, rather than to a specific type of food.

Our results on women are in line with the existing literature that shows a large consensus about female consumers being more risk averse in terms of food purchases and safety (Dosman et al., 2001; Verbeke, 2005; de Boer et al., 2007; Healty et al., 2007). Moreover, older and more educated individuals are more conscious about calories and show higher risk aversion (Dosman et al., 2001; Verbeke, 2005).

Social class displays an important explanatory power: self-employed individuals exhibit higher awareness towards taste and conviviality. Manual workers, house-persons and unemployed individuals are especially careful regarding prices: this confirms the large difference in attitudes between the non-manual and manual social classes, as emphasized in the literature (Barker et al., 1995; Healty et al., 2007).

Moreover, our results might be relevant in terms of marketing strategies. In fact, micro-targeting of advertising campaigns strongly benefits from the knowledge of how perceptions influence choices. Our study sheds light on the socio-economic characteristics that predict the importance of those psychological factors. Thus, marketing campaigns that focus on specific aspects of user-oriented quality, e.g., calories, taste or safety, can be more efficiently

targeted at those subgroups within the EU population that are more concerned about such aspects of subjective quality.

Because of their generality, our results might also be useful from a public communication perspective. For example, campaigns aimed at raising or creating awareness about the risks of specific diets can be better targeted to population subgroups that are found to be more or less concerned with those risks.

#### *4.2. Limitations*

There are two main limitations to our empirical approach. First, survey data could be affected by biases due to the response process itself (Bertrand and Mullainathan 2001, McFadden et al. 2005). Question ordering could induce respondents to attach a larger weight to the aspect that is covered first. Moreover, because of social desirability concerns, respondents might make up an opinion when they do not have one and they might display some tendency to agree with *all* questions being posed.

The second limitation is that we are bound to focus on the features of user-oriented quality that are available within the survey. Although these variables capture many of the attitudes previously analyzed by the literature, we recognize that there are other subjective aspects of food quality that we cannot measure and analyze.

### **5. Conclusion**

We analyze how demographic and socio-economic variables at the individual level explain the perception of different features of food quality. Our results show that women put more attention than men on calories and safety. Age, education and income are positively related to taste and calories. Married individuals care about conviviality, safety and taste, while the occupational status leads to significantly different attitudes toward prices.

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**Table 1:** Summary statistics: dependent variables

	Mean	Median	Std. Dev.	Min	Max	Obs
<i>Hunger<sub>i</sub></i>	3.31	3	0.73	1	4	26,569
<i>Conviviality<sub>i</sub></i>	3.42	4	0.69	1	4	26,562
<i>Taste<sub>i</sub></i>	3.55	4	0.62	1	4	26,597
<i>Price<sub>i</sub></i>	3.29	3	0.75	1	4	26,577
<i>Calories<sub>i</sub></i>	2.64	3	0.99	1	4	26,568
<i>Safety<sub>i</sub></i>	3.12	3	0.84	1	4	26,565

**Table 2:** Summary statistics: indicator variables

	Proportion
<b>Gender</b>	
<i>Female<sub>i</sub></i>	53.91
<b>Place of residence</b>	
<i>Rural<sub>i</sub></i>	35.90
<i>Small<sub>i</sub></i>	35.68
<i>Large<sub>i</sub></i>	28.26
<b>Marital status</b>	
<i>Married<sub>i</sub></i>	52.33
<i>Partner<sub>i</sub></i>	9.94
<i>Single<sub>i</sub></i>	19.02
<i>Divorced<sub>i</sub></i>	7.44
<i>Widow<sub>i</sub></i>	9.48
<b>Occupational status</b>	
<i>Selfemployed<sub>i</sub></i>	7.11
<i>Manager<sub>i</sub></i>	10.15
<i>Whitecollar<sub>i</sub></i>	11.19
<i>Manual<sub>i</sub></i>	19.94
<i>Houseperson<sub>i</sub></i>	6.99
<i>Unemployment<sub>i</sub></i>	8.38
<i>Retired<sub>i</sub></i>	27.93
<i>Student<sub>i</sub></i>	8.30

