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Research article

Bottling it? Consumer responses to less environmentally friendly products: A choice experiment for water in plastic packaging in the UK

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ABSTRACT

Consumers have several options when confronted with less environmentally friendly packaging like water in single use plastic bottles – they can ignore environmental concerns and proceed with a purchase, refuse to buy any such product, seek out a less damaging version like water in biodegradable bottles, and/or engage in off-setting/compensatory behavior such as donating to a charity. Understanding how consumers value these options is an important academic and management challenge. To address this, a stated choice experiment is employed. It considers the preferences of a representative sample of UK consumers for bottled water with the attributes: packaging (PET versus biodegradable), charity donation (environment/social/none), origin (domestic/foreign), and price. Data were analyzed using random parameter logit modeling, incorporating a latent variable into the model, which captured environmentally conscious behavior. Based on the model estimations, domestic origin, biodegradable packaging, and charity donations (both for environmental and social causes) positively affect decision-makers' perceived utility. In keeping with moral consistency theory, as consumers' level of nature relatedness and green consumption values increase, biodegradable packaging becomes more preferable than non-biodegradable packaging, and the likelihood of refusing to purchase any bottled water option, rises, respectively. In contrast, high levels of materialist values are associated with lower environmental consciousness. The paper provides evidence to managers regarding consumers' valuation of more environmentally friendly packaging, and strategies to increase uptake.

1. Introduction

Consumers increasingly regard sustainability as important, with over 71% of consumers globally reporting that they are making changes to their lifestyle and the products they purchase to live more sustainably (Simon-Kucher & Partners, 2022). However, the stronger salience of environmental concerns does not always translate into more sustainable consumption (ElHaffar et al., 2020; Koenig-Lewis et al., 2022); in many cases pragmatic considerations regarding price, branding, and convenience prevail (Gorton et al., 2023). Understanding how consumers make tradeoffs between less and more environmentally friendly purchase options is thus an important challenge for researchers, managers and policymakers seeking to promote environmentally desirable behavioral change (Leão et al., 2022; Schuermann and Woo, 2022).

A particularly important challenge relates to understanding consumer behavior for less environmentally friendly product categories (Xu et al., 2022). In such cases, consumers could follow one of four strategies: i) ignore environmental concerns, ii) opt out of purchasing any option within the category, iii) select a less environmentally damaging option within the category, or iv) seek to offset the damage in some

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regard. For example, in relation to air travel, consumers could ignore concerns about carbon emissions, opt-out of taking any flight, seek out airlines with more fuel efficient aircraft, or look to offset their carbon emissions (Schuermann and Woo, 2022; Xu et al., 2022).

Consumption of bottled water has been steadily increasing worldwide over recent decades, even in countries where tap water quality is excellent (Grebitus et al., 2020). This trend is even more pronounced in low- and middle-income countries, although access to good quality tap water has improved in these regions over the past decades (Cohen and Ray, 2018). Unfortunately, consumption of bottled water has a much larger environmental impact than the supply of public drinking water (Garfí et al., 2016; Leão et al., 2022). Specifically, the negative environmental impact of bottled water is 1400–3500 times higher than tap water (Lai, 2021), because the raw materials and energy required for packaging account for most of the impact of bottled water use (Villanueva et al., 2021).

In the bottled water market, the most popular form of packaging is polyethylene terephthalate (PET) plastic (Iacovidou et al., 2019). While plastic bottles used to store drinks are theoretically reusable, they have a threshold for how long they can be safely reused before harmful chemicals leak into the liquid inside, which is a serious health risk, exacerbated by the intensity of use (Iacovidou et al., 2019). Consequently, the packaging for most bottled water is single use plastic, which ends up in landfill sites in large quantities, and by 2020, the world generated around 150 million tons of plastic waste annually (Nejad et al., 2021). Worryingly, single-use plastic waste is leaking into the environment at unprecedented and uncontrolled rates, negatively impacting ecosystems. For instance, one of the most notorious and largest accumulation zones is between California and Hawaii (the Great Pacific Garbage Patch), of which 8% is in the form of microplastics, and 92% is in the form of floating plastic. If current trends continue, it is estimated that by 2050, around 12,000 million tons of plastic waste will be landfilled or released into the natural environment (Nejad et al., 2021).

