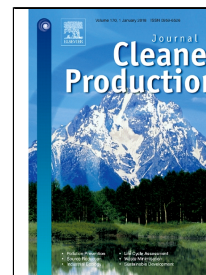


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Exploring pro-environmental food purchasing behaviour: an empirical analysis of italian consumers

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Highlights

- Factors influencing consumers' decision to consume organic products are analysed.
- A two-level framework for modelling green purchasing behaviour is introduced.
- Italian citizens' green purchasing is explored considering regional heterogeneity.
- Ordered multilevel random intercept and random slope models are estimated.
- Environmental concerned individuals tend to buy organic products more frequently.

ACCEPTED MANUSCRIPT

EXPLORING PRO-ENVIRONMENTAL FOOD PURCHASING BEHAVIOUR: AN EMPIRICAL ANALYSIS OF ITALIAN CONSUMERS

ABSTRACT

Over the last decades, there has been growing consumers' interest in environmentally friendly products and green agriculture has experienced a steady increase in European countries. Although the purchasing behaviour of consumers is closely linked to their personal needs, environmental preservation has also become one of the main concerns since food production exerts significant pressures on the environment, especially through water, energy, pesticide and fertiliser use.

Environmentally-friendly purchasing decisions can reduce the environmental impact of food by substituting higher-impact products with "green" products which do not pollute the planet thus preserving the environment and public health, but bringing also significant benefits to the economy as a whole.

Therefore, the aim of this study is to analyse the factors influencing consumers' decision to buy green products by suggesting a two-level conceptual framework, based on the theory of planned behaviour and adding the context in which individuals reside.

We estimate two different type of ordered multilevel random effects models in order to examine whether and to what extent differences in individuals' behaviour concerning organic food consumption among Italian regions can be attributed to the socio-economic and environmental characteristics of the area in which the individuals reside. By using the 2014 Aspect of Daily Life Survey carried out by the Italian National Statistical Institute, we obtained interesting results concerning the role of individuals' environmental concern and attitudes. People concerned with animal welfare, soil pollution and deforestation have a higher probability of buying organic products on a daily basis. The results obtained from the random slope model specification, which allowed us to analyse if and to what extent the effect of awareness for soil pollution varies across regions, confirm that the across regions awareness for soil pollution significantly and positively influence individuals' consumption of organic food on a daily basis.

Keywords: *Organic food; Sustainable consumption; Environmental attitudes; Environmental concerns; Theory of Planned Behaviour; Multilevel models.*

1. Introduction

Over the last decades, there has been growing consumer interest in “environmentally-friendly” products (Paul et al., 2016; Moser, 2015; Biswas and Roy, 2015). Organic agriculture has experienced a steady increase in EU countries and has become one of the fastest growing market segments (IFOAM EU, 2016; Pinto De Moura et al., 2012; Pino et al., 2012). Organic products are made, stored and processed by using methods that comply with the standards of organic agricultural system which can be defined as “...a management practice that eliminates the use of synthetic external inputs such as synthetic pesticides and fertilizers, genetically modified organisms, preservatives, and other synthetic additives. ...The goal of organic agriculture is to maintain long-term soil fertility, biological cycles, and biodiversity” (Food and Agriculture Organization, 1999).

Although the purchasing behaviour of consumers is closely linked to their personal needs, environmental preservation has also become one of the main concerns. In this respect, food production and consumption exerts significant pressures on the environment, especially through water, energy, pesticide and fertiliser use. It has been estimated that global agriculture and food production release more than 25% of all greenhouse gases (GHGs) (Tilman, 2014; Popp, 2010) and consumer household purchases are responsible for 40% of the environmental damage (Grunert, 1995). Therefore, in order to ensure long-term sustainability, a shift toward the sustainable consumption of goods and products is required with the aim of minimising the use of natural resources and toxic materials and the waste and pollutants emissions over the product life cycle (Seyfang, 2006).

In other words, “environmentally-friendly” purchasing decisions can reduce the environmental impact of food by substituting higher-impact products with “green” or “environmentally-friendly” products which do not pollute the planet or exhaust natural resources thus preserving both the environment and public health¹.

¹ As underlined by Dangelico (2010) various definitions of green products are used in literature which emphasize different aspects related to the product’s greenness. Notwithstanding green products can be defined as products that protect the environment by conserving resources and reducing the use of toxic agents, pollution, and waste.

The increase in consumption of green food may help to preserve the environment and improve public health, but it may also create opportunities for businesses dealing with organic products, thus bringing significant benefits to the economy as a whole (Isenhour, 2010; Tilman, 1998).

Indeed, by consuming “environmentally-friendly” or “green” products, individuals are able to transfer their environmental concerns into corresponding actions with the aim of optimizing the environmental consequences in order to safeguard current and future generations (Moser, 2016).

Over the last three decades, there has been a steady increasing in green food consumption and farming across Europe. Indeed, the organic market has experienced double-digit growth, both in terms of the European market and the area of organically managed agricultural land thus making the European Union the second largest organic market worldwide with 38% of global retail sales (IFOAM EU, 2016).

More specifically, in 2015 organic farmland increased by approximately one million hectares compared to 2014 and the countries with the largest organic agricultural areas were Spain, Italy and France. In 2014, the EU market for organic products increased by 7.4% showing an exceptional upward trend considering that in the period 2006-2012 the average annual growth rate in grocery retail markets was approximately 2% to 3%. Germany showed the largest market for organic products with a share of 30% of retail sales, followed by France (18%), the United Kingdom (9%) and Italy (8%).

This trend reflects the demand of EU consumers for high quality food production that supports the environment, animal welfare and the development of rural areas as the organic agriculture system does not use chemical fertilisers and pesticides and animals are bred under natural conditions (Seyfang, 2006). Indeed, the per capita consumption of organic food has almost doubled in the last decade with EU consumers spending on average 47 euro in 2014 per week.

Focusing on Italy, a recent SINAB² report (2014) on organic agriculture estimated the Italian market for organic products to be 11.2 % of the Italian utilized agricultural area. The Italian regions with the largest number of organic farmers were Sicily, Calabria and Apulia. These regions account for more than 45% of the total Italian organic farmers.

The shift towards organic production systems has led to a reduction of GHG (Greenhouses Gas) emissions as organic production systems produce fewer GHG emissions and require less energy

² SINAB is an Italian Ministry of Agriculture (MiPAAF) project managed by ISMEA-Istituto di Servizi per il Mercato Alimentare and CIHEAM-Mediterranean Agronomic Institute of Bari. Among its objective it promotes the dissemination of data and information on the Italian organic sector. At www.sinab.it, users can find continuously updated information at Italian and Regional level.

than conventional industrial farming systems even if they cover larger areas of land and there is more eutrophication and acidification potential per product unit (Tuomisto et al., 2012).