**Table 3:** Summary statistics: categorical variables

	Mean	Median	Std. Dev.	Min	Max	Obs
<i>Age<sub>i</sub></i>	2.89	3	1.05	1	4	26,691
<i>Income<sub>i</sub></i>	5.64	5	1.83	1	11	26,691
<i>Children<sub>i</sub></i>	0.28	0	0.65	0	4	26,691
<i>Schooling<sub>i</sub></i>	2.03	2	0.75	0	3	26,200
<i>Internet<sub>i</sub></i>	4.51	6	2.52	1	7	26,691

**Table 4:** Ordered logit estimates: odds ratios

	<i>Hunger<sub>i</sub></i>	<i>Conviviality<sub>i</sub></i>	<i>Taste<sub>i</sub></i>	<i>Price<sub>i</sub></i>	<i>Calories<sub>i</sub></i>	<i>Safety<sub>i</sub></i>
<i>Female<sub>i</sub></i>	0.91*** (0.03)	1.27*** (0.05)	1.47*** (0.06)	1.35*** (0.05)	1.73*** (0.08)	1.50*** (0.05)
<i>Age<sub>i</sub></i>	0.90*** (0.03)	0.95** (0.02)	1.11*** (0.03)	1.04* (0.03)	1.16*** (0.03)	1.13*** (0.03)
<i>Income<sub>i</sub></i>	0.96*** (0.01)	1.05*** (0.01)	1.05*** (0.01)	0.89*** (0.01)	1.04*** (0.01)	1.01 (0.01)
<i>Children<sub>i</sub></i>	1.07*** (0.03)	1.01 (0.02)	1.02 (0.03)	1.09*** (0.03)	0.96 (0.02)	1.04** (0.02)
<i>Schooling<sub>i</sub></i>	0.99 (0.03)	1.05* (0.03)	1.15*** (0.02)	0.92*** (0.02)	1.15*** (0.03)	1.11*** (0.03)
<i>Internet<sub>i</sub></i>	0.99 (0.01)	1.05*** (0.01)	1.06*** (0.01)	0.97*** (0.01)	1.06*** (0.01)	1.04*** (0.01)
<i>Rural<sub>i</sub></i>	0.96 (0.06)	1.00 (0.06)	1.03 (0.06)	0.91* (0.05)	0.92* (0.04)	0.99 (0.06)
<i>Small<sub>i</sub></i>	0.95 (0.04)	0.98 (0.06)	1.04 (0.06)	1.00 (0.06)	0.94 (0.04)	0.93* (0.04)
<i>Married<sub>i</sub></i>	0.96 (0.04)	1.46*** (0.09)	1.28*** (0.07)	1.13*** (0.05)	1.20*** (0.04)	1.29*** (0.04)
<i>Partner<sub>i</sub></i>	1.04 (0.06)	1.28*** (0.06)	1.24*** (0.07)	1.14** (0.06)	1.03 (0.04)	1.08 (0.06)
<i>Divorced<sub>i</sub></i>	0.96 (0.06)	1.07 (0.06)	1.08 (0.08)	1.37*** (0.09)	1.05 (0.06)	1.13** (0.06)
<i>Widow<sub>i</sub></i>	0.92 (0.06)	0.99 (0.06)	1.01 (0.07)	1.07 (0.06)	0.93 (0.05)	0.99 (0.04)
<i>Self employed<sub>i</sub></i>	0.98 (0.06)	1.12* (0.07)	1.18** (0.08)	0.82*** (0.06)	0.88** (0.04)	0.89** (0.05)
<i>Manager<sub>i</sub></i>	0.91** (0.04)	1.11* (0.06)	1.05 (0.05)	0.83*** (0.05)	1.02 (0.06)	0.94 (0.06)
<i>Manual<sub>i</sub></i>	1.04 (0.05)	1.09** (0.05)	1.04 (0.06)	1.19*** (0.05)	0.87*** (0.04)	0.92 (0.05)
<i>Houseperson<sub>i</sub></i>	1.04 (0.06)	1.01 (0.07)	1.07 (0.07)	1.20*** (0.08)	0.99 (0.06)	1.05 (0.07)
<i>Unemployed<sub>i</sub></i>	1.03 (0.05)	0.94 (0.05)	0.99 (0.07)	1.64*** (0.12)	0.87*** (0.04)	0.93 (0.05)
<i>Retired<sub>i</sub></i>	0.91** (0.04)	0.92* (0.05)	1.00 (0.06)	1.08 (0.05)	0.97 (0.06)	0.97 (0.07)
<i>Student<sub>i</sub></i>	1.06 (0.08)	0.97 (0.07)	1.00 (0.08)	0.79*** (0.06)	0.92 (0.06)	0.85*** (0.05)
<i>Cut1</i>	0.00*** (0.00)	0.03*** (0.01)	0.04*** (0.01)	0.01*** (0.00)	0.84 (0.12)	0.13*** (0.02)
<i>Cut2</i>	0.03*** (0.00)	0.22*** (0.04)	0.30*** (0.04)	0.06*** (0.01)	3.37*** (0.45)	0.71** (0.10)
<i>Cut3</i>	0.26*** (0.04)	2.20*** (0.36)	3.62*** (0.49)	0.56*** (0.07)	19.20*** (2.43)	5.15*** (0.72)
<i>Country fixed effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	26,087	26,087	26,121	26,095	26,091	26,088

