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

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Abstract

Our paper contributes to the literature examining the relationship between environmental attitude and consumer behavioural patterns using novel theoretical approaches and adapting methods not typical of food consumption studies. We conduct a survey in two countries (Italy and the UK) with different climatic, socio-economic and cultural profiles to retrieve respondents' bi-dimensional environmental attitude, distinguishing between attitude towards environmental protection and attitude towards nature, and to see how these two measures characterize respondents' Willingness to Pay, elicited from a Discrete Choice Experiment, for the sustainability attributes of a hypothetical tomato. We observe that the two measures of attitude affect consumption patterns differently, and the signs of these directions change in the two countries, too. In other words, the spending propensity of Italians and Britons for a sustainable tomato is not only affected by their different food habits and cultural heritage, but also by their *environmentalist* or *naturalist* behaviour. The explanation of green behaviour using different dimensions of environmental attitude paves the way to new approaches for the analysis of food consumption behaviour that could be useful in the development of new markets driven by environmental and agri-food policies.

Keywords: Environmental attitude measurement; Consumer behaviour; Discrete Choice Experiment; Campbell Paradigm; Resilient tomato; Rash 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 relevant 12 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) as well as sustainable food consumption (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, by 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 and affected by subjectivity (De Houwer *et al.*, 2013) or over-estimated as the cognitive efforts are relatively easy to answer (Kaiser and Byrka, 2015).

The General Ecological Behaviour (GEB) scale has been proposed as an alternative approach overcoming the limitations above (Kaiser, 1998; Kaiser & Wilson, 2004, Kaiser *et al.*, 2010). Being based on the completeness of the psychometric assessment, this method can probably be considered one of the best measures in environmental psychology (Lange and Dewitte, 2019). This scale is based on the theoretical framework of the paradigm of Campbell (1963), henceforth CP, in which the measurement of attitude bypasses the causal direction usually adopted in the literature and that embraces the two-way relation from environmental attitude to green behaviour and vice-versa. This approach fundamentally relies on the ranking of selected indicators depending on their difficulty. These items are entirely based on past behaviours or overt acts and not on the evaluative and normative self-reported statements that instead characterize an explicit measure of attitude (Kaiser *et al.* 2018).

It also worth stressing that environmental attitude is generally considered as a uni-dimensional factor influencing green behaviour even though there are more shades of environmental attitude that are about to be discovered, as discussed in Lange and Dewitte (2019). In this spirit, research has tried to raise and exalt the latent dimensions of environmental attitude that could fill the big puzzle of consumer green behaviour.

Many times, this multi-dimensionality has been explored as a proper way to measure environmental attitude and to compare different pro-environmental behaviours (Stern, 2000; Vining & Ebreo, 2002; Lee *et al.*, 2014; Larson *et al.*, 2015). Among others, Kaiser *et al.* (2013) deconstructs environmental attitude into two components, the first being moved by individual efforts aimed at protecting the environment, and the other depending instead by the pure exploitation of nature for personal purposes.

The considerations above are aimed at contextualizing our paper, whose ultimate target is the understanding of consumer preferences and behaviour, as expressed by Willingness to Pay (WTP), for a hypothetical and sustainable tomato taking into account individual psycho-attitudinal propensity towards environmental issues.

Our paper offers an original methodological framework, by measuring individual environmental attitude using CP and the advancements proposed by Kaiser's scale in the food consumption domain, 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.

This is an original approach that, to the best of our knowledge, has never been adopted in agricultural economics for the comprehension of consumers' food decisions and for the analysis of tomato purchasing drivers.[1]

We thus fill this gap by explaining this behaviour with the two shades of environmental attitude, and by embracing the idea that these two shades might generate different consumption patterns and WTPs.

