Attitude Toward Environmental Protection and Toward Nature: How Do They Shape Consumer Behaviour for a Sustainable Tomato?

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Abstract

Several research efforts have tried to explain the forces driving food-related decisions. In this article, we explore how individual attitude toward the environment could be a potential determinant of green behavior. This research offers an original methodological framework never adopted in the food consumption domain that is based on the seminal contribution of Campbell Paradigm and the related advancements on attitude measures proposed by the environmental psychology literature. We also contribute to the literature by envisaging a two-dimensional environmental attitude, that distinguishes between attitude toward environmental protection and toward nature appreciation. The ultimate target is to explain consumer purchasing intentions, represented by Willingness to Pay, toward a hypothetical tomato with improved resource use efficiency taking into account consumer psycho-attitudinal propensity towards environmental issues. The analysis is conducted in Italy and in the UK, two countries characterized by different perceptions about tomato as a consumption good and about water related issues. Findings indicate that the two dimensions of consumer attitude affect differently the spending propensity for a sustainable tomato and these differences are also country-specific. The analysis suggests that policies aimed at promoting sustainable food products should also target the type of consumers (naturalists or environmentalists) that is more sensible to environmental sustainability.

Keywords: Environmental attitude measurement; Consumer behaviour; Discrete Choice Experiment; Campbell Paradigm; Resilient tomato; Rasch model

1. Introduction

Consumers are pivotal to the definition and development of new goods and services, and their interests are such to give rise to new consumption trends. This is particularly relevant when it comes to sustainable food consumption: if, on one side, global consumption patterns are still far from being sustainable, exploiting natural resources and causing non-negligible environmental damage (Chen and Chai, 2010), a new, increasing environmental awareness is reshaping food consumption behaviours (Tobler *et al.*, 2011; Grunert *et al.*, 2014).

Food is a multi-sensorial experience that is moved by so many old memories and ancestral feelings that is hard to explain all the forces behind food-related decisions. Nonetheless, many research efforts have tried to overcome this impediment by identifying some of the most relevant purchasing drivers. Recently, Bazzani *et al.* (2018) identified up to 12 relevant values that range from a more altruistic sphere, such as environmental impact, to a more ego-centric sphere, like price and food safety. The trade-off between altruistic and hedonistic drivers and their co-existence has been extensively discussed in the consumer behaviour literature (Aertsens *et al.*, 2009; Mondelaers *et al.*, 2009; Gracia *et al.*, 2012; Bartels and Onwezen, 2014; Migliore *et al.*, 2014; Tully & Winer, 2014; Van Loo *et al.*, 2017; Hansen *et al.*, 2018).

Clearly, also individual characteristics and personality traits affect food consumption in general (Roberts, 2009; Peschel et al, 2016; Lin et al, 2019; Ardebili and Rickertsen, 2020; Wu *et al.*, 2020) and sustainable food consumption, too (Bazzani *et al.*, 2017, Peschel *et al.*, 2019). In this context, individual attitude toward the environment has been investigated as a potential determinant of green behaviour (Ellen, Webb and Mohr, 2006; Vermeir and Verbeke, 2006; Arvola *et al.*, 2008; Liu *et al.*, 2012). Consumer environmental attitude has been usually measured in an explicit way, asking consumers to self-report themselves by providing cognitive and affective responses. However, this direct approach is not flawless: as individuals express their personal point of view, the resulting attitude could be biased, affected by subjectivity, and over-estimated (De Houwer *et al.*, 2013). For example, verbally endorsing the importance of financially supporting an environmental cause is probably easier for most people than actually donating money to an environmental organization. Thus, the cognitive cost required to declare this statement is lower than the cost required to behave as stated (Kaiser and Byrka, 2015).

Attitude measurement has been a highly debated research question in the environmental psychology field. Among the different approaches suggested to measure pro-environmental behaviour, the review by Lange and Dewitte (2019) emphasizes the General Ecological Behaviour (Kaiser, 1998; Kaiser & Wilson, 2004, Kaiser et al., 2010) on the basis of its frequency of use and thoroughness of psychometric evaluation. Still, this scale has been developed for a general domain, and for a general population, and as such it can be applied to different contexts. Despite its versatility, this scale has never been used to examine food consumption behaviour. The General Ecological Behaviour scale is based on the theoretical framework of the Campbell paradigm (1963), in which the measurement of attitude bypasses the causal direction usually adopted in the literature and embraces a two-way relation from environmental attitude to green behaviour and vice-versa. This approach considers different past behaviours or overt acts, sorted from the least green to the greenest. Environmental

attitude indirectly depends on how green the reported behaviours of all respondents actually are, and not on the evaluative and normative self-reported statements that instead characterize an explicit measure of attitude (Kaiser *et al.* 2018).

As recalled in the environmental psychology literature (e.g. Kaiser, 1998; Dunlap, 2000), environmental attitude can be interpreted as either a unidimensional or multidimensional concept, a distinction which is also highly debated (Lange and Dewitte, 2019). Nonetheless, the multidimensional approach allows researchers to distinguish different drivers that may be instead misconceived under a unidimensional definition. This is the conclusion of Milfont and Duckitt (2004), for whom there are two attitudinal forces, namely unselfishness and self-interests, that should be kept apart. In this spirit, Kaiser et al. (2013) decomposed the conventional environmental attitude in two components: the propensity for environmental protection as an unselfish force, and the pure appreciation of nature as a self-interested dimension.

The considerations above are aimed at contextualizing our paper, whose ultimate target is the understanding of consumer purchasing intentions that can be reflected by their Willingness to Pay for a tomato, taking into account individual psycho-attitudinal propensity towards environmental issues. The product considered in this analysis is a hypothetical tomato, not currently sold to final consumers and characterized by specific attributes of environmental sustainability, such as a reduced water footprint and reduced use of fertilizers during cultivation.

Tomato was chosen as the research object for several reasons. First, because in terms of volume, it is the fifth most cultivated crop in the world and the eighth in Europe (FAOSTAT, 2018), representing a pillar of the global food system. Tomato is also a horticultural crop with a non-negligible environmental impact in terms of resource use efficiency. Moreover, fresh tomatoes or processed tomatoes are consumed basically everywhere. Even if consumers all over the world are familiar with tomatoes, the extent to which they are perceived by consumers is country-specific. For this reason, we decided to embed the analysis in a cross-country setting to see how different environmental attitudes can affect the behaviour of consumers toward an environmentally sustainable tomato. To this purpose, we conducted the analysis in two countries, Italy and the UK, that differ with regards to tomato perception, consumption levels (20 kg per capita in Italy and 6 kg per capita in the UK of fresh tomato, FAOSTAT, 2018), and to climatic and cultural profiles.

Tomato indeed is clearly an iconic product in Italy, and it is the symbol of its food culture and diet (see Trentinaglia et al., 2020, and references therein); Italy is one of the major exporters of tomatoes at the global level (FAOSTAT, 2017), but its cultivation areas are concretely threatened by water scarcity. On the contrary, in the UK the internal production of tomato is negligible and most of the

fresh tomatoes consumed are imported (FAOSTAT, 2017): there is little room for Britons to give tomato a leading role in their food tradition. Also, the threat of water scarcity and what water shortages may bring about are perceived in the UK as remote issues, not strictly related to where Britons live (Baringa, 2020).

On the basis of these considerations, the survey we conducted includes a set of questions on consumer attitude toward environment and nature and a Discrete Choice Experiment with different sustainability and other tomato attributes. We obtained individual Willingness to Pay for tomato attributes by estimating the Discrete Choice model data and then implemented a Seemingly Unrelated Regression analysis to see how Willingness to Pay are affected by the two dimensions of attitude retrieved.

The present work offers an original methodological framework, as it combines the seminal contribution of the Campbell Paradigm with the advancements proposed by Kaiser's scale to explain food consumption choices, an approach that has never been adopted so far in this field.

We also contribute to the literature by envisaging a two-dimensional environmental attitude, that distinguishes between attitude toward environmental protection and nature appreciation. To the best of our knowledge, this approach has never been adopted in agricultural economics for the comprehension of consumers' food decisions. There are few works investigating how tomato consumers react when offered tomatoes with environmentally sustainable characteristics, mainly in terms of nutrient use efficiency (e.g. Maples *et al.*, 2016; Meyerding *et al.*, 2019), but these analysis do not look at the role played by consumers' attitude.

The present work is structured as follows: Section 2 discusses the theoretical structure and the conceptual framework developed. Section 3 describes the empirical methodological aspects used to measure the two dimensions of environmental attitude and to estimate the Discrete Choice Experiment; Section 4 presents the survey; Section 5 reports the results; Section 6 discusses the results and Section 7 draws the main conclusions.

2. Background

In the literature, attitudes are usually examined with respect to their causal relation with behaviour (Eagly & Chaiken, 1993, Milfont & Duckitt, 2004; Fazio *et al.*, 2008) leading to unresolvable debates about its direction. In this article we adopt an alternative concept of attitude proposed by Kaiser et al. (2010) on the basis of the seminal idea of DeFleur and Westie (1963), for whom attitude is described as an inferred property that can be "...equated with the probability of recurrence of behaviour forms of a given type or direction". From this perspective, attitude and behaviour appear as inseparable

aspects of a unit, indivisible and their relation formal rather than causal.

One of the most common theoretical framework to analyse attitude-behavior reltion is the Tripartite Model of Attitude conceived by Rosenberg and Hovland (1960), where attitudes are latent variables that manifest themselves in affective reactions, cognitive evaluations, or overt behaviour. According to this view, a higher level of environmental attitude should translate into greater chances for activities, positive affective reactions to environment or more positive cognitive statements about the environment.