Although organic and conventional farming systems are not easily comparable with regards to global warming potential and effects on climate change, the main benefits clearly recognized to the organic agriculture are the reduced negative impacts on biodiversity and enhanced animal welfare and water and soil quality (Reganold et al., 2016; Tuomisto et al., 2012; Gomiero et al., 2011; Birkhofer et al., 2008). Moreover, in the case of Italy, Di Felice et al. (2012) and Caporali et al. (2003) demonstrated that integration of biodiversity at the farm level is more likely to be achieved in organic farms than in conventional ones and Chiriaco et al. (2017) demonstrated that organic farming for wheat cultivation in Italy has the potential for reducing the impact on global warming in terms of GHG emissions per hectare.

In the light of these environmental benefits of organic food consumption, more and more research studies are focusing on the factors influencing consumers' green purchasing behaviour (Moser, 2016; Biswas and Roy, 2015; Joshi and Rahman, 2015; Zhao et al., 2014; Lin and Huang, 2012; Hühner, et al., 2007). Indeed, identifying the drivers of pro-environmental consumption is essential for understanding the diffusion of organic products.

Since the decision to consume organic products seems to be strongly related and guided by consumers' environmental awareness (Moser, 2016; Kikuchi-Uehara et al., 2016; Vicente-Molina, 2013), this paper determines whether Italian consumers who are aware of environmental issues actually buy green products.

We introduce a two-level framework for modelling consumer green purchasing behaviour, based on the Theory of Planned Behaviour (TPB) introduced by Ajzen (1991) which is widely applied for analysing environmentally-friendly consumers behaviour (Paul et al., 2016; Bamberg and Möser, 2007).

Moreover, the study was carried out at national level bearing in mind the regions in which the participants of the survey reside, as green consumption may be affected by the quality of the environment, the regional social and economic situation and the extent to which sustainable transportation is used.

This paper aims at investigating the behaviour of Italian citizens by referring to the 2014 wave of the "Aspect of Daily Life" (ADL) survey carried out by the Italian National Statistical Institute (Istat). In addition to the participants' demographic and socio-economic characteristics, the questionnaire also included questions on environmental attitudes and behaviours. The participants

also express their views and concerns on environmental issues and were asked how often they consumed organic products.

In order to take into account the hierarchical structure of the micro data and the two-level conceptual framework, we estimated multilevel random effect models, which enabled us to determine how personal and territorial environmental behaviour influences individuals' likelihood of buying green products.

We also assessed whether and to what extent differences in individuals' green food consumption are associated with the socio-economic context in which they reside thus obtaining statistical information concerning territorial variability across regions.

The rest of this paper is structured as follows. Section 2 introduces our conceptual framework based on the TPB and the literature review on organic food consumption while in Section 3 the characteristics of the data are illustrated. In Section 4, we describe our methodological approach based on ordered multilevel random effect models. In section 5 we report our findings concerning territorial variability and the association between individual and area-level covariates and green food consumption. Finally, we draw some conclusions in Section 6.

2. Pro-environmental purchasing behaviour: a conceptual framework

Green product purchasing behaviour is a result of multiple and complex factors related to various aspects of consumers' purchasing decisions. Therefore with the aim of developing a conceptual framework, we referred to the TPB at individual level but added the characteristics of the area in which consumers reside in order to consider the conditions in which green purchasing is carried out, thus obtaining a two-level framework.

According to the TPB, consumers' behaviour concerning green products is driven by three major factors: attitude, subjective norm and perception of behavioural control. Therefore, we studied existing literature in order to determine the variables measuring these aspects in our two-level framework.

Considering the environmental attitude dimension, several authors found that the decision to consume green products is strongly and increasingly driven by consumers' environmental awareness. As shown by Iosifidi (2016) individuals who are environmentally concerned, i.e. those linking environmental degradation with the production of goods, tend to consume fewer products

characterized by high environmental impacts. Other studies found that animal welfare plays an important role in organic purchase behaviour (Thøgersen and Olander, 2003; Harper et al, 2002; Zanolli and Naspetti, 2002). Moreover, the soil quality, climate change awareness and extensive livestock production tend to be important drivers for accelerating individuals' conversion to organic products (Dabbert et al, 2004).

Purchasing green products may also be influenced by subjective norms, which can be defined as perceived social pressure for a person to perform a behaviour or not (Thøgersen, 2010). A Chinese study on green purchasing behaviour shows that people who declare to have a positive attitudes toward organic purchasing behaviour is associated with energy saving behaviours, such as recycling paper, glass and plastic and no using of disposable tableware (Zhao, 2013). Other studies show a positive correlation between the environmental, social and ethical values of consumers and their purchase behaviour toward green products (Chen et al, 2010; Peattie, 2010; Arvola et al, 2008; Thøgersen and Olander, 2006). Among social norms, various studies have found that a high consumption of traditional, local or regional food products was related to a shorter transport distances which reduces environmental impacts (Moser, 2016; Tsakiridou et al.; 2008). A recent stream of literature focused on the role of cultural participation as a self-identification process regarding organic food consumption (Crociana et al, 2014). In particular, basing their study on Italian microdata, Agovino et al. (2017), found a positive relationship between individual pro-social dispositions and organic food consumption.

The concept of Perceived Behavioural Control (PBC) refers to people's perception of their ability to perform a given behaviour and reflects beliefs concerning factors or circumstances that may facilitate or complicate that behaviour (Ajzen, 2006). Various studies found that income and education play significant positive roles in explaining organic food purchases. More specifically the best-educated individuals appear to be also more worried about environmental issues (Aertsens et al, 2009; Gracia and de Magistris, 2007; Grunert and Kristensen, 1991; Cunningham, 2002).

Moreover, one of the "perceived personal-abilities" that lead to the consumption of green products may be the tendency of consumers to read product labels in order to obtain information concerning the product characteristics (Kikuchi-Uehara et al., 2016; Koos, 2011).

In addition to the TPB factors, we believe that the degree of environmental concern, which denotes an individual's general orientation toward safeguarding the environment, may have a direct impact on green consumer behaviour as observed in previous studies (Paço et al, 2013; Chan 1996). It may be the case that environmentally consumers are more likely to purchase environmentally-friendly

products than those who are less concerned about environmental issues. Indeed, air and soil degradation in socio-environmental systems negatively affect sustainable development paths (Zambon et al., 2017) increasing environmental awareness of the general public.

Moreover some environmentally-friendly behaviour such as recycling, using alternative transport and energy saving may be positively correlated to green food consumption (Johe et al, 2016; Gadenne, 2011; Bamberg, 2003).

Socio-demographic and lifestyle characteristics were included in order to explain green purchasing behaviour (Diamantopoulos et al., 2003). Age and gender are two personal characteristics much debated in literature; as regard gender, women appear to purchase more green products than men (Davidson, 1996; Davis et al., 1995). Fotopoulos and Krystallis (2002b) found that age does not play an important role in shaping organic food consumption while Jolly (1991) observed that younger people tend to consume more organic food.