Notes: Standard errors in parentheses. \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

**Table 5:** Principal Component Analysis: factor loadings

	$PC_1$	$PC_2$	$PC_3$
<i>Hunger<sub>i</sub></i>	0.62	-0.22	0.23
<i>Conviviality<sub>i</sub></i>	0.51	0.04	-0.56
<i>Taste<sub>i</sub></i>	0.45	0.23	-0.29
<i>Price<sub>i</sub></i>	0.37	0.12	0.73
<i>Calories<sub>i</sub></i>	-0.10	0.70	-0.01
<i>Safety<sub>i</sub></i>	0.07	0.63	0.09
<b>Eigenvalue</b>	1.65	1.47	0.91
<b>Cumulative Variance</b>	0.27	0.52	0.67

**Table 6:** Principal Component Analysis

	$PC_{1,i}$	$PC_{2,i}$
<i>Female<sub>i</sub></i>	0.09*** (0.01)	0.36*** (0.03)
<i>Age<sub>i</sub></i>	-0.02 (0.01)	0.10*** (0.02)
<i>Income<sub>i</sub></i>	-0.01 (0.01)	0.02*** (0.01)
<i>Children<sub>i</sub></i>	0.03** (0.01)	-0.00 (0.01)
<i>Schooling<sub>i</sub></i>	0.01** (0.00)	0.04*** (0.00)
<i>Internet<sub>i</sub></i>	0.00 (0.01)	0.08*** (0.02)
<i>Rural<sub>i</sub></i>	-0.02 (0.03)	-0.03 (0.03)
<i>Small<sub>i</sub></i>	-0.01 (0.02)	-0.04 (0.03)
<i>Married<sub>i</sub></i>	0.11*** (0.03)	0.17*** (0.02)
<i>Partner<sub>i</sub></i>	0.10*** (0.02)	0.05* (0.03)
<i>Divorced<sub>i</sub></i>	0.05 (0.03)	0.07** (0.03)
<i>Widow<sub>i</sub></i>	-0.01 (0.03)	-0.02 (0.03)
<i>Selfemployed<sub>i</sub></i>	-0.00 (0.03)	-0.08*** (0.03)
<i>Manager<sub>i</sub></i>	-0.03 (0.02)	0.00 (0.03)
<i>Manual<sub>i</sub></i>	0.06** (0.02)	-0.06** (0.03)
<i>Houseperson<sub>i</sub></i>	0.04 (0.03)	0.01 (0.04)
<i>Unemployed<sub>i</sub></i>	0.05** (0.02)	-0.06* (0.03)
<i>Retired<sub>i</sub></i>	-0.04** (0.015)	-0.02 (0.04)
<i>Student<sub>i</sub></i>	-0.03 (0.03)	-0.09** (0.04)
<i>Constant</i>	6.664*** (0.0590)	3.359*** (0.0735)
Country Fixed Effects	Yes	Yes
$R^2$	0.05	0.10
Obs	25,835	25,835