To reduce the amount of packaging waste released into the environment, biodegradable packaging is a proposed solution. The most commonly used biopolymer is polylactic acid (PLA) (Gibbens, 2018), which is a biodegradable aliphatic polyester. One of its advantages is that the raw material can come from a renewable source (e.g., maize, rice, wheat), consequently it is regarded as a form of green packaging (Ahmed and Varshney, 2011). However, while biodegradable materials can reduce the environmental burden of landfill waste, it is not a panacea (Siracusa, 2016). Biodegradable packaging for bottled water still generates a higher carbon footprint than mains water and replacing all petrochemical plastic packaging with bioplastics, would significantly increase land and water use (Leão et al., 2022). This could be particularly damaging in countries with weak environmental legislation, where increased competition for land leads to deforestation (Rossi et al., 2018).

The paper considers consumer choices for bottled water in the UK, which is an exemplary context for studying this issue. The collection rate for PET bottles in the UK in 2020 was 59% (Unesda, 2022), but recycling capacity was only 11% (EUNOMIA, 2022). Collection rates in the UK are below those recorded by many northern European states – for instance Germany and Sweden achieve 95% and 86% respectively (Unesda, 2022). In 2022, in the UK, 95.2% of bottled water packaging was PET/plastic (BSDA, 2023). To address the problem, 250 organizations signed a global pledge to 'eliminate plastic waste and plastic pollution at source' as part of the UK Plastic Pact, a joint initiative led by WRAP, the Waste & Resource Action Programme (Gong et al., 2020). However, despite government commitments to manage and reduce plastic waste and pollution, implementation of sustainable plastic management remains slow. One reason for this is that stakeholders do not understand their role and importance in the plastic packaging system (Gerassimidou et al., 2022).

The aim of this study is to examine consumer preferences for bottled water, considering the impact of environmental values on decision making. It contributes to the literature by investigating how consumers, when confronted with a less environmentally friendly product category, value four potential options - i) ignoring environmental concerns, ii) selecting a less environmentally damaging option within the category, iii) opting out of purchasing any option within the category, or iv) seeking to offset the damage. A Discrete Choice Experiment (DCE) includes attributes to capture and measure consumers' valuations of these options.

The paper is structured as follows. The next Section presents the results of a broad thematic literature review, identifying how the study builds on the extant literature. Section 3 hypothesizes the determinants of consumers' WTP for a less environmentally friendly product (water in plastic packaging). Subsequently, Section 4 outlines the methodology employed for testing the hypotheses, before Section 5 details results. Section 6 discusses the theoretical, managerial and policy implications of the results, as well as acknowledging limitations and presenting suggestions for further research.

2. Thematic literature review

To analyze the extant literature on consumers' attitudes toward (plastic) packaged food and drink products (particularly bottled water), the authors undertook a thematic literature review,[1] following the guidelines of Paul et al. (2021). This led to the identification of 11 studies (see Table 1), helping document the current state of the art, gaps in the literature, and subsequently, develop hypotheses (Tranfield et al., 2003).

Reviewing previous research, reveals that consumers' valuations of food and drink products are sensitive to the nature of the packaging, who generally prefer bioplastics (De Marchi et al., 2020; Grebitus et al., 2020; Wensing et al., 2020) and recycled materials (Herrmann et al., 2022; Wensing et al., 2020; Xu and Ward, 2023). However, the origin of a product may have a stronger effect on WTP than the nature of its packaging (Herrmann et al., 2022; Van Loo et al., 2019) and consumers' preferred option of no packaging at all may be infeasible for some goods (Herrmann et al., 2022). Regarding potential intervention strategies, labelling can increase the appeal of bioplastics to consumers (Wensing et al., 2020), and the provision of information on environmental impacts can increase reflection on sustainability concerns (Goucher-Lambert and Cagan, 2015) but this may not translate into increased WTP for more sustainable options (De Marchi et al., 2020).

Considering the extant literature detailed in Table 1, while several packaging options are considered, especially WTP for recycled/recyclable materials, as noted by Van Loo et al. (2019), few directly consider biodegradable packaging, and how it is valued by consumers (Koenig-Lewis et al., 2022). Moreover, in explaining choices, no previous study considers the effect of consumers' environmental consciousness. Similarly, there is a lack of consideration of offset/compensatory schemes such as donations to charities, even though these have become ubiquitous within less sustainable product categories (Truong-Dinh et al., 2023). More than half of the studies listed do not explicitly consider or model opt-outs, where consumers fail to choose any of the options, which may be important in less environmentally friendly product categories, especially amongst those with high levels of environmental consciousness. Moreover, the literature largely relies on evidence from Western Europe and the USA, and the generalizability of results to other regions remains uncertain. These considerations

[1] Conducted on the 12th September 2023 using the search terms: (((TS=("willingness to pay")) OR (TS=("discrete choice"))) AND (((TS=(bottled water)) OR (TS=(plastic packaging)) OR (TS=(biodegradable packaging))) with the Web of Knowledge database. The initial database of 108 articles was reduced to 11, after a double-screening process focusing on publications related to the research. Exclusion criteria were first and foremost, relevance to this paper's objectives and study design.