Lifestyle variables are also considered in our framework. It was observed that the purchase of green product can be motivated by health concerns (Gracia and de Magistris, 2007; Chinnici et al., 2002; Zanolli and Naspetti, 2002); in fact, smoking negatively affect green purchasing behaviour (Brécard et al, 2009).

Since individual choices may also be influenced by factors in the macro-environment, we considered variables referring to the context in which individuals' reside, such as air and environment quality, soil and water pollution and street cleanliness. There are therefore, regional differences among Italian citizens' as organic food consumption may be affected by the use of sustainable transportation, urban or rural area, cultural differences and economic situation.

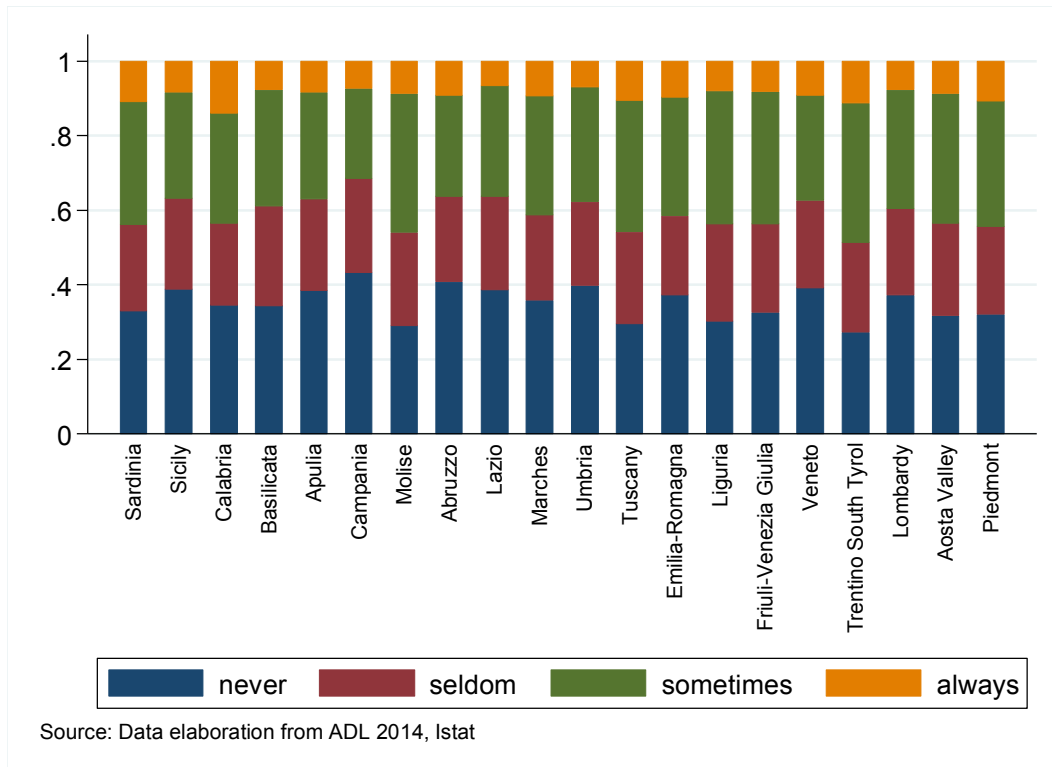
3. Materials and Methods

In order to determine the factors behind the Italians' organic food consumption we used the 2014 wave of Italian multipurpose "Aspect of Daily Life" (ADL) survey, which has been carried out annually by Istat since 1993 as part of an integrated system of social surveys. Each year the ADL survey involves a random sample of approximately 50,000 individuals (20,000 households) thus gathering detailed information on a range of topics regarding individual and household daily life.

Bearing in mind the aim of our paper, it is worth noting that in addition to the socio-demographic and economic characteristics of the respondents, the 2014 wave includes questions regarding:

- a) Self-reported assessment of specific life domain, such as health, economic conditions and life-style (smoking habits, sports, reading of books and magazines);
- b) Self-reported frequency of organic product consumption (“never”, “seldom”, “sometimes” and “always”);
- c) Self-reported concerns regarding environmental conditions issues. The question “Are you concerned about the following environmental issue?” was divided into various aspects, such as: global warming, plant and animal health and welfare, climate change, waste production and disposal, noise, air and soil pollution, pollution of seas and rivers, earthquakes and floods, man-made disasters, forest destruction, electromagnetic pollution, landscape destruction, excessive construction of buildings, depletion of natural resources, other environmental problems. Each question is collapsed into binary variable assuming value 1 when the respondent refers to be concerned;
- d) The pro-environmental behaviour of citizens, which refers to the propensity to behave in an environmentally-friendly way, such as: self-reported frequency of local products consumption, whether they take note of the information on product label and if they use alternative means of transport and disposable products;
- e) Self-assessment of correct social behaviour such as the habits of second row parking and street littering habits.

Regarding the self-assessment of organic product consumption at national level, only 35% of Italians say they have never purchased any organic products. Among consumers, 23% declared that they seldom consume organic food products, 31% declared that they sometimes consume organic products and approximately 9% stated that they consume organic products on a daily basis. However, there is high heterogeneity across the Italian regions. As shown in Figure 1, the highest percentages of individuals who use organic food products on a daily basis reside in Calabria (13,97%), Trentino Alto Adige (11,36%), Sardinia (10,80%), Piedmont (10,72%) and Tuscany (10,54%).

Figure 1. Propensity to buy organic food products at regional level

Contrastingly, the percentage of individuals who do not-use organic products is higher in Abruzzo (40,78%), Umbria (39,76%), Veneto (39,24%) and Sicily (38,84%) than the national average.