Notes: See Table 4.

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## Letter to Referee 1

We thank you for your useful suggestions that helped us to better focus the original contributions of our paper. See below how we specifically addressed your remarks. As mentioned in the letter to the Editor, now the paper is in the form of a Short Communication.

Also notice that, since all our dependent variables capture different features of user-oriented quality, we decided to rename as “*Taste<sub>i</sub>*” the variable that before was named “*Quality<sub>i</sub>*”.

### *Comment 1*

*In general, in this manuscript the rationale, logic, and method of the study are not clear to me. The authorship team should consider taking a careful look at their analysis plan and make significant adjustments. First, I think the team should clearly identify the main points they would like to make in the paper. This gets lost in the current draft. Once the analysis plan has been streamlined, a reader can clearly walk through the major points that the team is trying to make. In short, I'd like to see an introduction that leads clearly and directly to the proposed hypotheses. Provide a succinct introduction that focuses on a) what we already know from the literature, b) what new concepts this study can address that make a distinct contribution beyond the prior studies, and c) state the hypotheses of the research.*

Following your suggestions, in the new version of the manuscript we completely rewrote the introduction. As a consequence, and also in accordance with the concision of the Short Communication, we organize the new introduction in three main parts: in the first part we focus on what we already know from the existing literature; in the second part we clarify the three original contributions of our paper to this literature.

Those contributions are as follows:

(i) we do not focus on perceptions about specific circumstances related to food consumption, but on consumers' perceptions on food and eating in a more general fashion. We do so by analyzing the 2010 Eurobarometer Special Survey on Risk Perception.

(ii) We exploit the fact that the Eurobarometer database is a statistically representative survey which includes 26,691 citizens of 27 European countries. To our knowledge, this is actually the largest survey on food perceptions at the individual level.

(iii) We are the first to analyze this publicly available dataset by means of multivariate regression analysis. No systematic regression analysis has been performed before, with the only exception of Vainio et al. (2014), who focus on the subsample of Finnish respondents.

In the third part of the introduction we emphasize that our scope is to test the external validity of previous findings within the literature, which are based upon smaller surveys, whose participants are citizens of specific countries, regions or cities, and are often asked about specific types of food.

### *Comment 2*

*Much of the literature cited from the field is outdated. For example, concerning attitudes toward genetically modified food in Italy, the authors cited a paper published 15 years ago. More recent paper have been published since then in Italy (e.g., Prati et al. 2012, in the same journal).*

Following your suggestion at Comment 1, we decided to refer to the existing literature only in the first part of the new introduction and the added Discussion Section. This is also consistent with the suggestions by both the other reviewer and the editor to revise and resubmit the paper in the concise form of a Short Communication. As a consequence, we were restricted to cite the most recent contributions in the literature that are closer to the general aim of our paper: the empirical investigation of the user-oriented quality. More specifically, in the new version of our paper, we did not refer to the literature on GM food.

*Comment 3*

*The manuscript attempted a fairly thorough look at the determinants of individual attitudes on food. However, it was heavy on the statistics but rather light on the implications. It left me asking, "So what?" How can I possibly use this information? It is not clear to me what the theoretical and practical implications of the study are. At present, I feel that the discussion focuses mainly upon description of the findings and not enough on the broader theoretical and practical implications of this data. Finally, the authors should emphasize the new and important aspects of the study.*

The new Subsection 4.1 provides a discussion of the theoretical and practical implications of our main results. We first compare our results with previous findings and we highlight how micro-targeted marketing strategies and public awareness campaigns would benefit from the breadth of our empirical analysis.