In a recent work, Kaiser and Wilson (2019) propose a highly restricted and workable version of this model using the Campbell Paradigm, a theoretical framework in which an attitude is inferred from the relative cost of implementing a behaviour. According to this theory, attitudes can be manifested not just through evaluative statements, but also via other responses, such as behavioural self-reports and intentions, and via observed locomotor responses. The more impediments a person attempts to overcome and the greater the cost to reach the goal, the greater the involvement towards the goal or, in other words, the higher the attitude. On the contrary, when the slightest problem is sufficient to inhibit a person from undertaking environmentally suitable behaviours, sensitivity to environmental issues is probably rather feeble. The basic principles of this paradigm are the following ones: i) attitudes distinguish a set of behaviours; ii) the behaviours are ordered transitively in terms of difficulty; iii) behaviours can be used to identify an individual's level of an attitude. Following these assumptions, the attitude obtained is objectively measured.

Campbell approach has been applied to different perspectives, such as environmental attitude (Kaiser *et al.*, 2013, 2014; Ogunbode *et al.*, 2018), attitude toward nature (Brügger *et al.*, 2011; Kaiser *et al.*, 2013, 2014), health attitude (Byrka and Kaiser, 2013), and attitude toward conformity (Brügger and Höchli., 2019), though most studies remain in the context of psychological research. Other works have extended this approach to applied economics, such as energy related behaviour (diffusion of eco-innovations as in Byrka *et al.,* 2016, or energy-saving behaviour, in Starke *et al.,* 2020), sustainable travel behaviour (Taube *et al.,* 2018); climate change policies (Urban, 2016), and tailoring environmental policies in Africa (Ogunbode *et al.,* 2018).

In the food consumer behaviour context, there are very few papers based on the Campbell Paradigm, and these use this construct to establish barriers to sustainable purchase behaviour (Yamoah and Acquaye, 2019) and to investigate behaviour toward waste (Bortoleto, 2014), not to directly explain food consumption choices despite the more objective measurement of attitude proposed. This gap could be due to the risk of running into a circularity trap as this approach explains behaviour using a

measure of attitude re-constructed from the analysis of past behaviours. The Kaiser and Wilson (2019) reinterpretation of the Tripartite Model of Attitude represents a solution to this circularity issue that is based on the separation between the behavioural indicators used to measure attitude from the behavioural consequences caused by attitude. This is the approach we follow to see how general environmental attitude shapes Willingness to Pay for a sustainable tomato.

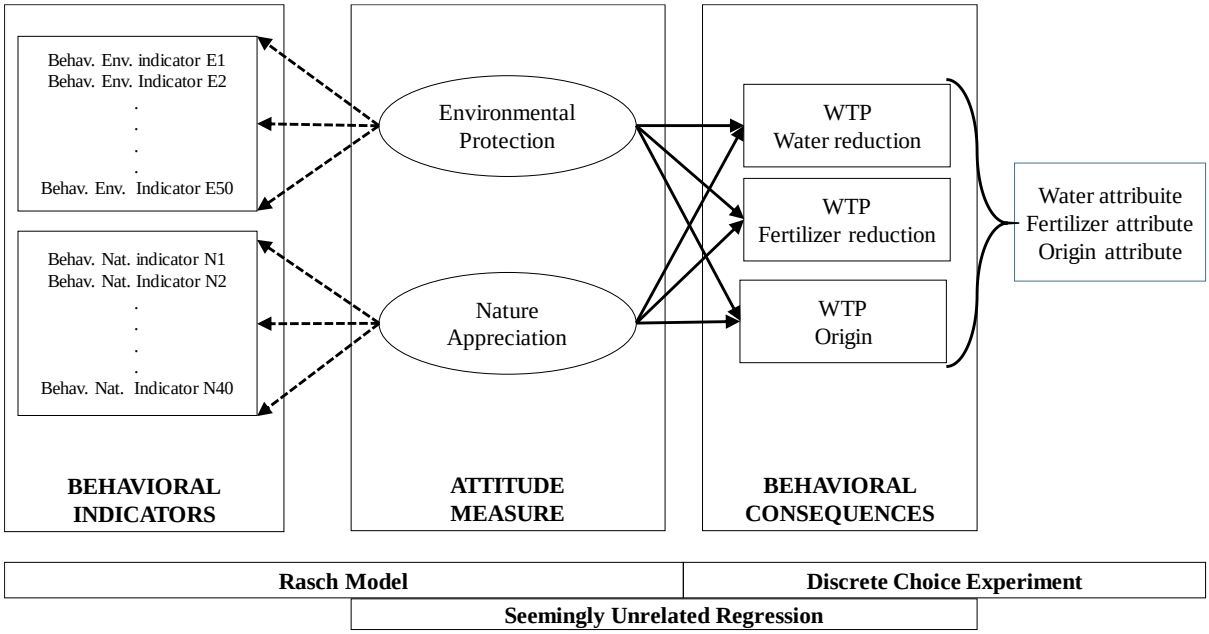
In the literature, environmental attitude has been defined as an inner state linked with a person evaluative response toward environmental protection (Dunlap *et al.*, 2000), environmental degradation (Schulz, 2001), and that can be also linked with certain behaviours toward energy conservation, transportation, and recycling (Dunlap and Jones, 2002). We bypass this one-dimensional face of environmental attitude to embrace instead its twofold interpretation, in which environment preservation and nature appreciation are considered as two different faces. The first suggestion in this sense can be traced back to Thompson and Barton (1994), who distinguish anthropocentric, i.e. environmental protection, and eco-centric factors, related to the appreciation of nature. Bogner and Wiseman (2002) support this idea contemplating up to three different components of environmental attitude, that is i) intent to support environmental protection measures; ii) care with resources and, iii) enjoyment of nature. In a similar vein, other authors (Hartig *et al.*, 2001, 2007; Kaiser and Byrka, 2011) argue that the individual costs and sacrifices that characterize environmental protection are all related to unselfishness. Similarly, the pure enjoyment of nature and its exploitation to achieve individual benefits for recreation, relaxation and inspiration are more of an act of selfishness (Mayer and Frantz, 2004; Martin and Czellar, 2017). Kaiser *et al.* (2013) formally treat and solve the unidimensional environmental attitude issue, finding proof that a twofold interpretation fits better than the one-dimensional model, even if the two components of environmental attitude could be related one another. In their work, environmental protection is defined as a measure of a person's attitude toward environmental issues, and consists of more cognitive items, whereas connection to nature is seen as a measure of the person's attitude towards nature, and describes affective, cognitive, and experiential aspects of that relationship.

These two dimensions of environmental attitude can be conveniently studied in a Campbell framework using two different difficulty-based transitive item structures such as the measurement model for individual attitudes. According to this principle, someone who appreciates nature or wants to protect the environment will engage in specific behaviours that express such valuations.

In Figure 1, we propose an adapted conceptual framework that combines the model advanced by Kaiser and Wilson (2019), the bi-dimensional characterization of environmental attitude (Kaiser et

al. 2013), and our research question. This methodology distinguishes behavioral indicators from behavioral consequences: the former reflects general behaviors towards the environment and nature, whereas the latter defines specific intention behavior, such as the Willingness to Pay for sustainable tomato attributes

Figure 1 – Adapted conceptual framework



Note: Conceptual framework adapted from Kaiser and Wilson (2019) and Kaiser et al. (2013). The lower part refers to the models used in the methodological steps.

3. Methodological aspects

When consumer preferences for environmentally sustainable food product elicited by a Discrete Choice Experiment are also explained by environmental attitude, the estimation process can be subject to endogeneity. In this setting, Willingness to Pay resulting from the estimation of a Discrete Choice Experiment that includes sustainability tomato attributes interacted with attitude towards nature and the environment could be biased: there would be many interconnections between preferences for sustainability and actual personal dispositions toward the environment. To address this endogeneity, the methodological steps of the conceptual framework of Figure 1 were implemented: first, we performed a Rasch model to characterize individuals in terms of their attitude towards environmental protection and toward nature. We then developed a Discrete Choice Model to retrieve individual Willingness to Pay; last, we ran a Seemingly Unrelated Regression to explore the relationships between consumer Willingness to Pay and attitudes.

3.1 Measuring attitude toward environmental protection and nature: the Rasch model

The two dimensions of environmental attitude, each measured using a specific measurement scale, were assessed using the Campbell Paradigm, by establishing a distinctive class of attitude-relevant behaviours ordered by their difficulty to be performed.

According to Kaiser (1998) and his subsequent works, the Campbell idea can be implemented by means of the Rasch framework (Rasch, 1993), that models in a stochastic way the formal link between a person's attitude and the probability of engaging in any specific behaviour (Bond, 2015). In essence, a behaviour measure is based on the assumption that contextual circumstances can impede or encourage the engagement in certain behaviours, which in turns become less or more likely to be performed. The Rasch model outcome stems from the following equation:

$$ln\left(\frac{p_{n\omega}}{1-p_{n\omega}}\right) = \theta_n - \delta_\omega \qquad (1)$$

Where $p_{n\omega}$ expresses the probability of person n to engage in a specific environmental/nature behaviour ω, θ_n is the individual attitude toward the environment/nature, and δ_ω is the difficulty of behaviour ω. As Kaiser *et al.,* (2010) note, according to this formalization, people differ with respect to their attitude levels, regardless of the specific behaviours used in the assessment. Similarly, each behaviour is characterized by its own difficulty, regardless of the individuals used in the difficulty assessment.