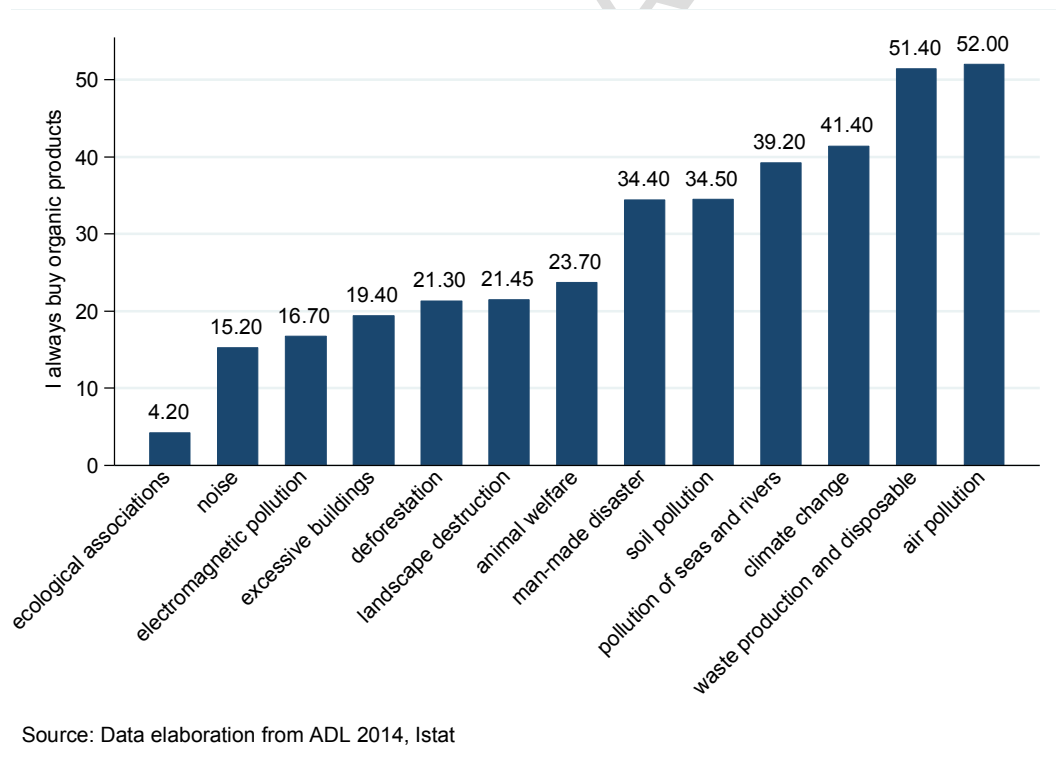
As regard to the socio-demographic characteristics, 21% of the individuals aged between 35 and 54 consume organic products on a daily basis. The percentages of the other age groups are considerably lower: 7% for individuals aged between 15 and 24, 13% for individuals aged between 25 and 34; 14% for people aged between 55 and 64 and only 7% for individuals aged 65 and over. The strong and significant relationship between the amount of organic food consumed and age was confirmed by the χ^2 test of independence for which we were able to reject the null hypothesis of independence between variables (Pearson $\chi^2(18) = 1400$, p-value = 0.000). Moreover, the relationships concerning organic food consumption and gender (Pearson $\chi^2(1)$, p-value = 0.000) and between organic food consumption and bachelor's degree holders were found to be statistically significant (Pearson $\chi^2(6) = 1100$, p-value = 0.000). On one hand, females appear to be more inclined to consume organic foods than males (almost 58% of females occasionally buy or buy organic food on a daily basis compared to 41% of males). On the other hand, bachelor's degree holders tend to consume more frequently organic products (16% of bachelor's holders compared to 8% of other).

In addition, the relationships concerning organic food consumption and habits of reading daily newspapers were found to be statistically significant (Pearson $\chi^2(6) = 1100$, p-value = 0.000).

People who read newspaper on a daily basis (22%) appear to be more inclined to consume organic food products than other people who do not read newspaper (12%). Economic conditions also positively influence organic consumption behaviour (Pearson $\chi^2(6) = 722$, p-value = 0.000): 27% of high-wealth individuals consume organic food products on a daily basis compared to 18% of low-wealth individuals.

By comparing the responses regarding environmental issues and organic food individuals' consumption on a daily basis at regional level, as shown in Figure 2, in 2014 the highest associations are reported for air pollution (52% of respondents declared that they consume organic products on a daily basis and are concerned about air pollution), waste production and disposable (51,40%) and climate change (41,40%). All of the relationship are significant, obtaining evidence from χ^2 tests of independence for which the null hypothesis of independence were rejected, with p-values always equal to zero.

Figure 2. Individuals' awareness on environmental issues for consumers who always buy organic food

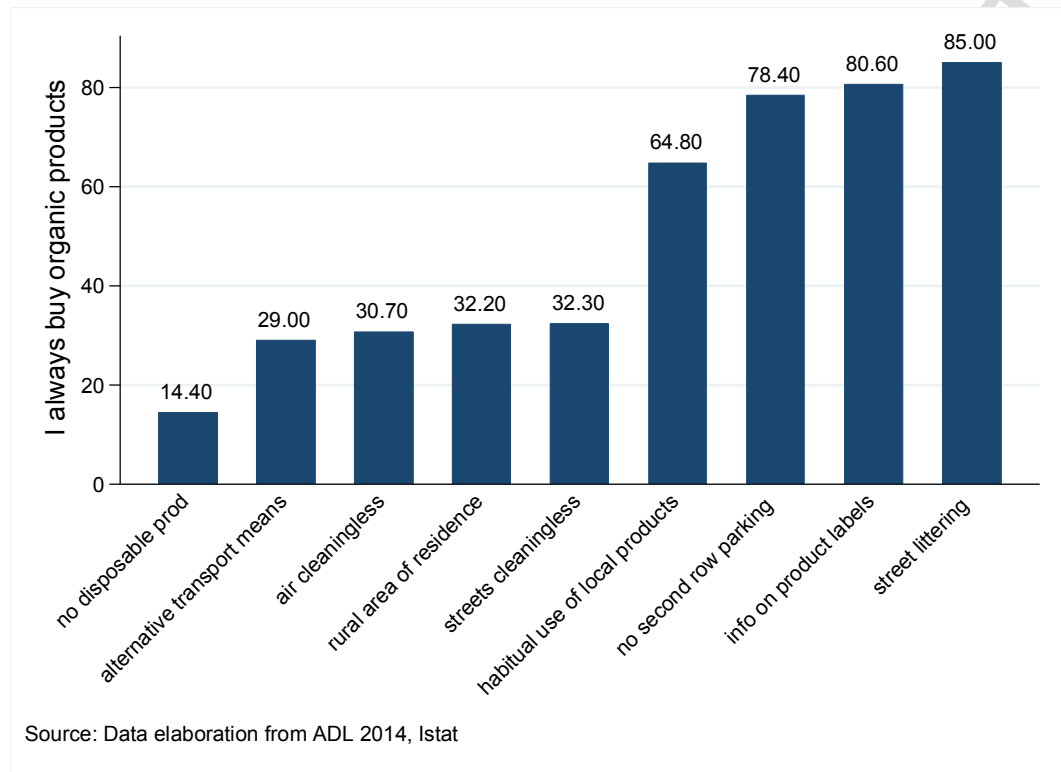


It is important to note also the association between the factors identified by the TBP toward organic product behaviour and individuals' organic food consumption on a daily basis.

Figure 3 shows the pro-environmental actions concerning the organic food consumption on a daily basis of Italian citizens identified by the TBP.

The three main aspects are: habits of not street littering (85% of respondents who declared to consume organic food consumption on a daily basis, do not litter the streets), habits to reading the information on product labels (80,60%) and habits of not second row parking (78,40%).

Figure 3. Pro-environmental behaviour for consumers who always buy organic food



4. Methods

4.1 Random intercept and slope multilevel model

In order to take into account the hierarchical structure of the micro data³ (ADL 2014) – namely individuals (level 1) grouped in regions (level 2) and the two-level conceptual framework, we use the multilevel random effect models with the aim of identifying the factors influencing organic food purchasing behaviour.

Our outcome variable represents the self-declared frequencies of purchasing organic food products by individual i . From a statistical perspective, the answer has an ordered meaning. For this reason, we used the multilevel ordered logistic models specification.