*Comment 4*

*The limitation section is missing.*

We discussed the limitations of our approach in the new Subsection 4.2.

## Letter to Referee 2

We thank you for the thorough and enlightening comments and suggestions. Please find below how we addressed them in the revised version of our paper, which now comes in the shape of a Short Communication, as asked by you and the Editor.

Also notice that, since all our dependent variables capture different features of user-oriented quality, we decided to rename as “*Taste<sub>i</sub>*” the variable that before was named “*Quality<sub>i</sub>*”.

### *Comment 1*

*There are (summarised) three problems. There are numerous, sloppy, errors that should have been picked up by proofreading (e.g. page 1 L30 - 27European (no space between 27 and European; L38 "an higher risk aversion" (use A instead of AN). Secondly, the English needs to be checked as word choice is often odd even leading to nonsensical or outright bizarre sentences. The word Whereas is used throughout where "Where" (or a different sentence construction) should be used, rendering many sentences nonsensical. Examples of bizarre sentences are: PIL2 "Food does involve a large set of dimensions" - This is weird. Food is distinctly 3-dimensional, no fewer, no more! P5L16 "A...sample of 26,691 individuals of each Member State" - This states that you had a total sample of 26691\*27 participants (as you claim that each individual member state had 26,691). (PS why capitalise member state). This needs to be fixed throughout. Finally, the MS does not conform to the instructions to authors. The referencing is not conform APA, and there are way too many footnotes to come even close to the demand that "Footnotes should be used sparingly." You should remove the vast majority of the footnotes and make those remaining much shorter.*

We went through the manuscript and we corrected all the typos, we checked our English prose, and we adjusted its format (sections, footnotes and references) to the instructions to the authors. More precisely, in the new version of the paper footnotes have been reduced and references now conform to APA standards.

### *Comment 2*

*Secondly, I am not convinced the paper presents enough, generalisable, new information to justify a full paper. A reduced paper in the form of a short communication may be more justified.*

As mentioned above, we revised our manuscript in the form of a Short Communication.

### *Comment 3*

*Content wise there are also a number of issues. First of all, you claim in rather grandiose terms your contribution over previous research. However, you hardly substantiate that these results are new, or indeed relevant at all. Either provide a much stronger justification of your claims, or tone down the articles claims.*

Following the suggestion coming from you and the other reviewer (see his/her Comment 1), we completely rewrote the introduction and organized it in three main parts: in the first part we focus on what we already know from the existing literature; in the second part we clarify the three original contributions of our paper to this literature.

Those contributions are as follows:

(i) we do not focus on perceptions about specific circumstances related to food consumption, but on consumers' perceptions on food and eating in a more general fashion. We do so by analyzing the 2010 Eurobarometer Special Survey on Risk Perception.

(ii) We exploit the fact that the Eurobarometer database is a statistically representative survey which includes 26,691 citizens of 27 European countries. To our knowledge, this is actually the largest survey on food perceptions at the individual level.

(iii) We are the first to analyze this publicly available dataset by means of multivariate regression analysis. No systematic regression analysis has been performed before, with the only exception of Vainio et al. (2014), who focus on the subsample of Finnish respondents.

In the third part of the introduction we emphasize that our scope is to test the external validity of previous findings within the literature, which are based upon smaller surveys, whose participants are citizens of specific countries, regions or cities, and are often asked about specific types of food.

#### *Comment 4*

*I will go through the paper from the top and raise further issues where I encounter them*

*4.1) PIL16 Example of such a grandiose claim (there is no previous systematic work on the overall determinants) - This heavily depends on how you define "overall determinants"*

As already explained in our reply to your Comment 3, we better focus the contributions of our paper to the existing literature. We thus avoid the “grandiose claims” you rightly complain about, and – more specifically- we drop the word “determinants” throughout the new version of the manuscript.