We implement the Rasch model for the two following attitude measures: the General Ecological Behaviour measure discussed earlier (Kaiser, 1998; Kaiser & Wilson, 2004), and the nature attitude scale conceived by Brügger et al. (2011). The first one includes 50 questions grouped in six domains:[1] energy conservation (e.g., owning energy efficient devices, solar panel); mobility and transportation (e.g., being a member of a carpool); waste avoidance (e.g., reusing shopping bags); consumption behaviour (e.g., buying seasonal produces); recycling behaviour (e.g., collecting and recycling used paper) and lastly social behaviours toward conservation (e.g., being a member of an environmental organization). Of these 50 items, 19 represent non-ecological behaviours and are negatively formulated (e.g., using a clothes dryer). This scale has been calibrated by authors who eventually estimated item difficulties and ordered behaviours by the implicit cost of performing them. The measurement of attitude toward nature has been put forward by Brügger *et al.* (2011), who consider reports of bonding activities and responses to evaluative statements that reflect appreciation of

[1] Table A1 in Annex reports the fifty Environmental Attitude Items

experiences involving natural situations and features of the natural world. In this scale, connection with nature is derived indirectly from a systematic inspection of reports of past bonding activities with nature, and of statements that indirectly reflect a person's connection with nature. This scale consists of 40 questions[2] linked to the behaviours toward animals (e.g., talking to them); toward the vegetable world (e.g. enjoying gardening), and enjoying natural surroundings (e.g. crossing meadows barefoot). Brügger *et al.* (2011) implemented the Rasch model to calibrate the items of the scale and to sort them according to the difficulty: the more a behaviour is difficult to pursue the more the connection with nature is likelier, and *vice versa*.

The most important aspect of these two scales is that they indirectly derive attitude towards environmental protection and toward nature from behavioural and evaluative statements rather than from a direct exploration of the personal disposition, thus solving the subjective measurement issue. Also, these scales, when used in a particular context, as the food consumption domain of our interest, are such that respondents are not aware of what is being measured and how, so that their answers are a representation of their behaviours.

3.2 Measuring Willingness to Pay: A Discrete Choice Experiment

This section discusses the steps followed to estimate the Discrete Choice Experiment data and to retrieve individual Willingness to Pay in a hypothetical setting, preserving econometric parsimony and robustness. More specifically, this section recalls the econometric theory underlying the two models used: The Mixed Logit Model, for the Italian sample, and the Latent Class Model for the UK sample. As we will explain later, the visual inspection of the choice data revealed different response patterns in the two countries. For this reason, we chose the econometric specification that fit best the data in either sample.

Discrete Choice Experiments are frequently used by researchers to explain consumer preferences for food attributes (e.g. Loureiro and Umberger, 2007, Costa-Font *et al.*, 2008, Van Loo *et al.*, 2011, Chen *et al.*, 2013). The theoretical foundation of this method relies on the economic theory of utility maximization (Ben-Akiva and Lerman, 1985; Train, 2003) and on the theory of random utility (Thurstone, 1927; Luce, 1959; Marschak, 1960). Under this framework, the utility function U of decision maker n with j available alternatives in choice situation t can be written as:

$$U_{njt}=\beta X_{njt} + \varepsilon_{njt} \qquad (2)$$

[2] The forty items regarding connection with nature are reported in Table A2 in Annex.

where βX_{njt} is the observable systematic component of the utility that depends on the design attributes X_{njt} and on the individual preference parameters β, and ε_{njt} is the stochastic and unobserved term that captures analysts' uncertainty over the choice process (Lancaster, 1966).

The underlying econometric framework was developed by McFadden (1974). In the Multinomial Logit specification an inherent assumption is the independence of irrelevant alternatives. For a decision-maker the relative probability of any two alternatives to be chosen does not depend on the characteristics of other alternatives in the choice set. Mixed Logit models relax this assumption allowing researcher to introduce preference heterogeneity among decision-makers in the utility function. When it comes to analysing choice data, which usually counterposes purchasing vs. non-purchasing or Status Quo alternatives, researchers should also bear in mind that purchasing and non-purchasing decisions are different by nature. If, on one side, respondents have already experienced the No-Buy options, on the other they are totally new to the Buy one. Hence, the decision to purchase comes with a greater degree of randomness relatively to the decision not to purchase. Also, the decision to purchase the hypothetical good presented in the Discrete Choice Experiment strongly depends on individuals' ability to process the description of hypothetical goods provided prior to the experiment, which is turn influenced by socio-demographic factors (see Scarpa et al., 2007), Following Scarpa et al (2005) and Scarpa et al. (2007), we consider a Mixed Logit, panel error component model. To this purpose, we impose that the mean for the alternative specific constant for the buying decisions is set to 0. Under such a constraint, we estimate in the Willingness to Pay Space (Scarpa *et al.*, 2008; Lin *et al.*, 2019) a Mixed Logit with correlated random coefficients. The resulting equation is Equation (2) shifted by the error component μ_{nj}, that is:

$$U_{njt} = \beta X_{njt} + \mu_{nj} + \varepsilon_{njt} \qquad (3)$$

We then re-estimate the model constraining to 0 all the covariances and variances within the Cholesky matrix with a statistical significance above 5%, in the spirit of de Villiers *et al.* (2019). The variances that we obtain are net of all the non-significant cross-effects. On the other side, the resulting covariances are instead increased by the share of information we subtracted when imposing the constraint on the Cholesky matrix. It is precisely from this last set of estimates that we retrieve the individual average betas for each of the random parameters included in the Mixed Logit, and that will be used as dependent variables in the Seemingly Unrelated Regression performed in the second step of the analysis (discussed in Subsection 3.3).

The cross-cultural differences characterizing Britons and Italians are such to shape differently respondents' preferences for the model attributes. As later discussed in Section 5.2, it turns out that

British respondents' preferences cannot be analysed with a Mixed Logit Model. Hence, we opt for Latent Class Analysis which also allows researchers to account for respondents' heterogeneity. Still, in Latent Class Models, the unobserved component of utility follows a discrete, rather than continuous, distribution, which can be grouped in classes. Preferences are assumed to be homogenous within each (latent) class but heterogeneous across classes, each of which is characterized by a specific utility function. Preference differences across individuals are explained by the probability of agent *n* of belonging to a specific latent class *q* (or segment). The conditional probability of individual *n* of class *q* to choose alternative *j* from a specific choice set *t* is expressed as:

$$P_{nj|q} = \frac{\exp(\beta_q X_{njt})}{\sum_{j=1}^{J_i} \exp(\beta_q X_{njt})} \quad (4)$$

Assuming that *Q* latent classes exist, the overall log-likelihood is given by:

$$lnL = \sum_{n=1}^{N} ln\,[\sum_{q=1}^{Q} C_{nq}(\prod_{t}^{T_i} Prob_{njt|q})] \quad (5)$$

Where C_{nq} is the probability for individual *n* to belong to class *q*.

3.3 Seemingly unrelated regression

Once the choice data have been examined, researchers could examine which product attribute have the highest power in predicting choice (Boccia and Sarnacchiaro, 2020) or analyse how individual characteristics can affect respondents' Willingness to Pay for the product attribute. This is precisely what we do when we explain behaviour on the basis of individual attitudes to corroborate the attitude-behaviour relation of theoretical framework (Figure 1). In other word, we explore which kind of relationship exists between attribute Willingness to Pay estimated in the previous stage and the attitude scores obtained from the Rasch analysis. To do this, we exploit the Seemingly Unrelated Regression model (Zellner, 1963), that represents a system of linear equations with errors terms correlated across equations for a given individual but uncorrelated across individuals. Thanks to this model structure, the dependent variables share the same error structure and we can simultaneously estimate the effects of attitudes on the attribute Willingness to Pay retrieved from the choice data.

The general specification of the model is:

$$y_{nx} = \sum_{s=1}^{2} \gamma_{nxs}\theta_{ns} + \varepsilon_{nx} \quad (6)$$

where y_{nx} is the willingness to pay of individual *n* for attribute *x*, θ_{ns}, with s=1,2, is the individual attitude towards environmental protection or connection with nature, γ_{nxs} is the regression coefficient

of individual attitude θ_{ns} in the regression for the tomato attribute x, and ε_{nx} is the error term on individual n in regression equation for attribute x.

4. The survey

We run a survey in Italy and UK, that took place between December 2019 and January 2020 and was administered by an external panel data online provider (Qualtrics). Each national sample includes approximately 500 respondents. In order to obtain a representative sample within each country, we implemented non-nested quotas on age, gender, and educational attainment. The final questionnaire consists of an initial section on socio-demographic characteristics (age, gender, educational attainment, income, household size), followed by the Discrete Choice Experiment questions and a last section containing questions for attitudes measurements.

4.1 The experimental design

To elicit consumers' preferences towards a hypothetical tomato with environmental and non attributes, a Discrete Choice analysis was developed (Hensher *et al.*, 2005). Under this methodological framework, preference elicitation requires consumers to face several hypothetical purchasing decisions, each contraposing two or more different alternatives. In each scenario, consumers must pick the most preferred item.

In this work, consumers faced 6 different choice situations, each consisting of two unlabelled alternatives and one No-Buy Option. The tomato alternatives were characterized by different use of water and fertilizers as cultivation inputs, by different cultivation origin, and by different prices. All the attributes and corresponding levels are reported in Table 1 below. The first two attributes (reduction in the use of water and fertilizers) have been selected as the most pertinent attributes for environmental sustainability, as current research is moving towards the identification of resilient crops with improved resource use efficiency (Pareek *et al.*, 2020). In the spirit of the several research initiatives supported in Europe to promote agricultural resilience, we considered the following levels for the two environmental attributes: 30% reduction, 20% reduction and no reduction.