³ From a statistical perspective this structure of the data (grouped-data) implies a violation of the assumption of independence among observations within the same second-level units, i.e. individuals living in the same region (Agresti, 2002)

The conditional distribution of the response given the random effects is assumed to be multinomial, with success probability determined by the logistic cumulative distribution function

Firstly, we referred to the random-intercept specification in which a region-specific (level-2) random intercept b_{01} is included in the linear predictor thus enabling us to explicitly model the hierarchical structure of the data and the unobserved heterogeneity (Goldstein, 2011; Skrondal and Rabe-Hesketh, 2004; Raudenbush and Bryk, 2002).

Secondly, we estimated a random-slope specification in order to assess whether and to what extent the effect of individuals' environmental awareness for soil degradation on organic consumption varies across regions. In this way we can relax the assumption of the random-intercept model, that the slope b_1 is fixed across regions, thus analysing the between-region heterogeneity which is one of the most important domains of organic agriculture (FAO, 2002).

We modelled our outcome ordinal variable Y_{ij} , which represents the self-declared frequencies of purchasing organic food products by individual i living in region j defined as “never”, “seldom”, “sometimes” and “always”. The response variable y_i is divided into four parts:

$$y_i = \begin{cases} \text{never if } y_i^* \leq k_1 \\ \text{seldom if } k_1 \leq y_i^* < k_2 \\ \text{sometimes if } k_2 \leq y_i^* < k_3 \\ \text{always if } y_i^* \geq k_3 \end{cases}$$

For the individual i_{th} in the j_{th} region, the multilevel proportional odds model is based on the cumulative logit link and fit according to following equations (O'Connell and Betsy, 2008; Raudenbush and Bryk, 2002):

$$\text{level 1: } \text{logit}(Y_{kij}) = \text{logit}\left(\frac{P(R_{ij} \leq k)}{P(R_{ij} > k)}\right) = \beta_{0j} + \sum_{q=1}^Q \beta_{qj} X_{qij} + \sum_{k=2}^{K-1} D_{kij} \delta_k \quad (1)$$

$$\text{level 2: } \beta_{qj} = \gamma_{q0} + \sum_{s=1}^{S_q} \gamma_{qs} W_{sj} + u_{oj} \quad (2)$$

In these expressions, level one equation represents the individual-level model and the two-level equation represents the regional-level models.

For the i_{th} individual in the j_{th} region, Y'_{kij} represents the cumulative odds for each k category, with $K = 1, \dots, K - 1$ levels of the ordinal response and based on $q = 1, \dots, Q$ individual-level explanatory variables.

The expression on the left-hand side of the equation (1) is the natural log of the cumulative odds for each k category and is referred to as the logit for the cumulative distribution.

The expression in the middle of equation (1) $\sum_{q=1}^Q \beta_{qj} X_{qij}$, represent the two specific probability comparisons made when determining the log-odds, where R_{ij} represent the outcome for the i_{th} individual in the j_{th} region. The first set of terms on the far right-hand side of equation (1) can be interpreted in the same way as the regression coefficients in the multilevel logistic model. The intercept for the j_{th} region is represented by β_{0j} and β_{qj} represent the collection of region-specific slopes for the j_{th} region in terms of expected change in the logit for each 1-unit change in the respective within-region explanatory variables X_{qij} .

The second level equation describes how the within-region effects may vary according to a specific region or group-level characteristics. γ_{q0} represent the intercepts for each of the $Q+1$ level-two models (one for the q -th predictor from level one plus the intercept). For each specific two level equation, the γ_{qs} represent effects of each predictor for the q -th equation at level two. The term u_{oj} is the region-specific random effect that also represent the level 2 error.

The random slope model accounts for both a varying intercept and a varying slope across second-level units. Where \mathbf{z}_{ij} is the subset of individual-level covariates $\mathbf{X}\mathbf{q}_{ij}$ having a random slope:

$$\text{level 1: } \text{logit}(Y'_{kij}) = \text{logit}\left(\frac{P(R_{ij} \leq k)}{P(R_{ij} > k)}\right) = \beta_{0j} + \sum_{q=1}^Q \beta_{qj} X_{qij} + \sum_{q=1}^V u_{qj} X_{qij} + \sum_{k=2}^{K-1} D_{kij} \delta_k \quad (3)$$

Where $V \leq Q$ is the number of individual-level X_{qij} covariates having a random slope. The regression analysis based on the multilevel framework, is often threatened by endogeneity, (Grilli and Rampichini, 2011). This phenomenon occurs when the random effect of covariates are not independent and estimators in the model parameters are biased.

We estimated models (1-3) by using Stata software (release 14) and implementing the meologit package which allows fitting multilevel mixed-effects ordered logistic models (StataCorp, 2015). The parameter estimation of these models involves log-likelihood calculations which require

integrating out the random effects. We used the common method Gauss–Hermite quadrature to directly estimate the integral required to calculate the log likelihood. Since the log likelihood itself is estimated, we use log-likelihood ratio tests to choose the model that best fits the data.

In order to avoid a model misspecification, we used the Mundlak approach (Mundlak, 1978) which consists of adding the cluster (group) means \bar{X}_{qij} of individual variables as additional covariates to the model. The Wald test on the slope of \bar{X}_{qij} can be used to verify whether the assumption of exogeneity holds for individual regressors. Whenever both the within (individual level covariate) and the between effects (the related country-level mean) were significantly different from zero, we included in our model the cluster mean of these covariates.

4.2 Model specification

Bearing in mind the conceptual framework describing individuals organic food purchasing behaviour, the initial selection of the variables to be included in models (1-3) was carried out by computing association and correlation tests according to the nature of each variable as reported in section 3 (Hosmer and Lemeshow, 2000).

Concerning the individual-level covariates, the demographic and socio-economic characteristics of the respondents were introduced in models (1-3), namely: gender, age in classes (15–24, 25–34, 35–44, 45–54, 55–64, 65 and over), the socio-economic status of individuals⁴, bachelor degree holder, employed or unemployed, activity sector, wealth status, area of residence in terms of level of urbanization (metropolitan or urban area).

The following variables describing lifestyle factors were introduced: the smoking status (smoker, ex-smoker or never smoked), self-declaration of health status (well versus ill) and number of books and newspaper read per week as cultural proxies.