*4.2) L23-24 While the Lancasterian approach is somewhat abstract, it is closely related to the attitude model of Fishbein (1975) and thus has become part of the highly influential Theory of Planned Behaviour (Ajzen 1991). Other authors, like Grunert 1995, also show similarity to this approach. You do not show that you are aware of these major theories.*

We fully agree with your remarks about the Lancasterian approach. We thus drop this reference, but –due to space constraints- we do not have room to follow your suggestion and cite the broader Theory of Planned Behaviour. Of course, if you deem it important, we stand ready to add it.

*4.3) L25-29 "by looking at its main dimensions" - Your main claim to relevance comes from the position that these dimensions are indeed the main dimensions. However, you provide neither a logical argument, nor a reference that substantiates this claim. This is unacceptable.*

*4.4) L33 "about the six dimensions". But above you define only 3 dimensions (albeit the bracketed text suggests you may consider subdimensions).*

In the new version of the Introduction, we better clarify the issues you raise in Comments 4.3 and 4.4 by underlying that there are three different types of food quality: product-oriented, process-oriented and user-oriented quality. As noticed by Grunert (1995), the first two are objective dimensions, while the third one is strictly connected to the subjective perception of quality. Our study is focused on user-oriented quality. As a consequence, the individual perception variables on hunger satisfaction, conviviality, price, freshness and taste, calories and safety, as provided by the Eurobarometer 73.5 Special Survey on Risk EU citizens, would capture many of the different features of the subjective dimension of food quality that have been discussed in the previous literature. Finally, in the new Subsection 4.2 (Limitations), we explicitly recognize that there are other specific features of user-oriented quality that our dependent variables are not able to capture.

Regarding Comment 4.4, we actually use the term “dimension” in the new Subsection 3.2. More precisely, the terms “primary dimension” and “secondary or post-modern dimension” are introduced to indicate the two main unobserved patterns, which are found to drive individual perceptions according to the Principal Component Analysis we performed.

*4.5) L34 "No empirical studies on these data" - Since empirical studies by definition include data collection this makes no sense at all. Again, you base most of the relevance of this paper on an implicit claim that this data contains anything of relevance (otherwise I could not care less that it has not been reported) yet you do not substantiate this.*

We understood your concern about this sentence being too sloppy. We address this comment in two different points of the revised version of the paper. First, in the introduction we explain the main reason why this dataset is relevant, i.e. the fact that it is the largest representative sample of food attitudes, which covers all EU countries. Second, we clarify that ours is the first systematic regression analysis that has been performed on this publicly available dataset, with the only exception of a study on the Finnish subsample of respondents (Vainio et al. 2014).

*4.6) L49 "Partial correlation" - looking at the data you seem to do regression, not correlation. In any case including interaction terms is not the same as extracting partial correlations. Unclear what you mean.*

We understand your concern about the term “partial correlation”, which we drop completely in the new version of the paper.

*4.7) P2 L19 "less significant" - this is nonsensical. Something either IS significant (in which case you conclude there is an effect) or it is not. You cannot compare significance levels in any sensible way.*

Following your suggestion we delete any reference to a result being “less significant”. More generally speaking, throughout the new version of the manuscript, we simply emphasize results that are statistically significant, without entering into the comparison of different significance levels.

*4.8) L20 "Female dummy" - example of bizarre language. The only female dummies I know of, are the dummies in fashion stores.*

We follow your suggestion and use the expression(s) “indicator variable(s)” instead of female dummy and the like.

*4.9) L27-28 "Our findings thus contribute" - This does not follow in any way from the text above. Substantiate or remove.*

We delete this sentence. More generally we discuss the implications of our results in the newly added Subsection 4.1.