To reach our research goals, we conduct a survey in two countries, Italy and the UK, that are

[1] Maples *et al.* (2016) and Meyerding *et al.* (2019) elicited consumer preferences for different tomato sustainability attributes, but none of them considered how actual behaviour patterns depend on individual environmental attitudes.

characterized by different climatic, socio-economic and cultural profiles, let alone fresh tomato consumption (20 and 6 kg/per capita in Italy and in the UK respectively).[2] The survey consists of questions on consumer engagement in environment and nature and of a Discrete Choice Experiment (DCE) with different sustainability and other tomato attributes. We obtained individual WTPs for tomato attributes by estimating the DCE data and then implemented a Seemingly Unrelated Regression (SUR) analysis to see how these are affected by the two dimensions of attitude retrieved.

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

2. Background

In the empirical research dealing with green consumption, studies on consumer behaviour are typically guided by the Theory of Planned Behaviour, (Ajzen and Fishbein, 1980, 2005), where "attitude… is …one of many factors that influence behaviour".

Attitudes are hypothetical constructs that are not observable on mental states, which must be deduced from overt responses (Heberlein, 2012). In the environmental sphere, these deal with beliefs, emotions and action intentions expressed in response to environmental issues (Schultz *et al.*, 2005). Still, intentions are most proximally related to (Ajzen, 1991) but not fully incorporated in consumption behaviour, so that the actual role exerted by attitudes on choices is still being scrutinized.

One of the most common models to measure explicit attitude 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

[2] Our elaboration from FAOSTAT data.

of this model using the CP, a theoretical framework in which an attitude is inferred from the relative cost or effort 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 effort spent 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. Hence, an attitude obtained from the analysis of past behaviours is more objective.

The basic principles of this paradigm are the following: 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.

Campbell approach of assessing attitude through behaviour 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 paper based on the CP, 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 environmental attitude shapes WTP 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 efforts 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 Franz, 2004; Martin and Czellar, 2017).

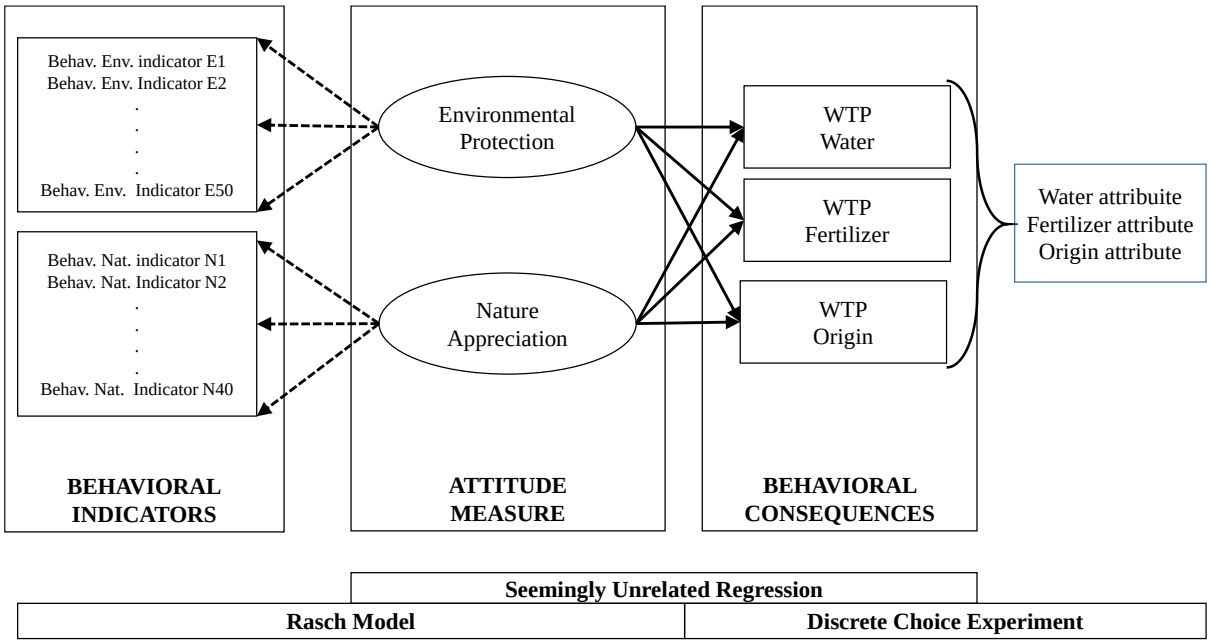
Kaiser *et al.* (2013) formally treat and solve the unidimensional environmental attitude issue, finding proof that a twofold interpretation fits better than the one-dimensional model, even if the two components of environmental attitude could be related one another. In their work, environmental protection 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 findings support the argument that people who exploit less of the natural environment are more likely to behave in a green way or, conversely, that people who are more committed to the environment are less concerned about their personal earnings from nature.