Table 1
Systematic Literature Review on consumers' WTP for (plastic) packaged food products.

Publication	Product	Methodology	Country	Sample size	Attributes	No-choice
Chatterjee and Barbhuiya (2021)	Bottled water	WTP, T-tests, ANOVA tests, SEM	India	336		–
De Marchi et al. (2020)	Bottled water	WTP, DCM (error component random parameter logit model)	Italy	212	Price, type of plastics, color	2 alternatives and no-buy option
Galati et al. (2022)	Mineral water bottles with eco-friendly packaging	Cluster analysis	Italy	378		–
Goucher-Lambert and Cagan (2015)	Single use spoons, reusable water bottles, washing machines	DCM	USA	94	Form, function, price, environmental impact values	–
Grebitus et al. (2020)	Bottled water	DCM (mixed logit modelling), WTP	USA	109	Price, water type, and bottle type	2 water alternatives and "no purchase" alternative
Hall et al. (2010)	Biodegradable containers	WTP	USA	834		–
Herrmann et al. (2022)	Food packaging (unpackaged, paper, recycled plastic, bioplastic)	WTP, DCM (mixed logit modelling); qualitative free-text	Germany	254	Packaging, price, origin	–
Kokthi et al. (2022)	Bottled mineral water	Grounded theory	Albania	230	Brand, origin, trust, advertisement, packaging, label, price	–
Testa et al. (2021)	Bottled juice in different plastics	Bayesian Generalized Linear Modeling	Italy	1236		–
Van Loo et al. (2019)	Cheddar cheese	Correlation, DCM (mixed logit modelling)	USA	103	Country of origin, region of origin, hormone use, biodegradable packaging, price	2 cheddar products and no-buy option
Wensing et al. (2020)	Bio-based plastics and normative information	WTP, DCM (error component RPL model)	Germany	1019	Bio-based packaging, organic, compostable, recyclable labels	2 cherry tomatoes products and opt-out
Xu and Ward (2023)	PET bottles	DCM (mixed logit modelling), WTP	China	634	Packaging material, bottle size and bundle, price	2 bottled juices and opt-out
Current study	Bottled water	DCM (mixed logit modelling with latent variables) WTP	United Kingdom	511	Origin of water, packaging, charity donation, price	3 bottled water options and opt-out

Note: DCM = discrete choice methodology.

motivated the research design and selection of attributes. The selection of the included attributes and their levels relies on our thematic literature review (e.g., Grebitus et al., 2020; Herrmann et al., 2022; Van Loo et al., 2019) and dovetail those included in a supplementary study for Taiwan (see Appendix A for further details). The remainder of this section introduces hypotheses relating to the attributes included in the study, focusing on biodegradable packaging, charitable donations, origin, and price.

3. Conceptual framework and hypotheses development

DCEs, drawing on the model of Lancaster (1966), assume that a consumer's perceived utility of a product relates to its attributes, rather than the product itself. The modelling of DCEs draws on Random Utility Theory (RUT), according to which there is a latent construct (perceived utility) in the mind of the decision-maker, which they try to maximize in their decisions. Part of this perceived utility relates to the observed attributes mentioned above (the deterministic component of perceived utility), while the other part consists of other unobserved factors (the stochastic component of perceived utility) (Ben-Akiva and Lerman, 1985). The remainder of this section introduces the hypotheses relating to the attributes included in the DCE (namely packaging, origin, charitable donations, and price), as well as the likely relationship with environmental values.

3.1. Biodegradable packaging

Single use plastics are a major contributor to environmental pollution, negatively impacting on marine and land-based ecosystems, and endangering public health if entering the food chain when broken down into microplastics (Borg et al., 2022). Consumers generally recognize the negative externalities of single use plastics and related waste, wishing to curtail their use (Allison et al., 2022). Moreover, consumers recognize biodegradable plastics as being more environmentally friendly, and regard packaging which is not biodegradable as a major environmental concern (Herbes et al., 2018). This reflects how biodegradable packaging offers more efficient waste management and reduced CO_2 emissions compared against landfill and incineration (Havstad, 2020). However, while consumers' attitude to biodegradable plastics is positive (Koenig-Lewis et al., 2022), it is based on rather weak knowledge (Allison et al., 2022; Filho et al., 2022) and the relationship with WTP is unclear in the extant literature. Namely, while evidence suggests consumers are willing to pay extra for greener packaging (Grebitus et al., 2020; Hall et al., 2010; Herrmann et al., 2022; Schuermann and Woo, 2022), in the context of cheese, Van Loo et al. (2019) found that biodegradable packaging did not influence consumers' choices. However, given the overall body of evidence suggesting consumers value positively biodegradable packaging (Walker et al., 2021), it is expected that.