We then considered the dimensions related to the TBP:

- a) Variables measuring individual eco-friendly attitudes on environmental issues (divided into: global warming, plant and animal health and welfare, climate change, waste production and disposal, noise, air and soil pollution, pollution of sea and river, man-made

⁴ The individuals' socioeconomic status is a composite relative indicator constructed by means of a Multiple Correspondence Analysis using the following four variables available in the ADL survey as proxies of individuals' wealth status: i) dwelling ownership; ii) number of cars owned; iii) judgment concerning the economic resources of all household members (categories ranging from "excellent" to "totally inadequate" iv) type of dwelling.

disasters, forest destruction, electromagnetic pollution, landscape destruction, excessive construction of buildings, depletion of natural resources, other environmental problems). It was observed whether individuals were concerned or not;

- b) Variables measuring social norms dimension: frequencies of local products consumption (“never”, “seldom”, “sometimes” and “always”), frequencies of take note of the information on product label (“never”, “seldom”, “sometimes” and “always), use alternative means of transport (yes or not) and use of disposable products (“never”, “seldom”, “sometimes” and “always).
- c) Variables measuring perceived behavioural control characteristics expressed by social responsible behaviour of the respondents: habits of street littering and second row parking. It was observed whether individuals were adopted or not these behaviours.

With the aim of including objective indicators that account for the environmental conditions of the region in which the respondents reside, we referred to data from the ISTAT Urban Environmental Quality database and the Equitable and sustainable well-being dataset regarding urban air quality, and the use of alternative means of transport at regional level.

5. Results

We began the analysis by comparing the models with and without random effects. The LRT statistic is 297.53 with 1 degree of freedom and a minimal p -value so that the null hypothesis was rejected. Therefore, there is evidence of unobserved heterogeneity at regional level: as expected, individuals in different regions have different levels of probability of purchasing organic foods.

By adding u_j to each equation, the cumulative response probabilities may vary across regions. As in any multilevel model, we can obtain estimates of the u_j from which we can compute region-specific probabilities.

In order to summarize the within-cluster correlation in models (1-3) for categorical responses, we computed the probabilities under several scenarios regarding territorial heterogeneity on organic food consumption, defined by fixing the random effect u_j to a set of percentiles of its estimated distribution, in the null model (Grilli and Rampichini, 2011). Denoting with $u[p]$ the percentile p , if the random intercept cumulative model (1) has a normally distributed u_j with estimated standard

deviation $\hat{\sigma}_u$, then three scenarios could be defined by fixing the random effect to the estimated percentiles $\hat{u}_{[2.5]} = -1.96\hat{\sigma}_u$, $\hat{u}_{[50]} = 0$ and $\hat{u}_{[97.5]} = +1.96\hat{\sigma}_u$. Once the covariates have been fixed to a set of values x_0 , the cumulative probability up to category k in the scenario corresponding to percentile p is defined as $Pr(Y \leq y_k | x^0, \hat{u}_{[p]})$ and it is computed by replacing the model parameters with their estimates.

In Table 1 we reported estimates of the conditional probabilities.

Table 1. Conditional probabilities of multilevel null model

	Low ($u = -1.96 \cdot \sigma_u$)	Medium ($u = 0$)	High ($u = +1.96 \cdot \sigma_u$)
$\hat{\pi}_1$	0.648	0.430	0.281
$\hat{\pi}_2$	0.408	0.669	0.511
$\hat{\pi}_3$	0.092	0.932	0.877

For example, $Pr(Y_{ij} \geq 3 | u_j = -1.96 \cdot \sigma_u) = 0.092$ for a region with a low probability of consuming organic products and $Pr(Y_{ij} \geq 3 | u_j = 1.96 \cdot \sigma_u) = 0.877$ for a region with a high probability of consuming organic products. These results confirm the high heterogeneity among Italian regions regarding organic consumption behaviour.

We continued analysing the multilevel models by adding the covariates representing the respondents' socio-demographic characteristics and the individual factors of our two-level framework identified by referring to the TBP: eco-friendly attitudes toward environmental issues, social norms and perceived behavioural control characteristics. Firstly, we estimated a random intercept model by including the individual-level variables (M1) and then a random intercept model by adding the contextual level variables (M2).

Secondly, we assessed random slope models in which the effect of individual characteristics (which are assumed to be the same in each region in the random intercept model), vary from region to region. To this aim, we firstly included individual-level variables (M3) then we added the contextual level variables (M4).

The estimates for the random intercept and random slope model specifications are reported in Table 2. Results are presented in terms of Odds Ratios⁵ (ORs).

Table 2. Random intercept and random slope models

	M1		M2		M3		M4	
	OR	sig	OR	sig	OR	sig	OR	sig
<i>Socio-economic factors</i>								
Male	0.911	***	0.912	***	0.910	***	0.911	***
Age								
25-34	1.041		1.043		1.038		1.038	
35-44	0.996		0.998		0.994		0.994	
45-54	0.917		0.918		0.915		0.915	
55-64	0.931		0.932		0.928		0.928	
65-74	0.752	***	0.754	***	0.749	***	0.750	***
>=75	0.696	***	0.697	***	0.693	***	0.694	***
Bachelor degree holders	1.358	***	1.360	***	1.358	***	1.359	***
Employed	1.158	***	1.157	***	1.156	***	1.156	***
Wealth status (ref. Low)								
Medium	1.389	***	1.389	***	1.390	***	1.389	***
High	1.502	***	1.500	***	1.502	***	1.500	***
Tertiary sector	1.085	***	1.085	***	1.085	***	1.085	***
Kind of family								
couple with children	0.945		0.946		0.947		0.947	
couple without children	0.962		0.962		0.963		0.963	
one parent	0.892	**	0.893	**	0.894	**	0.894	**
<i>Lifestyle factors</i>								
Smoking status (ref. smoker)								
Former smoker	1.106	***	1.105	***	1.105	***	1.104	***
Never smoker	1.177	***	1.177	***	1.177	***	1.177	***
Health status (ref. well)	1.068	**	1.068	**	1.069	**	1.068	**
Do you read newspaper?								
Sometimes	1.180	***	1.178	***	1.181	***	1.179	***
Every days	1.170	***	1.166	***	1.170	***	1.166	***
N. of books read	1.015	***	1.015	***	1.015	***	1.015	***
<i>Attitudes – environmental concern</i>								
Environmental degradation	1.063	*	1.063	*	1.064	**	1.065	**
Ecological associations membership	1.451	***	1.450	***	1.446	***	1.446	***
Global warming	1.159	***	1.159	***	1.158	***	1.159	***
Animal welfare	1.299	***	1.298	***	1.302	***	1.301	***
Climate change	1.085	***	1.085	***	1.087	***	1.086	***
Waste production	1.043	*	1.044	*	1.042	*	1.043	*
Air pollution	1.087	***	1.087	***	1.085	***	1.085	***
Noise	1.112	***	1.112	***	1.115	***	1.115	***
Soil pollution	1.202	***	1.202	***	1.195	***	1.196	***
Sea and river pollution	1.035		1.035		1.035		1.035	
Man-made disasters	1.076	***	1.076	***	1.075	***	1.076	***
Deforestation	1.205	***	1.205	***	1.206	***	1.206	***
Depletion of natural resources	1.110	***	1.110	***	1.112	***	1.113	***
Electromagnetic pollution	1.202	***	1.202	***	1.202	***	1.202	***
Environmental degradation	1.042		1.043		1.044		1.044	
<i>Social Norms</i>								
Do you read product labels?								
Sometimes	0.528	***	0.528	***	0.528	***	0.528	***

⁵ Considering a categorical covariate, an OR greater than 1 implies that the event under study (in our case organic food consumption) is more likely to occur for the specific category (organic consumption on a daily basis) compared to the other categories. On the other hand, an OR less than 1 implies that the event is less likely to occur in that category. An OR equal to 1 implies that the event is equally likely to occur in each categories.