Table 1 – Discrete Choice Experiment attributes and attribute levels

Attribute	**Attribute description**	**Levels**
Reduction in water as an input	Reduction in the use of water relatively to standard cultivation practices	-30%, -20%, no change

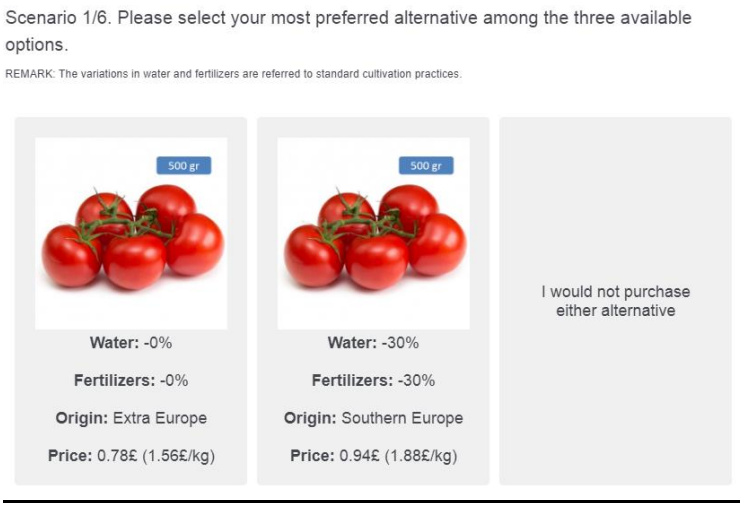
Reduction in fertilizers as an input	Reduction in the use of fertilizers relatively to standard cultivation practices	-30%, -20%, no change
Origin	Where the tomato is cultivated	Southern Europe, Northern Europe, Extra Europe
Price	Price for a pack of 500 grams of tomatoes sold in supermarkets	UK: 0.52£, 0.65£, 0.78£, 0.94£ Italy: 1€, 1.25€, 1.5€, 1.8€

The attribute for origin was suggested during two focus groups conducted in December 2018 and by international experts in the field. The levels for origin have been identified to capture the preferences of respondents towards tomatoes cultivated in Southern and Northern Europe, and for non-European tomatoes. Last, fresh tomato prices have been identified during a market analysis in the main stores of Italy and of the UK. Average prices in Italy and in the UK for a pack of 500g respectively range from 1€ to 1.8€ and from 0.52£ to 0.94£.

To make the purchasing scenario as realistic as possible and to reduce the hypothetical bias typical of Discrete Choice Experiment (Carlsson *et al.*, 2005), we introduced a cheap talk script to make consumers imagine themselves at the supermarket buying a pack of 500 grams of fresh tomatoes (Figure 2). This product specification was aimed at making consumers comfortable with a friendly and popular tomato product.

For each country, a D-efficient, a Multinomial Logit pilot design was developed and tested to retrieve parameter priors. The priors were then used to construct a D-efficient, Multinomial Logit design with Bayesian priors. The designs for the Italian and UK samples have a D-error of 0.01 and 0.013 respectively.

Figure 2 – Sample choice situation



The last section of questionnaire contains items from the scale for attitude toward environmental protection (Kaiser, 1998; Kaiser & Wilson, 2004, Kaiser et al., 2010) and items from the scale for attitude towards nature (Brügger el al. 2011): these questions are either dichotomic (yes/ no, approve/disapprove) or based on a 5-point Likert scale (never, seldom, occasionally, often, very often); a "not applicable" option was also available. In order to make the survey as user-friendly as possible, we reduced the number of items dividing the total set of 90 questions (50+40) in three sub-sets containing a selection of 36 questions regarding the environment and nature preserving, at the same time, the balance between the two types of items included (56% regarding environmental protection and 44% regarding connection with nature). To create blocks of similar difficulties and to ensure sufficient latent drift in each block, we selected questions depending on their difficulties reported in the literature: we used the environment protection difficulty scores of Kaiser et al. (2013) and the connection with nature difficulty scores of Brügger et al. (2011). Also, some questions were common across the 3 blocks to make sure the difficulty was ex-post comparable. Finally, the order of appearance was randomized.

4.2 Sample description

The representative sample compositions are reported in Table 2. The final samples consist of 500 respondents in Italy and 512 in the UK.[3] The two countries considered are similar in terms of age and gender composition, though they remarkably differ in terms of educational attainments: even though the two educational systems are not perfectly overlapping, in Italy almost half of the sample has a primary or lower secondary education. The distributions of the other socio-demographic variables collected throughout the survey are reported in Table 3.

[3] We dropped 22 observations (i.e. 2% of the total sample size) that displayed no variation at all in their responses. Following Green (1991), our sample sizes are satisfactory for a study in behavioural domain.

Table 2 - National and sample demographic characteristics

		Italy		UK	
Quota description		**National**	**Sample**	**National**	**Sample**
Age [a]	18-24	11.19%	10.40%	14.51%	14.06%
	25-49	37.95%	38.40%	40.24%	36.91%
	50-64	24.80%	25.00%	23.05%	22.46%
	Over 65	26.07%	26.20%	22.20%	26.56%
Gender[b]	Male	48.65%	49.00%	48.91%	47.27%
	Female	51.35%	51.00%	51.09%	52.73%
Education[c]	Primary and lower secondary education	49.25%	48.20%	21.06%	18.55%
	Upper secondary school and college	36.06%	36.40%	40.17%	40.63%
	Tertiary education	14.69%	15.40%	38.77%	40.82%

Note a: Our elaboration on 2018 Eurostat. The reported national quotas for the age group actually refer to the group aged between 15 and 24. Note b: Eurostat data. Note c: Italian national quotas from ISTAT; UK national sample quotas provided by Qualtrics.

Table 3 - Other socio-demographic variables distribution

Variable		**Italian sample**	**UK sample**
Income level adequacy	Not adequate	30.20%	8.98%
	Almost adequate	41.60%	39.45%
	Adequate	19.20%	36.52%
	More than adequate	9.00%	15.04%
Household size	1	12.60%	16.99%
	2	32.20%	42.77%
	3/5	52.80%	37.98%
	6 people and more	2.40%	2.34%

Source: Our elaboration on survey data

5. Estimation results

5.1 Rasch model results

To compute the two personal dimensions of attitude for Italians and Britons, we applied the Rasch model discussed earlier.[4] We calibrated the two different scales on the whole set of items regarding environmental protection and connection with nature to obtain item difficulties and the two attitude scores for each respondent. We dichotomized all the behaviours that originally had a five-point polytomous response format in order to prevent excessive measurement error, particularly in attitude research (DeCoster et al., 2009; Kaiser et al., 2020). By using the same split adopted in Kaiser's works, the options ''never'', ''seldom'', and ''occasionally'' were treated as negative and ''often'' and ''always'' were classified as positive responses. All missing values (i.e. the "not applicable" option in

[4] The analysis reported below were conducted using the Software R and the R-script for the General Ecological Behaviour scale calibration available at http://www.ipsy.ovgu.de/ipsy/en/sozpsy-path-980,1404-p-31.html.

all the responses) were considered as an individual not behaving alike, and hence they were handled as negative responses.

Results show that items are scored from -4 to 4 to sort behaviours from the least to the most difficult to engage with. Similarly, respondents' scores range from the lowest to the highest, indicating less or more care towards the environment and nature. It is worth recalling that item scores are endogenous and depend on how respondents in the samples answer and, more specifically, on how many respondents engage in a certain behaviour. The higher the share of respondents, the lower the item score. Item scores are the crucial in retrieving attitude, as person scores indicate if the person engages in easy or difficult behaviours (Smolders *et al.*, 2012).

Table 4 below reports the average item descriptive statistics for each type of question and country. By construction, each of the four-groups examined has a 0 mean item difficulty. The mean of Infit MS and Outfit MS indicate how productive for measurement the items considered are. Following Linacre (2002, 2010), Bond and Fox (2011) and Mahwah et al., (2020) we removed three misfitting items from the nature scale both for Italy and UK. All reliability coefficients are greater than 0.50, proving the reliability of the two scales in measuring attitudes. Tables A.1 and A.2 in Annex report the infit and outfit Mean Squared values for all items.

Table 4- Item descriptive statistics

Country	Item	Mean of difficulty scores	INFIT MS min	INFIT MS max	OUTFIT MS min	OUTFIT MS max	Separation reliability
Italy	Environmental Items	0.00	0.72	1.28	0.31	1.57	0.54
	Nature Items	0.00	0.72	1.38	0.48	1.72	0.71
UK	Environmental Items	0.00	0.80	1.21	0.37	1.68	0.58
	Nature Items	0.00	0.62	1.19	0.41	1.76	0.67

Note: MS stand for Mean Squared value. The reported "Separation" Reliability is the Rasch separation reliability coefficient.

In both countries, the environmental score is greater than the average nature one, suggesting that it is easier, on average, to display an environmental protection attitude rather than being connected with nature, even though the distribution of natural scores is more dispersed, suggesting a larger source of heterogeneity among respondents.

5.2 Discrete Choice Experiment results

In the next lines we describe the passages that brought us to the estimation of a Mixed Logit Model for Italy and of a Latent Class Model for the UK. All the choices we made were such to obtain the

highest flexible and parsimonious empirical specification. Each sustainability attribute was re-coded into a dummy to counterpose sustainability in either water or fertilizers vs. no sustainability. Origin was effect coded into a dummy for Southern Europe and a second dummy for Extra Europe.