These two dimensions of environmental attitude can be conveniently studied in a CP 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.

Our conceptual framework depicted in Figure 1 shows the combination between the model advanced by Kaiser and Wilson (2019) and the bi-dimensional characterization of environmental attitude. Our methodology distinguishes behavioural indicators from behavioural consequences: the formers reflect general behaviours towards the environment and nature, whereas the latter define specific behaviours, such as the WTPs for sustainable tomato attributes.

Figure 1 – Adapted conceptual framework



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

3. Methodological aspects

When consumer preferences on environmentally sustainable food product elicited by a DCE are also explained by environmental attitude, the estimation process can be subject to endogeneity. In our setting, WTP resulting from the estimation of a DCE using sustainable tomato attributes interacted with attitude towards nature and the environment could be biased due to the interconnections between preferences for sustainability and actual personal dispositions toward the environment. To reach our research goals and to address this source

of endogeneity, the following methodological steps 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 DCE to retrieve individual WTP; last, we ran a SUR to explore the relationships between consumer WTP and attitudes (Figure 1).

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

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

The CP 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 engagement in a specific environmental/nature behaviour ω, θ_n is the individual environmental/attitude toward 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.

A large number of scales have used the Rasch model to assess individual environmental attitude as a whole. Based on its frequency of use and thoroughness of psychometric evaluation, the GEB measure discussed earlier (Kaiser, 1998; Kaiser & Wilson, 2004) can probably be considered one of the best established of these domain-general propensity measures (Lange and Dewitte, 2019). This scale includes 50 questions grouped in six

domains:[3] 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 the GEB authors who eventually estimated item difficulties and ordered behaviours by the implicit cost or effort 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 experiences involving natural situations and features of the natural world.[4] 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 (cf. Beckers, 2005). This scale consists of 40 questions 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). Even for this scale did the authors calibrate the items using the Rasch model, ordering them by their 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 are such that respondents usually fail to recognize the aim of the measurement instrument.

3.2 Measuring WTP: discrete choice experiment

This section discusses the steps followed to estimate DCE and to retrieve individual WTPs, preserving the econometric parsimony and robustness.

DCE are frequently used by researchers to explain consumer preferences for food attributes (see, among others, Loureiro and Umberger, 2007, Costa-Font *et al.*, 2008, Van Loo *et al.*,

[3] For lack of space we do not report all the questions used in the scale.
[4] See the previous footnote.

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:

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

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

The econometric framework to model DCE in the context of random utility theory was developed by McFadden (1974). In the multinomial (MNL) model specification an inherent assumption is the independence of irrelevant alternatives (IIA). 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 (MXL) relax the IIA assumption allowing researcher to introduce preference heterogeneity among decision-makers in the utility function. When it comes to analysing DCE 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 one of the hypothetical goods presented in the DCE strongly depends on individuals' ability to process, influenced by socio-demographic factors (see Scarpa *et al.*, 2007), the description of hypothetical goods provided prior to the experiment. Following Scarpa et al (2005) and Scarpa *et al.* (2007) (see also De Marchi et al, 2016, and the references therein), we consider an MXL 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 WTP Space (Scarpa, Thiene & Train, 2008; Lin *et al.*, 2019) a MXL with correlated random coefficients. The resulting equation is Equation (3) 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 non-statistically significant covariances and variances within the Cholesky matrix, 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 MXL, and that will be used as dependent variables in the SUR performed in the second step of our 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 specified by an MXL. Hence, we opt for Latent Class Analysis (LCM) which, just like MXL, allows researchers to account for respondents' heterogeneity. Still, under LCM, 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 *c* (or segment). The conditional probability of individual *n* of class *q* to choose alternative *j* from a specific choice set *t* is expressed as