#### *Comment 5*

*Section 2 Literature review. This is largely an indiscriminate collection of papers. I am only interested in paper relevant to the topic - there are literary 1000's of papers on consumer perception of food and without selection on relevance there is no way to review them all.*

5.1) P4 1st paragraph. What is the relevance to learn about labelling, nothing in your data refers to that

5.2) 2nd para. You are talking about attitudes in most of your paper - and there are 100s of papers on consumer attitude towards quality and safety. None of these are discussed, but suddenly and unexplained Willingness to pay is raised as a key variable.

5.3) 3rd para. Why do we learn something about GM. Nothing in your data or arguments even hints at innovative technologies.

5.4) 4th para and again the emphasis shifts unexplained towards choice experiments and WTP, two constructs that were not measured in any way. This all suggests you have insufficient knowledge of consumer attitude research.

5.5) 5th This idea is further strengthened by the opening sentence of this section (L39 "A new strand of literature is focused on quality and safety". This literature has been around since (at the very least) the early 1990s with the work of people like Steenkamp, Shepherd, Frewer, Grunert, Sparks, van Trijp (and somewhat later Verbeke, Siegrist, Pidgeon etc etc etc). 25 years of research - conducted by well publishing respected research groups - is NOT a new strand.

5.6) P5L3 "We cannot analyze WTP" - Indeed, and who cares as that was never your intention. You should review the consumer literature basing itself on social psychology instead of that on economics and economic psychology and this whole issue would disappear.

Following all those suggestions (from Point 5.1 to Point 5.4, and Point 5.6) we completely removed the Literature Review Section. Consistently with the indications of the other reviewer as well, we refer to the existing literature only in the first part of the introduction and in the newly added Subsection 4.1. More precisely, we only cite the main contributions in the literature that are close to the general aim of our paper, i.e., the empirical investigation of factors that help explain user-oriented quality.

Finally, regarding Point 5.5, we delete the sentence you rightly complain about.

#### *Comment 6*

L26 "Universe" (why the capital). I guess you mean the population, as the universe at least includes all people living on earth (also e.g. North Koreans) and more likely also includes extraterrestrials.

Since we mean "population", we rewrote universe without capital letter.

#### *Comment 7*

P6 Second paragraph (L6-16). This section makes no sense without the footnotes (and even then it is not sufficiently clear). Age class definitions are essential for comprehension and should be in body text. So should the income class definitions. Why do you look at number of children? - A single parent household has fewer people than a married household with same number of children. At least justify why you do not include this difference.

We followed your suggestion and moved to the body text all the necessary information that was previously included in the footnotes. More precisely, we report in the text the specific age class definitions and the range of the categorical income variable. Regarding number of children, previous studies underline that attitudes about food risks are stronger for respondents with children *vis a vis* those without children (Dosman et al., *Risk Analysis*, 2001; Verbeke, *Food Quality and*

*Preference*, 2005). Moreover, since we always control for marital status, we explicitly take into account the presence of a wife/husband or partner, over and above the possible presence of children within the household.

*Comment 8*

*L21-22 "satisfaction components" ... "the price dimension". As you use dimension and component you imply a relevant difference between the two. Explain.*

In the previous version of the manuscript, we wrongly used the word “dimension” and “component” as synonymous. In the new version of the manuscript the expressions “perceptions”, “aspects” or “psychological factors” are used to indicate the six different attitudes that are connected with user-oriented quality and that we study in our empirical analysis.

*Comment 9*

*Equation 1: What happened to B8 (you now go from 7 to 9).*

We corrected this typo.

*Comment 10*

*P7 and at other places later on L1018 Here you do not present any result but instead provide discussion of results. Should not be in the results section (also further on)*

As suggested, we moved this paragraph and other analogous comments to the newly added Subsection 4.1.