We initially estimated in each country a Conditional Logit Model (MacFadden, 1974) with fixed parameters, i.e. assuming that respondents were all equal. We then re-estimated the Choice data also accounting for respondents' heterogeneity. As anticipated in Section 3.2, after the visual inspection of the choice data we decided to model Italians' choices using a Mixed Logit Model and to use a Latent Class Model for respondents in the UK. In fact, the parsimonious and flexible Mixed Logit Model with random terms and error component which was estimated for Italians[5] did not converge when applied to the UK data,[6] where respondents' preferences were characterized by a bimodal distribution. The heterogeneity of UK respondents was more properly represented by a segmentation in 4 latent classes. We therefore estimated a Latent Class Model, with 4 classes to retrieve the Willingness to Pay for each attribute of each class.[7] Since each respondent can belong to each of the four classes with certain probabilities, individual Willingness to Pay for a certain attribute are the weighted average of class Willingness to Pay and the probability of belonging to each class.

The results of the Italian Discrete Choice Experiment are reported in Table 5, which compares the Conditional Logit results with the unrestricted and restricted Mixed Logit Model. In terms of Log-Likelihood and information criteria, the Mixed Logit specifications outperform the Conditional Logit one. Despite the very similar fit displayed by the unrestricted and restricted model we prefer the more parsimonious and less noisy restricted version reported in specification (3) (de Villiers *et al.*, 2019) to retrieve individual Willingness to Pay. Results are displayed in the Willingness to Pay space, so the estimated coefficients should be interpreted directly as Willingness to Pay. On average, Italians are willing to pay a price premium for a tomato with sustainable water characteristics, but we observe a negative Willingness to Pay for fertilizers. Southern Europe origin is the attribute for which Italians are on average willing to pay the highest premium. On the contrary, they are not satisfied with a tomato coming from outside Europe.

Table 5– Discrete Choice Experiment results: Italy

[5] The Mixed Logit with random terms and error component was estimated in the Willingness to Pay-space using the command *mixlogitwtp* (see Hole, 2015) by Stata 16. This model estimates the Willingness to Pay for each model attribute. The Variance Covariance matrix is available upon request.

[6] Convergence was not achieved despite the several attempts conducted using different software (Stata, Biogeme, Julia), alternative optimization algorithms (Halton and MHLS) and several draws (up to 10,000).

[7] We estimated a Latent Class Model with class membership defined by age, gender, and family size dummies. The highest fit, in terms of LL, AIC and BIC, was obtained with the 4-class specification.

	(1)	(2)	(3)
	Conditional logit	Unrestricted MXL-EC	Restricted MXL-EC
Water	0.0850	0.147*	0.155*
	(1.69)	(2.37)	(2.40)
Fertilizers	-0.230***	-0.484***	-0.571***
	(-3.45)	(-3.97)	(-4.10)
South EU	0.469***	0.651***	0.712***
	(7.04)	(5.07)	(5.33)
Extra EU	-0.633***	-1.317***	-1.372***
	(-8.03)	(-7.44)	(-8.14)
Buy	1.284***	0	0
	(8.59)	(.)	(.)
Price	-0.540***		
	(-6.34)		
Price (negative)		0.571**	0.503***
		(3.28)	(3.38)
No - Buy		-3.265***	-3.358***
		(-10.46)	(-11.56)
Standard deviations for random terms in the MXL specification			
Water		0.2826***	0.2751***
		(0.0758)	(0.0896)
Fertilizers		1.7086***	1.8091***
		(0.1945)	(0.1929)
South EU		0.1319	0
		(0.1645)	(0.000)
Extra EU		1.6838***	1.7674***
		(0.2271)	(0.2023)
Buy		1.3797***	1.4537***
		(0.1772)	0.1758
Price (negative)		0.5290*	-0.1706
		(0.3020)	(0.2477)
LL	-3034.2667	-2332.793	-2332.97
N.	9,000	9,000	9,000
AIC	6080.533	4719.586	4719.94
BIC	6123.163	4911.42	4911.774

*Statistical significance: *, 10%; **, 5%; ***, 1%. MXL stands for Mixed Logit model and EC stands for Error Component. Standard errors are reported in parentheses. In the conditional logit, standard errors Willingness to Pay (WTP) clustered by respondent. Both the unrestricted and restricted MXL-EC have been estimated in the WTP-space on 1000 Halton draws. In either case, the mean of the Buy coefficient has been set to 0 and all parameters were assumed to be randomly distributed according to a Normal distribution function, with the exception of negative price and No-Buy, which were assumed to be respectively log-normally distributed and fixed. The restricted MXL-EC stems from the unrestricted MXL-EC as the covariances of the Cholesky matrix that were not statistically significant have been set to 0.*

Table 6 below reports the results in the preference space resulting from the British Discrete Choice Experiment. The Latent Class analysis improves the model statistical fit upon the conditional logit, and the restricted Latent Class model improves upon the information criteria of the unrestricted version. The results of the 4-latent class restricted model show that British respondents are, on average, not particularly sensible to the water footprint typical of tomato cultivation. On top of that, respondents belonging to Class 1 and 4 are averse to fertilizer reduction, too, differently from

respondents in Class 2, for whom fertilizer sustainability is utility enhancing. On average, origin seems not to be a tomato purchasing driver for British respondents, with the exception of Class 2, that is positively impressed by Southern Europe tomatoes and negatively affected by tomatoes from Extra Europe. Results reported in Tables 5 and 6 denote the average Willingness to Pay and preferences, for Italy and the UK, for different attributes relevant for tomato consumption.[8]

[8] Specifically, class membership in the UK was based on socio-demographic variables (gender, age, etc…). For Italy, as anticipated earlier, the error component introduced in the Mixed Logit Model implicitly accounts for consumers' different ability to conjecture the hypothetical alternatives presented in the Discrete Choice Model, which in turn depends also on individual and socio-demographic factors (see Scarpa *et al.*, 2007).

Table 6 – Discrete Choice Experiment results: the UK

	Conditional logit		Unrestricted LCM				Restricted LCM			
			Class1	Class 2	Class 3	Class4	Class1	Class 2	Class 3	Class4
Water	-0.168***		-0.928***	0.102	-0.544**	-0.613***	-0.851***	0.000	-0.636***	-0.596***
	(0.050)		(0.299)	(0.120)	(0.275)	(0.222)	(0.271)	(.)	(0.209)	(0.216)
Fertilizers	-0.533***		-2.894***	0.312**	-0.319	-0.781***	-3.026***	0.231**	0.000	-0.782***
	(0.063)		(0.416)	(0.139)	(0.215)	(0.271)	(0.417)	(0.114)	(.)	(0.261)
South EU	0.082		-0.092	0.310**	0.160	-0.037	0.000	0.284**	0.000	0.128
	(0.058)		(0.236)	(0.125)	(0.349)	(0.278)	(.)	(0.116)	(.)	(0.245)
Extra EU	-0.043		-0.155	-0.308***	0.839***	-0.383	0.000	-0.300***	0.629***	0.000
	(0.058)		(0.277)	(0.114)	(0.315)	(0.262)	(.)	(0.108)	(0.243)	(.)
Buy	3.842***		5.086***	3.437***	10.745***	1.414***	5.377***	3.584***	11.010***	1.142**
	(0.169)		(0.668)	(0.526)	(1.024)	(0.503)	(0.744)	(0.529)	(1.091)	(0.469)
Price	-2.563***		-1.665***	-0.584**	-10.148***	-2.090***	-2.137***	-0.576**	-10.453***	-1.925***
	(0.180)		(0.611)	(0.286)	(1.253)	(0.704)	(0.666)	(0.285)	(1.362)	(0.689)
		Determinants of Class membership								
		Gender dummy (women)	0.105	-0.358	-0.311	0.000	0.106	-0.354	-0.287	0.000
			(0.375)	(0.375)	(0.344)	(.)	(0.372)	(0.368)	(0.341)	(.)
		Age dummy (Over 65)	-0.759**	-1.727***	-0.944***	0.000	-0.745*	-1.664***	-0.906***	0.000
			(0.384)	(0.430)	(0.352)	(.)	(0.382)	(0.419)	(0.350)	(.)
		Single household dummy	-0.278	-0.150	0.671	0.000	-0.266	-0.103	0.665	0.000
			(0.559)	(0.534)	(0.447)	(.)	(0.551)	(0.521)	(0.447)	(.)
LL	-2428.520		-2011.216				-2014.071			
AIC	4869.04		4094.432				4088.141			
BIC	4911.812		4351.065				4302.002			
N	9216		9216				9216			

*Statistical significance: *, 10%; **, 5%; ***, 1%. LCM stands for Latent Class Model. Standard errors are reported in parentheses. In either LCM specifications, all terms*

were random. We estimated the unrestricted model followed by its restricted version, where for each class all the non-statistically significant coefficients were set to 0.

5.3 Seemingly Unrelated Regression results

Let us now examine how individual Willingness to Pay of Italians and Britons, respectively derived from the Mixed Logit model or the Latent Class model, are affected by the two shades of environmental attitude. Table 7 reports the result of the Seemingly Unrelated Regression analysis conducted in Italy and in the UK. In both cases, we reject the null hypothesis of the Breusch-Pagan test of independence of errors across the four equations considered, and conclude that this model is indeed superior to its Ordinary Least Square counterpart (Breusch and Pagan, 1980).[9] Hence, residuals from each Seemingly Unrelated Regression equation are significantly correlated one another; this reveals that the error terms associated with the environmental and nature attitude are highly correlated across the four equations describing the different tomato attributes. In other words, there is a certain relationship between the Willingness to Pay for the different tomato attributes.