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

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

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

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

3.3 Seemingly unrelated regression

To corroborate attitude-behavioural model, we explain behaviour on the basis of individual attitudes. In other word, we explore which kind of relationship exists between attribute WTPs estimated in the previous stage and the attitude scores obtained from the Rasch analysis. To do this we exploit the SUR 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. Hence, we can simultaneously estimate the effects of attitudes on the attribute WTPs retrieved from the DCEs before.

The general specification of the model is:

$$y_{ns} = \sum_{z=1}^{Z} x_{nz}\beta_{sz} + \varepsilon_{ns} \qquad (6)$$

where $n=1,...N$ denote individuals, $s=1,...S$ is the number of linear regression equations and $z=1,...Z$ is the number of regressors. In our setting, y_{ns} represents the WTPs of individual n in equation s, x_{nz} stands for the dimension z of the attitude of individual n, which is constant across equations S, and ε_{ns} is the error term on individual n in equation s.

4. The survey

4.1 The experimental design

To elicit consumers' preferences towards a hypothetical tomato with environmental and non attributes, a DCE 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 our setting, consumers faced 6 different choice situations, each consisting of two unlabelled alternatives and one No-Buy Option. The attributes describing the two unlabelled tomato alternatives are the following: reduction in water consumption relative to standard cultivation practices, reduction in the use of fertilizers relative to standard cultivation practices, origin, and price. The first two attributes 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). The attributes for origin and price came up during two focus groups conducted in December 2018 and by international experts in the field.

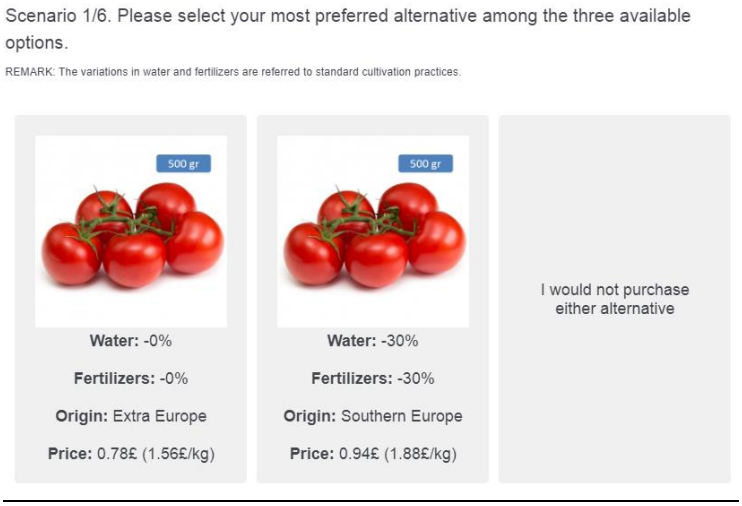
The levels for the two environmental attributes were retrieved from the trials that are being performed under a European research framework to identify tomato resilient varieties, which are: 30%, 20% reduction and no reduction. As for origin, three levels have been identified to capture the preferences of European respondents towards tomatoes cultivated in Southern and

Northern Europe, and for non-European tomatoes. Last, the price levels 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 DCE (Carlsson *et al.*, 2005), we introduced a cheap talk script in order 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, MNL pilot design was developed and tested to retrieve parameter priors. The priors were then used to construct a D-efficient, MNL 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 final survey consists of an initial section on socio-demographic characteristics (age, gender, educational attainment, income, household size), followed by the DCE questions. The last section contains the Kaiser scales for environmental protection attitude and attitude towards nature: 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 attitude related questions dividing the original set of 90 questions in three sub-sets, each containing a random selection of 36 questions regarding the environment

and nature and each of similar difficulty using the item difficulty coefficients reported in Kaiser *et al.* (2013). Finally, the order of appearance was randomized.