*Comment 11*

*P8 Footnote 21: Based on what literature did you assign these regions. Personally I am somewhat surprised that e.g. the UK, with its major city London being both South AND West of Belgium and the Netherlands is classified as Northern Europe, while the Netherlands and Belgium and Austria are classified west (while the western most point of all countries is far to the east of the most westernmost point of the UK, Ireland, Portugal and Spain. At least provide a strong reference that this is a relevant and standard classification, otherwise it seems utterly random. If it is indeed more or less random, we should not expect any relevant results making the whole of table 3 irrelevant.*

We used the standard classification provided by the United Nations Geoscheme, which includes UK within the Northern Europe subregion. However, because of space constraints, we removed from the new version of the manuscript those results about regions.

*Comment 12*

*P9 "Admit the lack of attitude" - In phrasing like this you put this as a deficit of the consumer. Rephrase.*

We shorten and rephrase the sentence as follows: “Moreover, because of social desirability concerns, respondents might make up an opinion when they do not have one [...]”

*Comment 13*

*Section 4.3 Your way of dealing with response bias, is nice. It is fairly similar to how ANOVA type analyses deal with this (automatically) through repeated measures procedures and is probably relevant here. However, either you correct for this if you think this is needed, in which case you claim the uncorrected data are flawed and should not be reported - i.e. only report the stats based on corrected observations, or you don't. You can't have both.*

We thank you for your appreciation about our way to deal with response bias. However, because of strict space constraints we decided to show in the text only the main results obtained from our standard ordered logit estimates (Table 4), and dropped -with some regret- the part on response bias. Please notice that in the new version of the manuscript we refer to the different potential instance of response bias in the limitation section (see the new Subsection 4.2).

*Comment 14*

*Section 4.4 P10L38 - Report the first 3 Eigen values otherwise we cannot interpret your Kaiser Criterion claim. Similarly, report the cumulative variance of the 1st 3 factors.*

*L44 and further. Although it is indeed odd that the first factor is all positive, it makes no sense to interpret unrotated factors. These hardly ever make sense. Apply an orthogonal or oblique rotation and reinterpret. (BTW An alternative explanation for your first factor could be that this picked up response bias. Try to rerun with corrected scores and see what happens then).*

As suggested, the new Table 5 reports the first three rotated components together with their associated eigenvalues and cumulative explained variance. Following the Kaiser Criterion, only the first two components are selected, since they exhibit eigenvalues with a magnitude greater than one (for details, see the first paragraph of new Subsection 3.2).

We computed both orthogonal (varimax) and oblique (oblimin) methods and we generally found the same pattern of loadings. For this reason, only the rotated components following the orthogonal methodology are shown and discussed in the new Subsection 3.2. Note that loadings associated to rotated components show some differences with respect to the loadings associated to the *unrotated* components we presented in the previous version of the manuscript.

*Comment 15*

*Conclusion P11 L24 - A sudden shift from regression (causality assumed) to correlation (no causality assumed). Make consistent.*

We rewrote the Conclusion section without any erroneous shift from regression to correlation.

*Comment 16*

*Table 1: For dichotomous dummies - the data is fully described by the proportion. Median, Std Dev, Min and Max are all redundant if the proportion is known - and is hence irrelevant to report. Clean up table.*

Proportions for dichotomous dummies are reported in the new Table 2, while we drop all other summary statistics that are actually redundant, as you rightly point out.

*Comment 17*

*Table 2: Move discussion of cuts to main body text. The way of footnoting significance levels  $A^{**}[***]$  at 10(5)[1] per cent is very unconventional. Look for a more conventional footnote to make reading easier.*

Following your suggestion, we moved the discussion of cutpoints at the beginning of the new Subsection 3.1. We also provided more conventional footnotes in the new Tables 4 and 6.

## **Research Highlights, “Individual Attitudes on Food Quality and Safety: Empirical Evidence on EU Countries”**

- We study how individual characteristics explain perceptions of food quality.
- We use data from the Eurobarometer 2010 Special Survey on Risk Perception.
- We are the first to analyze this large dataset with multivariate regressions.
- Women, older and more educated individuals care about calories, safety and taste.
- Manual workers, house-persons and unemployed especially care about prices.