In either country, the coefficients capturing the effects of environmental attitude on Willingness to Pay are significant at the 1% level in almost all the equations considered, with the exception of the equation for reduction in the use of fertilizers. The statistical significance of effects exerted by attitude toward nature characterizes all the equations in the UK Seemingly Unrelated Regression analysis, a result that fail when we detect in the Italian coefficients. Generally speaking, the chi-square statistic is statistically significant for the Italian and UK Seemingly Unrelated Regression for all the single equations, but that of fertilizers. Overall, the results reported in Table 7 indicate that, generally speaking, attitudes have an influence on persons' Willingness to Pay, being most of the estimated coefficients and robustness check statistically significant. Moreover, the two different attitudes perform in a very different way, as we expected from our research question.

Table 7 – Results of Seemingly Unrelated Regression analysis

[9] We can reject the null hypothesis of diagonality at 1% significance level.

	Italy	UK
Eq.1: WTP for water sustainability		
Nature	-0.036	0.057*
	(0.038)	(0.03)
Environment	0.263***	-0.269***
	(0.053)	(0.039)
Eq. 2: WTP for fertilizer sustainability		
Nature	0.014	-0.032*
	(0.047)	(0.019)
Environment	0.000	0.006
	(0.065)	(0.024)
Eq. 3: WTP for Southern European origin		
Nature	-0.048	0.055***
	(0.048)	(0.013)
Environment	0.203***	-0.122***
	(0.067)	(0.016)
Eq. 4: WTP for Extra European origin		
Nature	0.034	-0.082***
	(0.045)	(0.019)
Environment	-0.352***	0.200***
	(0.062)	(0.024)
Chi square:		
Eq.1	*26.35****	*47.41****
Eq.2	*0.11*	*2.8*
Eq.3	*9.18***	*62.31****
Eq.4	*34.82****	*72.2****
BP test	*342.807****	*1255.457****
LR Test	*579.638****	*3498.635****
N	500	512

*Note: WTP stands for Willingness to Pay. Statistical significance: *, 10%; **, 5%; ***, 1%. Standard errors are reported in parentheses. GLS estimator is used. BP stands for Breusch-Pagan LM Diagonal Covariance Matrix Test for Independent Equations and testing the correctness to run the Seemingly Unrelated Regression instead of single Ordinary Least Squares. LR test is the Likelihood Ratio LR Test for Heteroscedasticity.*

6. Discussion

In line with the conceptual framework of Figure 1, according to which behavioural consequences may be affected by attitudes, we start from the results of the Seemingly Unrelated Regression analysis to discuss how the two dimensions of environmental attitude estimated earlier affect consumers' Willingness to Pay for certain tomato attributes. As it emerges in Table 7, attitude toward environmental protection and toward nature exert different effects on consumers' Willingness to Pay, a result confirming the bi-dimensional characterization of attitude conceived by Kaiser *et al.*, (2013).

As expected, results also confirm that consumers in Italy and in the UK perceive fresh tomatoes in two very different ways, and the way they react when offered such a product seems to be influenced

by exogenous factors such as food habits and climate conditions, that in turn characterize consumption and purchasing patterns. The comparison is thus between a "tomato-lover" country, Italy, and a "tomato-neutral" country, the UK.

The results of the Italian analysis reveal that the impact of attitude toward nature (which is never statistically significant) differs substantially from that of attitude for environmental protection (which is always statistically significant, with the exception of fertilizers). Thus, Italians' attitude toward nature has no effect on their consumption choices toward a resilient tomato. When it comes to attitude toward environmental protection, results suggest that Italians are willing to pay a price premium for a tomato with a reduced water footprint. Italians prone to environmental protection are also willing to pay more for fresh tomatoes grown in Southern Europe, which are usually perceived as "local" by consumers and rich in all the symbolic features typical of a local product. Similarly, Italians prone to the conservation of the environment are also averse to tomatoes coming from outside Europe, as confirmed by the negative Willingness to Pay coefficient. Italians environmentalists are clearly aware of the social, economic, and qualitative role played by tomato cultivation, especially in traditional cultivation areas. They are familiar with tomato cultivation, and their support for this product might be driven by motivations aimed at fulfilling their sustainability desire. The purchasing decision of an environmentalist is thus a sort of "endorsement" of sustainability: A Southern Europe tomato is, in their opinion, more socially sustainable even if cultivated with a great water consumption in a potentially water-deficit area probably falling into the *local food trap* (Born and Purcell, 2006, Baldi *et al*., 2019).

The analysis conducted on the UK sample generated totally different results. First of all, the role exerted by attitude toward nature on their Willingness to Pay is statistically significant for all the tomato attribute considered. This is true also for the attitude toward environmental protection, though not for fertilizers. Once again, the two dimensions of attitude are perfectly distinct and, in this case, even complementary. Attitude toward environmental protection is statistically significant and negative as far as the Willingness to Pay for tomato water reduction is concerned: perhaps, Britons with environmental attitude perceive water scarcity as a non-impelling issue, not strictly related to environmental protection in the UK, be it for the lower domestic relevance of tomato cultivation or for the different climatic profile that blur the perception of the incumbent water shortage risk. Those who are instead keen to nature show their sensibility to tomato water-related issues. As far as origin is concerned, it is important to recall that the physical extension of tomato cultivation in the UK is rather limited, and most of the fresh tomatoes consumed by Britons are imported (FAOSTAT, 2017). It would be very hard for most Britons to think of tomato as a local product, when it can more

accurately pictured as an "imported good". This remark is useful when interpreting the different effects of the two dimensions of attitude on Willingness to Pay for tomato origin. Attitude toward environmental protection does not automatically translate into an increased spending propensity toward a Mediterranean tomato, whereas it increases the Willingness to Pay for tomatoes grown outside Europe. This evidence should not fail to consider the Brexit factor, which occurred shortly before the survey took place. We argue in fact that the recent political shock might have ultimately impacted British consumers' preferences for origin. Under these circumstances, consumers actively engaged in environmental protection might end up opting for extra European tomato grown crops, to the detriment of typical Mediterranean varieties. On the other hand, Britons connected with nature are more inclined to incur an increased cost for a Southern European origin relative to Extra-European tomatoes. This could be traced back to their hedonistic desire of enjoying nature and evoke personal and subjective feelings, such as landscapes, tastes and odours typical of Southern Europe.

Last but not least, we discuss how environmental and nature attitude affect the Willingness to Pay for tomato fertilizer reduction. In this context, we argue that water and fertilizer reductions, though equally important and ambitious targets for environmental protection and for policy-makers in charge of environmental conservation, are conjectured differently by consumers. In all of the cases considered (with the exception of a 10% statistical significance for UK naturalists) its impact is in fact statistically non-significant. Hence, we can conclude that, in either country, for tomato cultivation fertilizer reduction is an attribute that seems to be not affected by the two dimensions of attitude considered.

7. Conclusions

The present study contributes to the literature examining the relation between consumer environmental attitudes and the corresponding behavioural patterns using novel theoretical approaches and adapting strategies not typical of food consumer studies. In particular, we assess how two distinguished dimensions of environmental attitude affect consumer behaviour in terms of their Willingness to Pay for a hypothetical tomato with specific cultivation characteristics (reduced water footprint, reduction in the use of fertilizers, geographical provenance).

To this purpose, we use a revised Campbell Paradigm to measure attitude resulting from the analysis of past behaviours or overt acts. This is an innovative approach to study food consumer behaviour that differs from the traditional one that is based on a subjective and explicit measure of attitude resulting from evaluative and normative self-reported statements. We use the twofold interpretation

of attitude for the environment domain proposed by environmental psychologists who distinguish environment preservation from nature appreciation. The analysis was performed in two countries, Italy and the UK, that conceive differently tomato as a product and are more or less aware of its environmental footprint. Tomato in Italy is an iconic product, the symbol of Italian cuisine and food culture, loved and consumed by most of Italians. Also, many regions in Italy experience water scarcity on a regular basis; this increases Italians' awareness of the water shortages afflicting Mediterranean areas. Tomato is regularly consumed in the UK, too; nonetheless, consumers do not perceive it as a local product and are not particularly concerned with the significant water footprint typical of its cultivation. We conducted the same survey in the two countries and analysed the two samples separately. We performed a Rasch analysis to retrieve individual attitude measures from stated behaviour; then we analysed the choice data using a Mixed Logit model (in Italy) and Latent Class model (in the UK) to obtain individual Willingness to Pay for each tomato attribute. Last, a Seemingly Unrelated Regression was performed to estimate the impact of the two distinguished attitudes on intention behaviours expressed by willingness to pay. The whole methodological structure is based on a novel conceptual framework (Rosenberg and Hovland, 1960; Kaiser and Wilson, 2019) never applied to the context of food analysis.

This analysis has several findings. First, we observe that the two individual measures of attitude that we have considered, that is, attitude toward environmental protection and toward nature, play a significant role in shaping the purchasing behaviour for the resilient tomato. This result is thus in line with the intuition of those environmental psychologists that, in light of the different behavioural consequences, recommended to keep the two attitudes apart. Moreover, we observe that cross-cultural and climate profiles generate differences in consumer acceptance of a sustainable tomato. From this perspective, environmental protection attitude drives Italians' spending propensity for a tomato with a reduced water footprint with a local, or Southern European, origin. Attitude toward nature seems instead not to affect tomato consumption behaviour. On the other hand, we observe that in the UK attitude toward environmental protection shapes consumer Willingness to Pay in a totally different way, let it be for consumers' mis-perception of water shortage and/or for the way tomato is considered. When it comes to attitude toward nature, Britons' consumption behaviour is instead more favourable toward a Southern Europe tomato with a reduced water footprint.