H1. Biodegradable packaging has a positive effect on consumers' WTP for bottled water.

3.2. Origin

Consumers generally prefer food and drinks produced locally for three main reasons. Firstly, ethnocentrism – a concern for one's own country and belief that foreign competitors harm fellow citizens (Shimp and Sharma, 1987) is prevalent globally and affects consumers' choices (Chryssochoidis et al., 2007). Purchasing local food and drinks is a mean to express patriotism (Brečić et al., 2021) and ethnocentrism heightens consumers' WTP for local products (Shahabi Ahangarkolaee and Gorton, 2020) and visual attention to origin labelling (Van Loo et al., 2019). Secondly, consumers tend to trust domestic food safety processes more

than those of foreign countries (Mauracher et al., 2013), except in cases where high profile food safety scandals dent consumer confidence (Wu et al., 2014). Consequently, origin-linked brands can often help firms mitigate trust problems (Kokthi et al., 2022). Thirdly, consumers typically regard local food and drink as of higher quality, either due to it being perceived as fresher and/or more in keeping with local tastes (Brečić et al., 2021). A meta-analysis (Printezis et al., 2019) suggests that collectively these factors lead to consumers being willing to pay a premium for locally produced food and drink. While evidence relating to WTP for bottled water is limited (Grebitus et al., 2020), it is nonetheless expected that.

H2. Local origin has a positive effect on consumers' WTP for bottled water.

3.3. Charitable donations

Products are often marketed so that their sale triggers a donation to a charity – for instance "for every product sold we donate a S1 to charity X" (Pappu and Cornwell, 2014). Such charitable donations are a form of cause related marketing whereby 'company donations to a specified cause are based upon sales of specified goods or services' (Larson et al., 2008, p. 272). Generally, consumers favorably regard such charitable donations, increasing their likelihood of purchasing the product, especially when they strongly approve of the cause (Galan-Ladero et al., 2013). Moreover, consumers typically like charitable donations where they offset or compensate for other, less desirable actions (Andrews et al., 2014). Namely they allow the consumer to maintain a "warm glow" of feeling good about themselves, especially where the cause fits with a desired self-identity (Winterich and Barone, 2011). Charitable donations also reduce the perceived risks of a product (Bhattacharya et al., 2021), which increases trust in a charity-linked brand, positively affecting consumers' value judgments, including in the case of mineral water (Kokthi et al., 2022). While few studies directly consider the effect of charitable donations on WTP (Fan et al., 2020), their positive effects on brand image, trust and purchase intentions (Patel et al., 2016; Silva et al., 2021) suggest that.

H3. Charitable donations have a positive effect on consumers' WTP for bottled water.

3.4. Perceived fit between charitable donations and the product

In the context of charitable donations, perceived fit relates to the 'degree of similarity and compatibility that consumers perceive between a social cause and brand' (Bigné-Alcañiz et al., 2012, p. 267). Drawing on congruity and information integration theories, Lafferty et al. (2004) argue a high degree of perceived fit between the company/product and cause works better because consumers regard the link between the two entities as intuitive. In general, individuals prefer concordant stimuli, perceived to belong together (Lafferty et al., 2004). When consumers regard the product and cause as compatible, they are more likely to regard the initiative as appropriate and genuine (Basil and Herr, 2006). Conversely, low perceived fit generates greater consumer scepticism (Mendini et al., 2018). Given congruity theory, the widespread concern about negative environmental impacts, and the desire of some consumers to compensate for the environmental damage resulting from their consumption choices (van Birgelen et al., 2011), it is expected that for bottled water, an environmentally based charitable donation will have a more positive impact on WTP, *ceteris paribus*, such that.

H4. After controlling for donation amounts, an environment-based charitable cause will have a more positive effect on consumers' WTP for bottled water than a non-environment-based cause.