Each sample includes approximately 500 respondents, recruited by an external panel data online provider (Qualtrics). The survey was administered online between December 2019 and January 2020. In order to obtain a representative sample within each country, we implemented non-nested quotas on age, gender, and educational attainment.[5]

4.2 Sample description

The representative sample compositions are reported in Table 1. 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 2.

Table 1 - National and sample demographic characteristics

		Italy		UK	
Quota description		**National %**	**Sample %**	**National %**	**Sample %**
Age	18-24[a]	11%	10.40%	14%	14.06%
	25-49	38%	38.40%	40%	36.91%
	50-64	25%	25.0%	23%	22.46%
	Over 65	26%	26.2%	22%	26.56%
Gender	Male	49%	49%	49%	47.27%
	Female	51%	51%	51%	52.73%
Education	Primary and lower secondary education	50%	48.2%	21%	18.55%
	Upper secondary school and college	36%	36.4%	40%	40.63%
	Tertiary education	14%	15.4%	39%	40.82%

Source: Our elaboration on 2018 Eurostat, Istat (for the educational attainment in Italy), and on survey data.
Note a: The reported national quotas for the age group actually refer to the group aged between 15 and 24.

[5] Educational attainment refers to the population aged between 15 and 74.

Table 2 - 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%	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 and discussion

5.1 Rasch model results

In this section we describe how the Italians and the Britons differ in terms of environmental protection attitude and towards nature. Before analysing Kaiser scale response, we dichotomized all the behaviours that originally had a five-point polytomous response format: 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 all the responses) were considered as an individual not behaving alike, and hence they were handled as negative responses (see DeCoster *et al.*, 2009).

To compute the two personal dimensions of attitude, we applied the Rasch model discussed earlier.[6] After some data cleaning to drop respondents with inconsistent response patterns, we divided each group of respondents that faced the same block of questions into Nature and Environment. This step returned 6 different sub-samples for each country. We then ran the Rasch model to derive the item scores as well as the person scores. 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 sample answer and, more specifically, on how many respondents engage in a certain behaviour. The higher the share of respondents, the lower the item score.

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

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 3 below reports the item scores for each type of question and country. As expected, in terms of average difficulty, the four categories have a 0-mean score in all the cases considered. The mean Infit and Outfit MS indicate how productive for measurement the items considered are. Following Linacre (2002), who indicates an optimal value ranging from 0.5 to 1.5, our items are suitable for retrieving environmental attitude and attitude toward nature. All reliability coefficients are greater than 0.50, proving the reliability of our scales in measuring attitudes. Table 4 reports the summary statistics of the person scores in the two countries.

Table 3 - Item descriptive statistics: average values

Country	Item	Mean	Infit MS	Outfit MS	SD Infit MS	SD Outfit MS	Reliability
Italy	Nature	0.000	0.93	1.06	0.12	0.90	0.7
	Environment	0.000	0.95	0.95	0.10	0.25	0.53
UK	Nature	0.000	0.92	0.99	0.14	0.56	0.66
	Environment	0.000	0.94	0.97	0.10	0.25	0.56

Note: MS and SD stand for Mean Squared value and Standard Deviation respectively. The reported "Separation" Reliability is the Rasch equivalent of the KR-20 or Cronbach Alpha "test reliability" statistic, i.e., the ratio of "True variance" to "Observed variance" (Fisher et al, 1982)

Table 4 - Descriptive statistics of person scores

Country	Item	Mean	St. deviation	Min	Max
Italy	Nature	-0.122	1.319	-3.743	4.137
	Environment	0.27	0.911	-2.161	3.072
UK	Nature	-0.206	1.324	-4.16	4.372
	Environment	0.125	0.991	-2.64	3.184

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. A cross-country comparison suggests that Italians are characterized by a greater environmental and nature sensibility, as they obtained higher average scores than the Britons in either section.