Seldom	0.319	***	0.319	***	0.319	***	0.319	***
Never	0.093	***	0.093	***	0.093	***	0.093	***
Do you buy local products?								
Sometimes	0.520	***	0.520	***	0.520	***	0.520	***
Seldom	0.299	***	0.299	***	0.299	***	0.299	***
Never	0.073	***	0.073	***	0.073	***	0.073	***
Use of disposable tableware products								
Always	1.035		1.038		1.037		1.039	
Sometimes	1.226	***	1.228	***	1.225	***	1.226	***
Seldom	1.197	***	1.197	***	1.196	***	1.196	***
Use of alternative means of transport	1.097	***	1.095	***	1.096	***	1.094	***
Perceived behavioural control								
Habit of second row parking	0.859	***	0.858	***	0.859	***	0.858	***
Habit of street littering	0.927	**	0.925	**	0.926	*	0.925	*
Area of residence								
Rural area of residence	1.081	***	1.079	***	1.080	***	1.078	***
Dirtiness of the streets	0.936	**	0.936	**	0.937	**	0.936	**
Pollution in area of residence	1.053	*	1.053	*	1.052	*	1.052	*
Second level covariates								
Regional mean of alternative means of transport			4.954	**			9.492	**
Regional mean of polluted areas			0.692				0.627	
Thresholds								
Cut_1	-1.936	***	-1.939	***	-1.945	***	-1.939	***
Cut_2	-0.468	***	-0.471	***	-0.475	***	-0.471	***
Cut_3	1.997	***	1.994	***	1.991	***	1.994	***
Random effect								
σ_u	0.026		0.022		0.017		0.017	
σ_e					0.029		0.030	
$cov(\sigma_u, \sigma_e)$					-0.007		-0.009	
Log-likelihood	136.71		111.27		146.04		122.20	
Prob>chi	0.000		0.000		0.000		0.000	
N	27,884		27,884		27,884		27,884	

The likelihood ratio test comparing model M2 and M4 is equal to 22 with 2 degrees of freedom, which confirms that the regional-level random effect is significantly different from zero: the multilevel model with the random slope enabled us to explore region-level variation on the propensity to buy green products.

In order to avoid misunderstandings and considering that similar results are found among the various models, we only referred to the magnitude and sign of the ORs concerning the covariates included in the random slope full model (M4).

The demographic and socio-economic individual characteristics, as well as attitudinal and behavioural variables, proved to be strictly related to the respondents' propensity to buy organic products. In line with the studies Davidson (1996) and Davis et al. (1995), our findings confirm that males are less likely to buy organic products than females (male OR is equal to 0.912).

As regard to age effect, it was observed that younger people are more likely to buy organic food products, as suggested by Jolly (1991). Occupational status and level of education were associated with a higher likelihood of buying organic food products on a daily basis. It was observed that

employed individuals were more likely to buy organic products (OR=1.157) similarly to those with higher levels of education (OR=1.359).

A significant positive correlation was observed for wealth status, thus confirming the results obtained by Aertsens et al. (2009) and Gracia and de Magistris (2007): the wealthier you are, the more likely you are to buy organic products (OR=1.5).

The variables concerning attitudes on environmental issues are strongly associated with the propensity of buying organic products on a daily basis: all of them have a positive OR on the consumers' purchase tendency towards organic food products and almost all of the variables have a significant coefficient for explaining this tendency. The highest OR was observed for: people participating in ecological association (OR=1.45), people concerned with: animal welfare (OR=1.29), soil pollution (OR=1.20) deforestation (OR=1.20) and electromagnetic pollution (OR=1.20).

The variables concerning eco-friendly behaviour are strongly associated with organic food consumption: reading information on product labels is associated with a higher probability of buying organic products more frequently, thus confirming the results obtained by Kikuchi-Uehara et al. (2016) and Koos (2011).

Individual who buy local food products on a daily basis are more likely to buy organic food products more frequently, thus confirming the results obtained by Moser (2016). People who seldom use disposable tableware have higher ORs of buying food organic products than people who more frequently use disposable tableware products.

People who use alternative means of transport tend to buy organic food with higher frequencies: they have 9.5% higher OR than individuals who do not use alternative means of transport.

On the other hand, people with anti-social behaviour have a lower OR of consuming organic food products on a daily basis (OR=0.858 for second row parking habit and OR=0.925 for street littering habit).

Moreover, individuals living in small towns or rural areas, are more likely to buy organic food products more frequently than individuals living in medium or large cities (OR = 1.08).

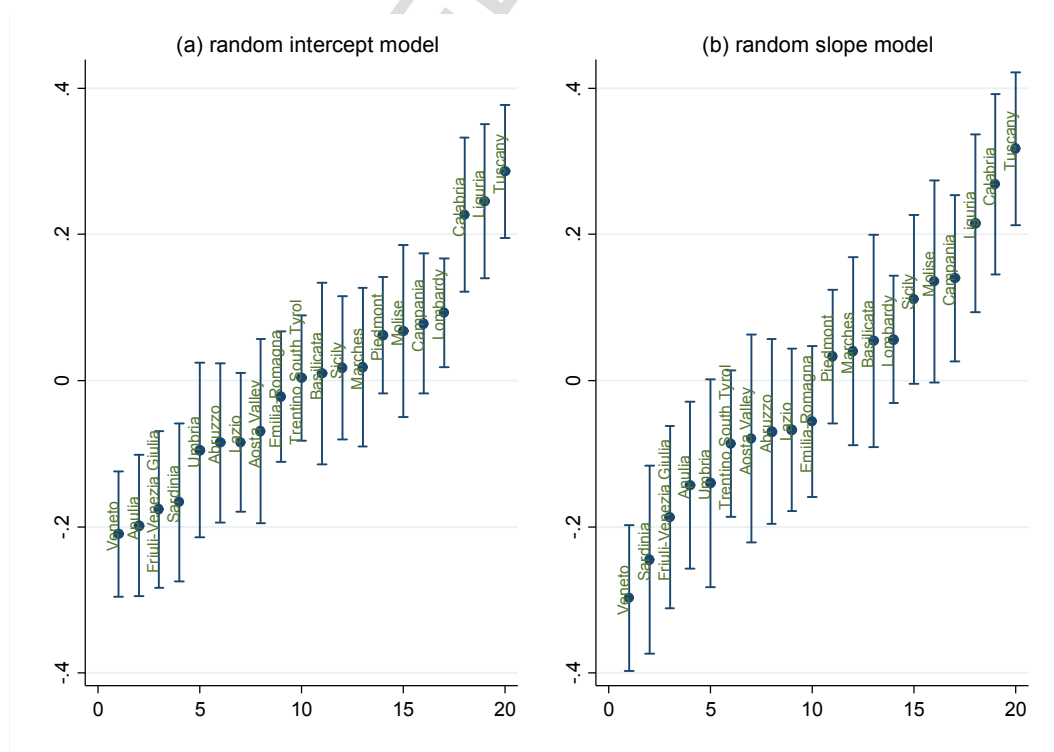
Concerning individuals' perception in living in a specific area, it worth noting that pollution in area of residence is positively correlated with a higher probability of buying organic food products (OR=1.052), while dirtiness is negatively related with a higher probability of buying organic products (OR=0.936).