3.5. Consistency with environmental values

Economic models of moral behavior (Benabou and Tirole, 2011) suggest a strong tendency toward consistency between an individual's values and actions. This is to preserve a sense of identity and investments made in their identity signaled to others. Consequently, the likelihood of consistency between values and behavior consistent with their identity is high (Heger and Slonim, 2022) – for instance environmental values are associated with partaking in multiple actions to reduce greenhouse gas emissions (Brick and Lewis, 2016). The negative environmental effects of non-biodegradable plastics are well known to consumers (Walker et al., 2021), especially the detrimental effect on birds and marine life (Hartley et al., 2018). Moreover, consumers' concern with plastic waste is highly correlated with bio-spheric values (Hartley et al., 2018). Consequently, we expect that.

H5a. As consumers' level of nature relatedness increases, biodegradable packaging becomes more preferable than non-biodegradable packaging.

However, while biodegradable plastics may reduce some damaging aspects, they are not a panacea. For instance, even with biodegradable packaging, toxicity may remain a problem (Zhu and Wang, 2020) and on most ecological and carbon footprint measures, water distributed through plastic bottles is drastically less environmentally friendly than mains (tap) connections. Empirical research on the relationship between environmental values and behavior (Chatterjee and Barbhuiya, 2021; Galati et al., 2022), suggests that higher levels of environmental concern create a sense of responsibility, which induces more environmentally friendly behavior. Consequently, those consumers with high levels of environmental consciousness are more likely to avoid less environmentally friendly options (Chatterjee and Barbhuiya, 2021), albeit this may be limited by consumer confusion regarding the consequences of different forms of packaging (Testa et al., 2021). Moreover, not buying (not choosing any of the alternatives) might be regarded as the most environmentally-friendly decision (Oehlmann et al., 2017), and to leave the market without buying anything is often the least polluting solution (Bennett and Adamowicz, 2001; Nixon and Gabriel, 2016). Consequently, based on economic models of moral behavior and supporting empirical work it is expected that.

H5b. Higher levels of green consumption values increase the likelihood of "no choice" becoming preferred to buying bottled water.

To test these hypotheses, consumers' WTP for bottled water is assessed using a DCE. Specifically, the study seeks to understand the effects of biodegradable packaging, origin, charitable donations (to environmental purposes, social purposes, or no donation), and price on consumers' WTP. DCEs aid understanding of consumers' evaluation of products by simulating real-life purchasing situations, which force them to make trade-offs between varying attributes (Tonsor et al., 2009). In this study, the DCE incorporates two types of charitable donations, namely a donation of 5% of the price of the bottled water to an environmental charity and a donation of 5% of the price of the bottled water to a social wellbeing charity. The inclusion of this attribute helps generate a better understanding of consumers' compensatory behavior (Barone et al., 2000; Mandel et al., 2017) when faced with a less environmentally friendly product and the degree to which it depends on the perceived fit between the product and cause. Consequently, the study addresses recent calls for a better understanding of how consumers make choices when confronted with less environmentally friendly products (Schuermann and Woo, 2022; Xu et al., 2022).

To summarise, this study includes attributes relating to price, charitable donations, origin, and packaging type to help understand how consumers, when confronted with a less environmentally friendly product (i.e., bottled water), value four potential options (ignoring environmental concerns, selecting a less environmentally damaging option, opting out of purchasing, or seeking to offset the damage). The

latent variable under investigation (environmentally conscious behavior) further helps explain choices. Fig. 1 presents the conceptual framework which underpins the paper.

4. Materials and methods

4.1. Survey procedures

The research was conducted through an online survey of adult UK consumers using the Prolific online research platform. Respondents completed the survey anonymously and were informed about the purpose of the project at the outset, having the opportunity to end the survey at any time if they felt uncomfortable answering. It took an average of approximately 15 min to complete the questionnaire, which was completed fully by 511 respondents. Our sample is representative of the UK population by gender, age category and ethnicity. Table 2 presents an overview of the sample's characteristics. Data collection occurred in May 2024.

4.2. Measurements

The questionnaire consisted of three main parts. The first part captures respondents' preferences for bottled water using a DCE. Environmental values were assessed in two blocks through twelve Likert scale items based on those developed by Haws et al. (2014) and Nisbet and Zelenski (2013) to measure green consumption values and nature relatedness, respectively. A three-item scale derived from Richins (2004) measured materialism, while this section also measured purchasing criteria for bottled water (through a multiple response question). The last section asked questions related to the respondents' demographic and socioeconomic characteristics.