5.2 Discrete Choice Experiment results

In the next lines we describe the passages that brought us to the estimation of an MXL for

Italy and of an LCM for the UK. All the choices we had to make 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 effects coded into a dummy for Southern Europe and a second dummy for Extra Europe.

We initially estimated for each country a Conditional Logit Model (MacFadden, 1974) with fixed parameters. We then moved to estimate the DCEs also including respondents' heterogeneity. The parsimonious and flexible WTP-space MXL with random terms and EC reached convergence for the Italian DCE,[7] but it failed to converge on the UK DCE data,[8] presumably because of the cross-cultural differences. Hence, for the UK, we opted for the LCM to retrieve individual WTP for each attribute.[9] The visual inspection of UK WTPs revealed a clear bimodal distribution in respondents' preferences and heterogeneity that was more properly represented by a segmentation in 4 latent classes. For the UK, individual WTPs are the averages of each class coefficient weighted by the individual probability of belonging to a certain class.

The results of the Italian DCE are reported in Table 5, which compares the Conditional Logit results with the unrestricted and restricted MXL. In terms of Log-Likelihood and information criteria, the MXL 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 WTPs. Results are displayed in the WTP space, and as such should be interpreted. On average, Italians are willing to pay a price premium for a tomato with sustainable water characteristics, but we observe a negative WTP 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.

[7] The analysis was conducted using the command *mixlogitwtp* (see Hole, 2015) using Stata 16. The Variance Covariance matrix is available upon request.
[8] 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).
[9] We estimated an LCM 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.

Table 5 – DCE results: Italy

	(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		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		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%. EC stand for Error Component. Standard errors are reported in parentheses. In the conditional logit, standard errors were 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 (-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 DCE. The LCM improves the model statistical fit upon the conditional logit, and the restricted LCM 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 WTPs and preferences, for Italy and the UK, for different attributes relevant for tomato consumption.[10] The core of our research is that of examining how individual WTPs of Italians and Britons, respectively derived from the MXL or the LCM, are affected by the two shades of environmental attitude. These relationships are described below.

[10] 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 MXL implicitly accounts for consumers' different ability to conjecture the hypothetical alternatives presented in the DCE, which in turn depends also on individual and socio-demographic factors (see Scarpa *et al.*, 2007).

Table 6 – DCE 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%. 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 SUR results

In line with the conceptual framework of Figure 1, according to which behaviour is affected by attitudes, we refer to the results of the SUR analysis below to discuss how the two dimensions of environmental attitude estimated earlier affect consumers' WTP for certain tomato attributes.

Table 7 – Results of Seemingly Unrelated Regression analysis

	ITA	**UK**
Eq.1: WTP for water sustainability		
Nature	-0.094**	0.089***
	(0.039)	(0.030)
Environment	0.204***	-0.176***
	(0.054)	(0.041)
Eq. 2: WTP for fertilizer sustainability		
Nature	0.017	-0.026
	(0.047)	(0.018)
Environment	0.024	-0.035
	(0.066)	(0.025)
Eq. 3: WTP for Southern European origin		
Nature	-0.083*	0.066***
	(0.049)	(0.013)
Environment	0.184***	-0.076***
	(0.068)	(0.017)
Eq. 4: WTP for Extra European origin		
Nature	0.096**	-0.100***
	(0.046)	(0.019)
Environment	-0.328***	0.114***
	(0.063)	(0.025)
Chi2:		
Eq.1	*15.72****	*21.87****
Eq.2	*0.39*	*5.55**
Eq.3	*7.93***	*37.16****
Eq.4	*26.79****	*37.22****
BP test	*332.5****	*1262.13****
LR Test	*567.18****	*3538.47****
N	500	512