Considered that consumers are central to the development of sustainable consumption goods, their preferences and attitudes should be duly taken into account by marketers and environmental policy makers. In particular, this finding clearly indicates that specific policies and marketing interventions aimed at promoting the consumption of a sustainable tomato, and, in general, of other sustainable

horticultural crops, should be tailored to consumers' characteristics, preferences, and to the different shades of consumers' attitude. The mere reference to a generic environmental attitude might not be sufficient to promote the development of a consumer culture oriented towards sustainable products. The authors see substantial theoretical and practical value in treating appreciation of nature and appreciation of environmental protection as two separate attitudes that both affect consumer behaviour. For example, if the intention is to promote the consumption of sustainable products in Italy, then attitude toward environmental protection should be the most malleable communication target and thus one of the critical factors in shaping market policies. A promotional campaign touching the chords of the pure enjoyment of nature might not achieve the desired goals.

These results pave the way to new approaches for the analysis of food consumption behaviour that could be useful in the definition of new sustainable markets that comply with green policies. These results can be achieved provided that policy makers and marketers can really understand how different consumer segments would react to different policy scenarios, and this is especially true when actions are to occur in the food sector. The present study comes with some limitations that future researches could overcome. The survey at the basis of the whole analysis combines different methodological approaches; in its final version, it included several questions measuring environmental attitude as well as the Discrete Choice Section, requiring a high cognitive effort on the participants' side. A non-hypothetical food product would surely reduce the overall survey difficulty. Moreover, future researches in this field could focus on more advanced models, such as hybrid choice models.

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Annex 1: Calibration of the Rasch Model

The Tables below (Table A.1 and Table A.2) report the results of the calibration of the Rasch Model performed on the 50 questions including items regarding environmental protection and 40 items mirroring individual connection with nature. A first calibration on the connection with nature returned items with outfits well above the cut-offs suggested in the literature. We removed these items (three in Italy and three in the UK) and re-calibrated the model.

Table A1 – Attitude toward environmental connection items													
		Italy						UK					
Item id	**Description**	**∂**	**Std. Error**	**infit MS**	**outfit MS**	**infit t**	**outfit t**	**∂**	**Std. Error**	**infit MS**	**outfit MS**	**infit t**	**outfit t**
ENV01	I buy beverages in cans*	-1.467	0.23	0.902	0.932	-0.733	-0.262	-0.424	0.188	0.974	0.94	-0.355	-0.48
ENV02	I buy seasonal produce	-1.381	0.23	0.77	0.668	-1.975	-1.702	-0.169	0.187	0.957	0.929	-0.618	-0.601
ENV03	I wait until I have a full load before doing my laundry	-1.744	0.263	0.864	0.69	-0.758	-1.229	-1.743	0.234	0.869	0.767	-0.946	-1.069
ENV04	I boycott companies with an unecological background	1.508	0.212	0.897	0.82	-1.041	-1.271	2.024	0.231	0.874	1.023	-0.999	0.184
ENV05	I buy beverages and other liquids in returnable bottles.	2.323	0.245	0.842	0.729	-1.139	-1.156	1.742	0.224	0.885	0.72	-1.012	-1.588
ENV06	I buy meat and produce with ecolabels	0.27	0.102	0.816	0.778	-5.56	-5.106	1.467	0.117	0.863	0.816	-2.506	-2.211
ENV07	I buy bleached and colored toilet paper*	-0.722	0.217	1.088	1.154	0.857	0.999	-1.706	0.239	0.961	1.138	-0.231	0.663
ENV08	I buy convenience foods*	-1.763	0.175	0.984	1.432	-0.115	2.149	-0.619	0.133	0.958	1.017	-0.759	0.199
ENV09	I buy furniture made with domestically grown wood	1.022	0.219	1.038	1.068	0.497	0.666	2.472	0.329	0.949	1.363	-0.161	1.073
ENV10	I buy products in refillable packages	0.363	0.183	0.802	0.769	-3.435	-2.984	1.157	0.192	0.857	0.788	-1.851	-1.851
ENV11	I talk with friends about problems related to environmental pollution, climate change, and/or energy consumption	1.02	0.188	0.843	0.81	-2.377	-1.907	1.039	0.19	0.844	0.784	-2.116	-2.007
ENV12	I have a contract for renewable energy with my energy provider.	0.51	0.201	0.982	0.969	-0.264	-0.393	1.144	0.202	1.093	1.191	1.106	1.451
ENV13	At red traffic lights I keep the engine running*	0.701	0.187	1.063	1.082	0.971	0.975	0.731	0.203	1.039	1.144	0.571	1.533
ENV14	I contribute financially to environmental organizations	2.686	0.267	0.834	0.598	-0.997	-1.532	2.787	0.278	0.799	0.604	-1.171	-1.31
ENV15	I own solar panels	2.894	0.28	0.93	1.029	-0.321	0.195	2.425	0.274	0.961	1.27	-0.165	0.994
ENV16	After meals I dispose of leftovers in the toilet*	-3.13	0.422	0.855	0.609	-0.353	-0.633	-3.179	0.422	0.948	1.682	-0.054	1.119
ENV17	After a picnic I leave the place as clean as it was originally	-3.823	0.582	0.82	1.089	-0.231	0.375	-3.528	0.509	0.885	1.683	-0.154	0.997
ENV18	I drive in such a way as to keep my fuel consumption as low as possible	-0.701	0.209	0.861	0.763	-1.477	-1.757	-1.328	0.229	0.867	0.829	-1.16	-0.987
ENV19	I refrain from owning a car	2.278	0.163	1.08	1.571	0.867	3.242	1.606	0.153	0.898	0.848	-1.351	-1.254
ENV20	I have already looked into the pros and cons of having a private source of solar power	0.29	0.197	0.918	0.9	-1.219	-1.081	0.654	0.198	1.124	1.149	1.616	1.341
ENV21	I drive on freeways at speeds under 100 kph (62.5 mph)	1.556	0.216	1.024	0.957	0.261	-0.237	1.078	0.207	1.205	1.333	2.342	2.768

ENV22	In the winter, I air rooms while keeping on the heat and leaving the windows open, simultaneously*	-0.006	0.179	1.086	1.054	1.394	0.655	-3.341	0.42	0.909	0.66	-0.161	-0.559
ENV23	In the winter I turn down the heat when I leave my apartment for more than 4 hrs	-0.345	0.19	1.059	1.089	0.797	0.822	-1.091	0.202	0.827	0.725	-1.92	-2.001
ENV24	In the winter I keep the heat on so that I do not have to wear a sweater*	-0.992	0.213	0.951	0.842	-0.413	-0.933	-1.286	0.209	0.91	0.807	-0.835	-1.167
ENV25	I wash dirty clothes without prewashing	0.071	0.186	0.975	0.94	-0.384	-0.695	-1.145	0.203	1.056	1.188	0.603	1.198
ENV26	I read about environmental issues	1.428	0.202	0.847	0.774	-1.737	-1.811	0.946	0.185	0.908	0.939	-1.35	-0.655
ENV27	I put dead batteries in the garbage*	-0.145	0.193	1.278	1.399	3.607	3.518	-0.75	0.202	0.939	0.866	-0.718	-0.81
ENV28	I have pointed out unecological behavior to someone	1.345	0.195	0.843	0.742	-2.037	-2.165	1.927	0.218	0.859	0.699	-1.293	-1.674
ENV29	I use a chemical air freshener in my bathroom*	-0.828	0.207	0.971	1.041	-0.261	0.313	-1.213	0.215	0.899	0.752	-0.912	-1.525
ENV30	I use a clothes dryer*	-1.719	0.177	0.969	0.996	-0.236	0.035	-0.495	0.131	1.042	1.117	0.858	1.414
ENV31	In nearby areas (around 20 miles) I use public transportation or ride a bike	1.504	0.11	0.988	0.982	-0.212	-0.21	0.834	0.103	0.97	0.961	-0.734	-0.677
ENV32	I bring empty bottles to a recycling bin	-1.446	0.23	0.927	0.733	-0.536	-1.336	-1.528	0.237	0.849	0.637	-1.072	-1.649
ENV33	I own energy efficient household devices (class A+ or better)	-0.744	0.205	0.964	0.905	-0.38	-0.664	-0.262	0.186	0.992	1.11	-0.099	1.03
ENV34	I own a fuel-efficient automobile (that is less than 3 gallons per 100miles)	0.36	0.201	1.049	1.075	0.72	0.817	0.688	0.221	1.069	1.056	0.791	0.491
ENV35	I prefer to shower rather than to take a bath	-1.827	0.258	0.973	0.776	-0.11	-0.841	-0.715	0.197	1.053	1.126	0.644	0.862
ENV36	For longer journeys (more than 6 hrs) I take an airplane*	-1.408	0.235	1.138	1.433	1.051	1.944	-0.384	0.204	1.059	1.038	0.826	0.337
ENV37	In hotels I have the towels changed daily*	0.011	0.195	1.104	1.2	1.46	1.934	-0.97	0.225	1.043	1.378	0.432	1.711
ENV38	I drive to where I want to start my hikes*	-0.756	0.212	0.925	0.781	-0.748	-1.498	-1.121	0.265	1.059	1.116	0.519	0.676
ENV39	I collect and recycle used paper	-0.601	0.194	0.889	0.793	-1.328	-1.705	-1.033	0.197	0.923	0.92	-0.853	-0.532
ENV40	I reuse my shopping bags	-2.8	0.391	0.826	0.651	-0.478	-0.696	-3.364	0.42	0.814	0.372	-0.467	-1.411
ENV41	If I am offered a plastic bag in a store I take it*	-0.696	0.195	0.859	0.757	-1.837	-2.04	-0.853	0.201	0.81	0.713	-2.208	-1.942
ENV42	I am a member of a carpool	3.087	0.178	0.947	1.017	-0.379	0.153	3.704	0.266	0.832	0.951	-0.792	-0.036
ENV43	I am a member of an environmental organization	3.204	0.335	0.828	0.719	-0.67	-0.699	3.066	0.316	0.931	0.81	-0.248	-0.477
ENV44	I am a vegetarian	3.289	0.351	0.719	0.311	-1.12	-2.269	2.949	0.295	0.901	1.029	-0.44	0.196
ENV45	I keep the engine running while waiting in front of a railroad crossing or in a traffic jam*	-1.616	0.245	0.946	1.018	-0.34	0.155	-0.899	0.23	1.009	1.179	0.125	0.955