4.3. Experimental design

The attributes and their levels in the stated choice experiment were selected based on our thematic literature review (e.g., Grebitus et al., 2020; Herrmann et al., 2022; Van Loo et al., 2019) and a shop check to confirm appropriate prices. The D-efficient design was applied, using Ngene 1.2 software to create the decision situations for the stated choice experiment (Bliemer et al., 2008; ChoiceMetrics, 2018; Rose and Bliemer, 2009). The final design included 32 decision tasks arranged in four blocks (with a D-error of 0.137,118). During data collection, respondents viewed eight decision situations. For each of these, three hypothetical bottled water alternatives and an "opt-out" option were presented to respondents, to approximate real market conditions. While there are both advantages and disadvantages of including a "no choice" option in a DCE, its inclusion is likely to be closer to the real market situation, as most purchase decisions are non-compulsory (Hensher et al., 2005). Given the research not only focuses on choices between attributes but also the interaction between choice/no choice and green

Table 2
Profile of the sample's demographic and socio-economic characteristics.

Characteristic	Sample (n = 511)
Gender (%)	
Male	47.7
Female	51.3
Non-binary	0.8
Prefer not to say	0.2
Age category (%)	
18–24	11.0
25–34	17.6
35–44	16.8
45–54	16.2
55–64	24.7
65-	13.7
Highest level of education achieved (%)	
GCSEs	14.7
A levels	25.4
Undergraduate BSc/BA university	39.9
Masters	14.9
PhD	2.9
Other	2.2
Income category (%)	
Less than £1000	16.0
Between £1000 and £1600	18.8
Between £1601 and £2200	17.6
Between £2201 and £3000	21.7
Between £3001 and £5000	14.5
More than £5000	3.9
Prefer not to answer/do not know	7.4

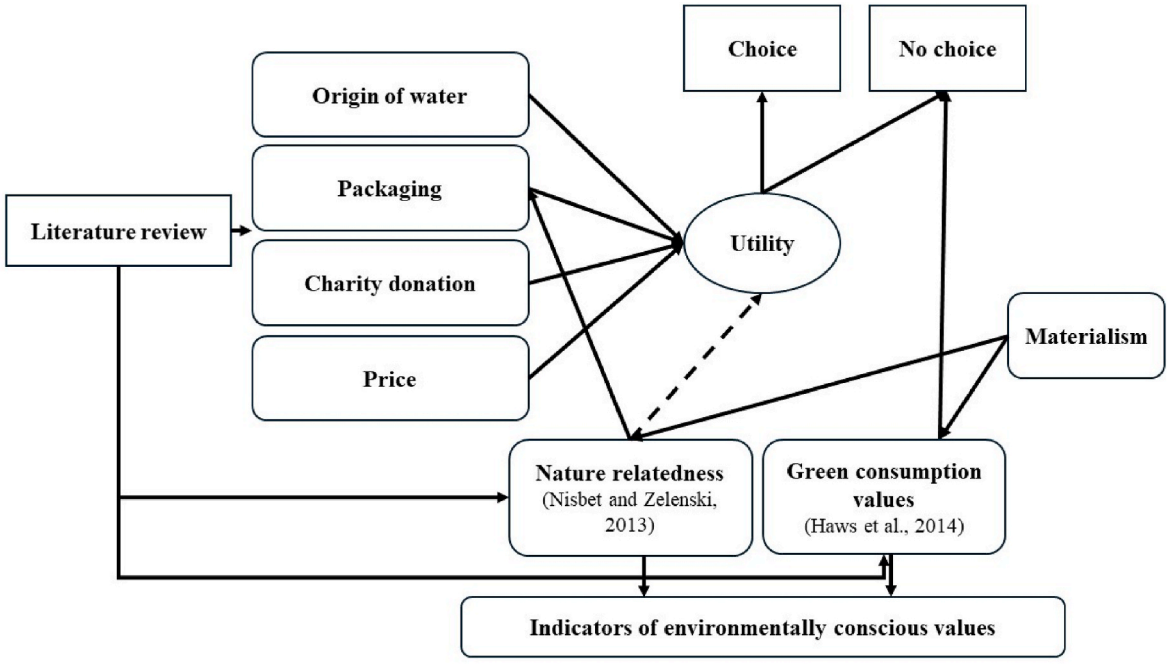

Fig. 1. Conceptual framework for the study.

Table 3
Attributes, their descriptions, and their levels in the DCE.