*Note: 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 SUR instead of single OLS. LR test is the Likelihood Ratio LR Test for Heteroscedasticity.*

The results reported in Table 7 clearly indicate that, generally speaking, attitude has an

influence on persons' WTPs, being most of the estimated coefficients statistically significant, a result which is in line with the literature relating attitude and behaviour. Moreover, Table 7 shows that the influence on WTP depends on the type of attitude considered, confirming the bi-dimensional characterization of attitude conceived by Kaiser *et al.*, 2013.

Also, consumers oriented to nature in Italy behave differently from consumers with an attitude towards nature in the UK, and the same holds for attitude towards environment protection. This result suggests that consumers in Italy and in the UK perceive fresh tomatoes in two very different ways, and the way they react seems to be strongly affected by the cultural heritage, which ultimately affects consumption and purchasing patterns.

Willingness to pay for water sustainability differs substantially not only across countries, but also across attitudes. Italians with an attitude towards environment protection seem to be sensible to water scarcity and are willing to pay a price premium for reduced water footprint, but their British counterparts behave in a totally different way: for them water scarcity is an intangible concept, not strictly related to environmental protection in the UK, be it for the less domestic relevance of tomato cultivation, or for the different climatic profile.

Results are entirely reversed when looking at the impact of attitude towards nature on the WTP for water reduction, which is in fact negative for Italians and positive for Britons. The negative coefficient mirrors Italians' opportunistic rather than altruistic relationship with nature. Since water sustainability does not directly benefit their individual sphere, there is no point for them in paying a higher price for a water-sustainable tomato. Their British counter parts are instead more sensible to water in order to preserve nature and landscape.

We are about to argue that water and fertilizer reductions, though equally important and ambitious targets, are conjectured differently by consumers. This is evident when looking at the effect of environmental attitude on WTP for fertilizer sustainability. In none of the cases considered its impact is in fact statistically significant. Hence, we can conclude that fertilizer sustainability is an attribute not at all affected by environmental attitude broadly speaking.

As far as origin is concerned, Italians prone to environmental protection are not only willing to pay more for fresh tomatoes grown in Mediterranean Europe, but they are also against tomatoes coming from outside Europe, to whom we observe a negative WTP.

Results are reversed when it comes to Britons keen to protect the environment: in this case, a

Mediterranean Europe origin does not translate into an increased spending propensity. This clear contradiction in the WTP for Southern Europe tomatoes characterizing environmentally aware Italians and Britons can be reconciled by the *local food trap* (Born and Purcell, 2006, Baldi *et al.*, 2019) which claims that local food production systems are usually misconceived as more ecologically sustainable and socially just than larger scale ones. Furthermore, consumers think of the term "local" as a synonym of proximity, not necessarily geographical.

Italians are apparently more aware than Britons of the social, economic, and qualitative role played by tomato cultivation, especially in naturally suited cultivation area. Also, Italians are familiar with tomato cultivation, and their support for this value chain might be driven by altruistic motivations aimed at fulfilling their environmental protection desire, thus falling into the local food trap. The purchasing decision of an environmentalist is thus a sort of "endorsement" of environment protection: A Southern Europe tomato is, in their opinion, socially and environmentally sustainable even if cultivated with a great water consumption in a potentially water-deficit area.

Britons are characterized by a different sensibility towards cultivated lands, which make them less vulnerable to the local food trap. It follows that, in our setting, Britons are willing to pay more for tomatoes grown outside Europe.

The dichotomic reaction of Italians and Britons also lies in the different understanding of agriculture in its broad sense. Northern and Southern European countries have in fact always sustained different visions of the Common Agricultural Policy. Northern countries tend to support the implementation of an extensive agricultural system, which would be at odds with an intensive system characterized by the presence of horticulture. Thus, British environmentalist consumers show resistance when offered a crop outside their agricultural policy vision, just like a Southern Europe tomato would be. This interpretation should not fail to consider the Brexit factor, which occurred shortly before our 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 domestically grown crops, to the detriment of typical Mediterranean varieties.