ENV46	I kill insects with a chemical insecticide*	-1.418	0.233	0.981	1.123	-0.111	0.614	-1.844	0.257	0.937	1.146	-0.369	0.568
ENV47	I drive my car in or into the city*	-0.381	0.131	0.948	0.916	-1.044	-1.12	-0.603	0.142	0.987	0.955	-0.222	-0.501
ENV48	I use fabric softener with my laundry*	1.358	0.198	1.032	1.157	0.415	1.201	1.275	0.196	1.069	1.12	0.824	0.931
ENV49	I use an oven cleaning spray to clean my oven*	-1.624	0.245	0.952	1.09	-0.283	0.452	-0.935	0.206	0.902	0.855	-1.036	-0.85
ENV50	I ride a bicycle or take public transportation to work or school	1.004	0.196	1.048	1.049	0.638	0.501	0.811	0.211	0.942	0.925	-0.721	-0.704

MS stands for Mean Squared value. ∂ represents the difficulty of an item expressed in logits; the more negative a logit value, the easier the particular behaviour is. Conversely, the more positive the logit value, the more difficult the particular behaviour is. Logits stand for the natural logarithm of the engagement/no-engagement or endorsement/no-endorsement ratio.

**Items representing a negative attitude toward environmental protection that have been reversed before the calibration.*

Table A2 – Attitude toward connection with nature items

		Italy						UK					
Item id	**Description**	**∂**	**Std. Error**	**infit MS**	**outfit MS**	**infit t**	**outfit t**	**∂**	**Std. Error**	**infit MS**	**outfit MS**	**infit t**	**outfit t**
NAT01	I help snails cross the street	2.464	0.19	0.898	1.729	-0.947	2.139	2.559	0.217	0.759	0.498	-1.9	-1.578
NAT02	Listening to sounds of nature makes me relax	-2.762	0.305	0.775	0.547	-1.21	-1.007	-3.209	0.332	0.695	0.418	-1.625	-1.077
NAT03	Walking through a forest makes me forget about my daily worries	-1.646	0.237	0.816	0.87	-1.574	-0.458	-1.951	0.252	0.847	0.795	-1.048	-0.769
NAT04	I cross meadows barefoot	3.242	0.375	0.828	0.524	-0.585	-0.803	2.857	0.338	0.895	0.745	-0.374	-0.456
NAT05	I personally take care of plants	-1.42	0.226	0.929	0.764	-0.599	-1.028	-1.893	0.241	0.748	0.711	-2.154	-0.984
NAT06	As a child, I spent time in the woods	0.261	0.194	1.016	0.944	0.235	-0.376	-1.316	0.216	1.068	1.098	0.717	0.52
NAT07	Even when it is very cold or rainy, I go out for a walk	1.176	0.201	0.94	0.826	-0.673	-1.053	0.798	0.199	0.843	0.725	-1.942	-2.122
NAT08	I hike or run in nearby nature reserves or forests	1.839	0.129	0.962	0.924	-0.531	-0.428	1.523	0.131	0.956	0.897	-0.621	-0.639
NAT09	Pets are part of the family	-1.875	0.252	0.959	0.987	-0.249	0.06	-2.514	0.292	0.962	0.869	-0.176	-0.17
NAT10	Watching animals is exciting	-2.347	0.279	0.819	0.531	-1.099	-1.335	-3.44	0.351	0.973	0.956	-0.051	0.151
NAT11	I watch TV-shows that have animals as main characters	0.817	0.2	0.903	0.842	-1.154	-1.043	1.242	0.207	0.936	0.882	-0.643	-0.616
NAT12	I have an audio file (es. MP3, CD, etc..) with recorded sounds of nature	2.201	0.238	1.389	1.727	2.776	2.129	1.553	0.224	1.179	1.389	1.56	1.654
NAT13	The croaking of frogs is comforting	-0.892	0.227	1.005	1.133	0.079	0.613	-0.817	0.219	0.945	1.019	-0.574	0.164
NAT14	My favorite place is in nature	-2.541	0.296	0.808	0.654	-1.084	-0.762	-1.407	0.22	0.907	1.088	-0.868	0.451
NAT15	The noise of crickets gets on my nerves*	-1.637	0.225	0.999	1.022	0.032	0.171	-1.314	0.225	0.981	0.866	-0.142	-0.7
NAT16	I mimic animal behavior, such as the way a vulture walks **	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NAT17	I mimic sounds of animals **	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.721	0.301	0.825	0.493	-0.97	-0.848
NAT18	Carving in a tree feels like cutting myself	-0.851	0.218	1.093	1.114	0.976	0.704	0.628	0.214	1.057	1.107	0.687	0.738
NAT19	Indoor plants are part of the family **	-1.529	0.241	0.824	0.942	-1.435	-0.141	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NAT20	I get up early to watch the sunrise	2.039	0.249	1.01	1.055	0.119	0.281	1.909	0.24	0.937	0.999	-0.421	0.081
NAT21	I enjoy gardening	-1.453	0.232	0.832	0.635	-1.45	-1.706	-1.933	0.251	0.629	0.529	-3.193	-1.733
NAT22	I take time to consciously smell flowers	1.962	0.246	0.817	0.65	-1.364	-1.286	0.833	0.194	0.894	0.808	-1.354	-1.41
NAT23	I take time to watch the clouds pass by	1.035	0.202	0.866	0.826	-1.583	-0.837	1.29	0.214	0.949	0.817	-0.473	-0.607
NAT24	I deliberately take time to watch stars at night	1.92	0.242	0.767	0.631	-1.844	-1.416	1.525	0.219	1.051	1.076	0.482	0.418

NAT25	It makes me miserable to see a hedgehog that was hit by a car **	-2.87	0.36	0.895	0.874	-0.384	-0.006	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NAT26	I consciously watch or listen to birds	0.377	0.193	0.827	0.763	-2.421	-1.883	0.376	0.19	0.785	0.691	-3.058	-2.951
NAT27	I talk to animals	0.349	0.106	1.01	0.968	0.237	-0.377	0.149	0.104	0.959	0.947	-0.972	-0.7
NAT28	I talk to plants	1.573	0.21	0.729	0.569	-3.017	-2.421	2.038	0.251	0.741	0.564	-1.972	-1.734
NAT29	I mourn the loss of pets	-1.515	0.229	1.03	0.891	0.304	-0.411	-1.917	0.259	0.886	0.727	-0.756	-1.035
NAT30	I prefer outdoor to indoor sports	-1.344	0.246	0.884	0.835	-0.936	-0.492	-1.705	0.273	0.905	0.75	-0.667	-0.723
NAT31	I prefer forest hikes to city strolls	-1.093	0.213	0.942	0.827	-0.598	-0.97	-0.835	0.2	0.855	0.885	-1.866	-0.873
NAT32	I would always prefer spending time with my friends to spending time alone in nature*	-0.624	0.206	0.917	1.109	-0.984	0.796	-0.258	0.186	1.069	1.133	1.054	1.302
NAT33	I prefer living in a city*	-0.426	0.202	1.042	1.32	0.535	2.272	-0.981	0.201	0.928	0.976	-0.85	-0.127
NAT34	I collect mushrooms or berries	3.302	0.314	0.747	0.482	-1.316	-1.053	2.471	0.299	0.969	0.726	-0.109	-0.695
NAT35	I collect natural objects, such as for instance stones, butterflies, or insects	1.748	0.22	1.189	1.211	1.694	0.926	1.307	0.239	1.193	1.351	1.662	1.585
NAT36	If there is an insect such as a fly in my home, I try to catch and release it rather than kill it	0.134	0.135	1.059	1.145	1.097	1.516	0.069	0.133	1.117	1.301	2.227	2.879
NAT37	If one of my plants dies, I reproach myself	-0.549	0.113	0.961	0.953	-0.797	-0.481	0.26	0.112	0.992	0.956	-0.15	-0.511
NAT38	I feel the need to be out in nature	-0.139	0.195	0.847	0.728	-2.126	-2.008	0.305	0.192	0.795	0.719	-2.884	-2.623
NAT39	I spend time in a park	1.074	0.203	0.864	0.908	-1.581	-0.385	0.357	0.195	1.049	1.761	0.621	3.587
NAT40	A cleared forest makes me miserable**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-1.28	0.232	1.08	1.178	0.757	0.808

MS stands for Mean Squared value. ∂ represents the difficulty of an item expressed in logits; the more negative a logit value, the easier the particular behaviour is. Conversely, the more positive the logit value, the more difficult the particular behaviour is. Logits stand for the natural logarithm of the engagement/nonengagement or endorsement/non-endorsement ratio.

**Items representing a negative attitude toward environmental protection that have been reversed before the calibration.*

*** These items have been removed from the model calibration as they were misfitting. In fact, the scale was initially calibrated on all the 40 questions but these items had outfit greater than the cut-offs suggested by the literature (Bond and Fox, 2011; Mahwah et al., 2020). Following the analysis of the nature item Mean-squared errors, we removed these items (Linacre, 2010) and re-calibrated the items and person scores for the connection with nature part.*