Attribute	Attribute levels
Origin of water	UK (local)
	France (imported)
Packaging	Non-biodegradable
	Biodegradable
Charity donation	No donation
	Donate 5% of the price of each bottle sold to an environmental charity
	Donate 5% of the price of each bottle sold to a social wellbeing charity
Price	50p
	75p
	£1.00
	£1.25
	£1.50

consumption values, the "no choice" option was also included. Decision situations were introduced with a cheap talk script. Four attributes characterized the product alternatives: (1) origin of water, (2) packaging, (3) charitable donation, and (4) price. Table 3 details the selected attributes and their levels, while Fig. 2 illustrates a decision task.

According to UK consumer reports (e.g., Statista, 2024), in terms of both value and volume, France is the most important source of imported water. In addition, in the UK 95.2% of bottled water is sold in PET/-plastic packaging, and currently none of the four leading bottled water brands (Volvic, Evian, Highland Spring and Buxton) use biodegradable packaging, only recycled PET plastic.

4.3.1. Econometric approach

The following guide defines the notation of the equations used in the paper.

U	Total utility
V	Observed part of total utility
E	Unobserved part of total utility
N	Respondent
I	Alternative
No	choice No choice between product attributes
B	Estimated coefficient for the utility function
ASC	Alternative-specific constant
X	Observed variable for the utility function
LV	Latent variable in the hybrid choice modelling
Λ	Estimated coefficient for the latent variable in the utility function
ME	Measurement equation in the hybrid choice modelling
K	Observed statement for the measurement equation
Z	Estimated coefficient for the latent variable in the measurement equation
Σ	Unobserved part in the measurement equation
Γ	Estimated coefficient for observed variable in the structural equation
F	Observed sociodemographic characteristic in the structural equation
H	Unobserved part in the structural equation
W	Estimated willingness to pay coefficient for the utility function in willingness to pay space

4.3.2. Standard approach of choice modeling

RUT assumes that from a decision set, individuals always choose the alternative that provides them with the highest level of utility (Equation (1)). In this case, the total utility consists of a systematic (observable) and a random (unobservable) component (Equation (2)) (Ben-Akiva and Lerman, 1985).

$$P_{n,i} = \text{Prob}\left(V_{n,i} + \varepsilon_{n,i} > V_{n,j} + \varepsilon_{n,j}\ \forall \text{j} \neq \text{i}\right) = \text{Prob}\left(\varepsilon_{n,j} < \varepsilon_{n,i} + V_{n,i} - V_{n,j}\ \forall \text{j} \neq \text{i}\right). \quad (1)$$

$$U_{n,i} = V_{n,i} + \varepsilon_{n,i}, \quad (2)$$

where n is the decision maker, i is the alternative, U is the total utility, V is the systematic part of the utility, ε is the random part.

To address differences in tastes (preference heterogeneity), two options exist: i) to solve this constraint through discrete (latent class approaches) or ii) use continuous (random parameter logit approaches) distributions. In the latter case, the coefficients for the attributes vary over respondents instead of being fixed. So, the systematic part of the utility can be written according to Equation (3) (Hess, 2014).

$$V_{n,i} = \beta_n' X_{n,i} \quad (3)$$

where βn denotes the estimated parameter vector for the observed attributes for the n-th decision maker, thus expressing individual tastes, while X is the vector of attributes for alternative i (McFadden and Train, 2000; Train, 2009).

In this case, the systematic part of the utility for the i-th alternative can be written as:

$$\begin{aligned} V_i = {} & ASC_i + \beta_{Origin\ of\ water_{UK}} Origin\ of\ water_{UK_i} \\ & + \beta_{Packaging_{Biodegradable}} Packaging_{Biodegradable_i} \\ & + \beta_{CSR\ Claim_{\text{Donate 5\% price per bottle to an env.}}} CSR\ Claim_{Donate\ 5\%\ price\ per\ bottel\ to\ an\ env._i} \\ & + \beta_{\text{Donate 5\% price per bottle to a soc.}} CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ a\ soc._i} \\ & + \beta_{Price} Price_i, \end{aligned} \quad (4)$$

where ASCi denotes the alternative-specific constant estimated for the *i*-th alternative, and β denotes the parameter vector estimated for the observed attributes.