Mediterranean countries are instead more suited to horticultural crops, and Italians clearly expressed a sound economic preference for a Southern Europe origin.

The WTPs resulting from consumers moved by the selfish and self-enhancement love for nature, the second face characterizing environmental attitude, is a whole different story. These consumers are moved by self-interest, and any environmentally action undertaken (for instance, picking up the trash after a picnic) is not moved by the desire to protect the environment and keep it proper, but rather by egoistic concerns (finding the field cleaned when going back there). In this spirit, Italians who exploit nature for individual purposes have a negative perception of Southern Europe tomatoes: we argue that they anticipate the side effects on the natural landscape and choose Extra-European tomatoes.

The self-enhancement characterizing British consumers emerges in the opposite way. In fact, British naturalists prefer Southern European origin vs. Extra-European tomatoes. This could be traced back to two main reasons. First of all, their hedonistic desire of enjoying nature can be easily satisfied in their surrounding landscapes, mostly preserved by intensive horticulture. Second, the decision to purchase a Mediterranean tomato could evoke personal and subjective feelings, such as landscapes, tastes and odours typical of Southern Europe.

6. Conclusions

Our paper contributes to the literature examining the relation between environmental consumer attitude and the corresponding behavioural patterns using novel theoretical approaches and adapting strategies not typical of food consumer studies. In particular, we assess how consumers' environmental attitude affect consumption behaviour in terms of willingness to pay for a resilient tomato.

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 based on a subjective and explicit measure of attitude resulting from evaluative and normative self-reported statements (Kaiser *et al.* 2018).

We also consider the two-fold interpretation of environmental attitude proposed by the environmental psychologic literature (Kaiser *et al.*, 2013; Alcock *et al.*, 2020; Liu and Chen, 2020) which distinguishes environment preservation from nature appreciation.

To this aim, we conducted a survey in Italy and in the UK, two countries with different climatic and cultural status, involving 500 tomato consumers in each country. The survey

included two psychometric scales to assess separately these two dimensions of environmental attitude, and a Discrete Choice Experiment on tomato sustainability attributes, that is water, fertilizers, and origin, and tomato prices to elicit participant WTP.

We performed a Rasch analysis to retrieve individual attitude measures from stated behaviour and a Mixed Logit and Latent Class models to obtain individual WTPs for each tomato attribute. Then, we performed a Seemingly Unrelated Regression to estimate the impact of the two distinguished attitudes on behaviour following a novel conceptual framework in food consumption analysis.

Our results not only confirm that these two dimensions do generate different consumption patterns, but they also reveal that the effects exerted by attitudes on consumption are country specific. In other words, Italians and Britons that are characterized by different food habits and heritage also differ in their *environmentalist* or *naturalist* behaviour.

Considered that consumers are central to the development of sustainable consumption goods, their preferences and attitudes must be duly taken into account by marketers and environmental policy makers. The results of this analysis clearly indicate that environmental sustainability cannot be achieved as long as consumers' psychological aspects are neglected. The authors see substantial theoretical and practical value in treating appreciation of nature and appreciation of environmental protection as separate attitudes both affecting consumer behaviour. For example, if the intention is to promote the consumption of sustainable products, then appreciation of nature should be the most malleable communication target and thus one of the critical factors in shaping market policies.

Hence, our 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.

Despite the interesting and promising results of this work, the hypothetical nature and the intrinsic features of the product considered might be difficult to conjecture. The attributes included in the analysis to elicit consumers' preferences towards a hypothetical and sustainable tomato might not be easily appreciated by consumers not familiar with the methodological approach followed. Future research in this field should be focused on non-

hypothetical agri-food products, well-known to a wide audience of consumers, and with a significant environmental and resource impact.

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