As already mentioned, contextual variables play a significant roles in explaining the differences across regions: at regional level a higher use of alternative means of transport is strongly related to a higher probability of buying organic food products. Highly polluted regions are characterized by a lower probability of buying organic food.

Considering the random slope model specification, in which the effect of awareness for soil pollution varies across regions, the estimated random effect σ_e is significant. This parameter enabled us to estimate specific regional coefficients on soil quality awareness. In order to gain a better understanding of the extent of between-region differences in the effect of soil pollution awareness, we plotted the relationship between the log-odds of having a higher tendency on organic food products and soil quality awareness for each region. To this aim, the region residuals \hat{u}_{ij} are estimated.

A particularly useful way to report the regional propensity of buying organic food adjusted for the individual and contextual characteristics is the caterpillar plots in Figures 4-5. These plots show the Empirical Bayes (EB) predicted random effects in ascending order together with 95% confidence intervals based on comparative standard errors (see for details Skrondal and Rabe-Hesketh, 2009) and can be used to test whether the random effect of the corresponding region is significantly different from zero, which is the population mean.

Figure 4. Between-region differences in the frequencies of organic food consumption



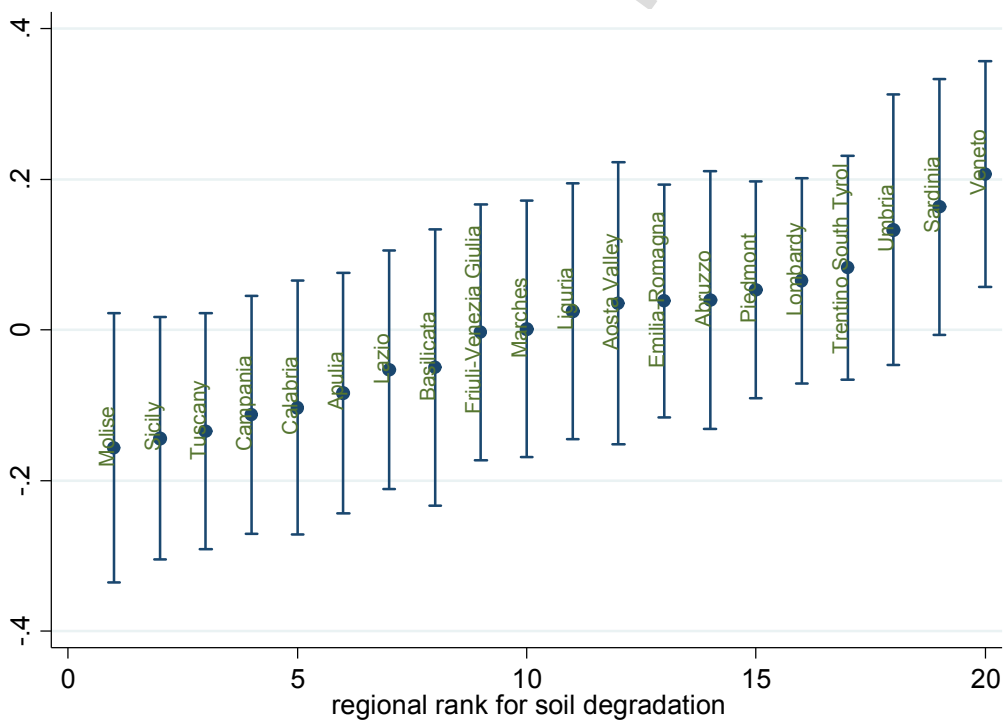
Therefore a region whose interval is entirely above (below) zero has an adjusted propensity of buying organic food significantly higher (lower) than the mean (Grilli and Rampichini, 2012).

Clearly, the estimated random intercept effects (left side of figure 4) and random slope parameters (right side of figure 4) show considerable variability indicating large region-specific deviations from the average propensity of buying organic food. Differences between unadjusted and adjusted propensity of buying organic products among regions (second level units) can be easily found depending on the role of explaining variables in models (1—3).

Italian regions tend to assume the same rank when random intercept and slope model were consider. Regions such as Liguria, Tuscany, Calabria and Lombardy lie in the upper right-hand corner, as they are less likely to frequently consume green food products, while Veneto, Sardinia, Apulia and Friuli are more likely to consume organic food products on a daily basis.

When considering the specific random slope there are fewer differences among regions, as we can see from the overlapping confidence intervals in Figure 5.

Figure 5. Between region differences on the awareness for soil degradation



Veneto and Sardinia are situated in the upper-part of the graph: these regions appear to be more aware of soil degradation. The performance of these regions differs significantly from Molise and Sicily, which are situated on the left-hand side and therefore are less aware of soil degradation.

6. Conclusions

The aim of this paper is to analyse consumers' organic food behaviour among Italian citizens by using information of the 2014 ADL survey carried out by Istat.

By referring to the TPB at individual level and adding the characteristics of the area in which consumers reside we constructed our two-level conceptual framework, thus selecting the variables influencing organic food consumption.

With the aim of analysing the unobserved heterogeneity associated with the different regions of residence we estimate two different type of ordered multilevel random effects models, thus examining whether and to what extent differences in individuals' behaviour concerning organic food consumption among Italian regions can be attributed to the socio-economic, personal and environmental characteristics of the area in which the individuals reside.

Our findings suggest that Italians' purchasing behaviour toward organic food products is influenced by attitudes, subjective norm, perceived behavioural control as suggested from the classical TPB. Environmental concerns significantly influence consumers' purchase behaviour. Similarly for individuals adopting an eco-friendly behaviour the probability of buying organic products increases.

The results supported the inclusion of the second level covariates in explaining the differences in organic food consumption across regions. On one hand, at regional level a higher use of alternative means of transport is strongly related to a higher probability of buying organic food products; on the other hand, highly polluted regions are characterized by a lower probability of buying organic food.

With the aim of understanding the between regions differences for soil degradation on organic products consumption, we estimated a random-slope model. The results obtained show that the estimated random effect σ_e , regarding the across regions awareness for soil pollution, is significant and positively influences consumption of organic food on a daily basis.

Our results may have relevant policy implications in order to develop suitable strategies for businesses dealing with organic products for increasing the consumption of green products by emphasizing their role in preserving the environment in marketing communications.

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