4.3.3. Hybrid approach of choice modeling

Hybrid choice models allow for a better representation of individuals' values in the modeling of the decision-making process. Directly unobservable factors such as different attitudes or perceptions become manageable (McFadden, 1986). The additional information obtained from the specification, often referred to as a latent variable model, is presented in three parts: (1) extending the utility function used in the standard choice approach with a new component (Equation (5)), (2) in the measurement equations (the latent variable is linked to the indicators observed in relation to the interested attitude) (Equation (6)), (3) in the structural equation (the latent variable is described as a function of various observed variables) (Equation (7)) (Bolduc et al., 2008; Mariel et al., 2015). Consequently:

$$U_{n,i} = V_{n,i} + \lambda LV_n + \varepsilon_{n,i}, \quad (5)$$

where LVn denotes the latent variable, while λ denotes its effect.

$$ME_{k,n} = \zeta_k LV_n + \sigma_{k,n}, \quad (6)$$

where ζk denotes the estimated coefficient for the latent variable for the k-th statement, while σ(k,n) denotes the random part of the measurement model.

$$LV_n = \gamma F_n + \eta_n, \quad (7)$$

where γ is a vector of estimated parameters; Fn is a vector of observed sociodemographic characteristics of respondent n; while ηn denotes the random term, which is assumed to follow a normal distribution.

In the case of this study, we included two latent variables in the utility function, the first one was green consumption values based on the scale of Haws et al. (2014) interacting with "no choice" alternative (Equation (8)) and the second one concerned nature relatedness based on the scale of Elizabeth K. Nisbet and John M. Zelenski (2013) interacting with biodegradable packaging (Equation (9)).

$$U_{n,No\ choice} = ASC_{No\ choice} + \lambda_1 LV1_n + \varepsilon_{n,No\ choice} \quad (8)$$

$$\beta_{Packaging_{Biodegradable_{New\ term}}} = \beta_{Packaging_{Biodegradable}} + \lambda_2 LV2_n, \quad (9)$$

where λ_1 denotes the effect of the latent variable on "no choice", while λ_2

	Product "A"	Product "B"	Product "C"
Origin of water	Great Britain	France	Great Britain
Packaging	Biodegradable	Biodegradable	Non-biodegradable
CSR claim	Donate 5% of the price of each bottle sold to a social wellbeing charity	No donation	Donate 5% of the price of each bottle sold to an environmental charity
Price	£1.50	£1.00	£1.00

Fig. 2. An example of a decision task.

denotes the effect of the interaction of the latent variable and the biodegradable packaging.

The two latent variables, based on the scales of Haws et al. (2014) and Nisbet and Zelenski (2013), captured respondents' environmental consciousness. The measurement equations were built up according to Equation (6). Due to the Likert-type nature of the statements, an ordered logit structure was applied. Accordingly, for the indicators with level I, I-1 threshold parameters were estimated (Daly et al., 2012). Table 4 details the frequencies of the responses to the statements, which are based on a clean (free of incomplete answers) sample (n = 505).

In case of the structural equation, to explain the latent variables, three statements related to the materialist tendencies of the respondents, derived from Richins (2004), were included as independent variables. Instead of including statements separately, we calculated the median agreement for each respondent and incorporated these values into our structural equations. Equation (10) details the final specification.

$$LV_n = \gamma_{Materialism} Med.\ materialism_n + \eta_n, \tag{10}$$

where, $\gamma_{Materialism}$ is the estimated coefficient for the observed independent variable (materialism), $Med.\ materialism_n$ the median agreement for the *nth* respondent on the statements related to materialism; ηn denotes the random term.

4.3.4. Willingness to pay (WTP) estimations

To estimate WTP for the examined attributes, a WTP-space estimation approach was used (Train and Weeks, 2005). The utility function formula based on the WTP-space approach was constructed according to Equation (11).

$$\begin{aligned} V_i = {} & ASC_{No\ choice} + \beta_{Price}\Big(Price_i + W_{Origin\ of\ water_{UK}} Origin\ of\ water_{UK_i} \\ & + W_{Packaging_{Biodegradable}} Packaging_{Biodegradable_i} \\ & + W_{CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ an\ env.}} CSR\ Claim_{Donate\ 5\%\ price\ per\ bottel\ to\ an\ env._i} \\ & + W_{CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ a\ soc.}} CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ a\ soc._i}\Big), \end{aligned} \tag{11}$$

where $W_{Origin\ of\ water_{UK}}$, $W_{Packaging_{Biodegradable}}$, $W_{CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ an\ env.}}$, $W_{CSR\ Claim_{Donate\ 5\%\ price\ per\ bottle\ to\ a\ soc.}}$ denote the willingness to pay for attributes examined. The R Apollo package was used to estimate the discrete choice models (Hess and Palma, 2019; Hess and Palma, 2021; R Core Team, 2020).

5. Results

5.1. Buying and consumption habits of respondents

Before proceeding to the WTP analysis, this subsection presents a brief overview of buying and consumption habits. Respondents detailed which of the following factors they consider when deciding to purchase bottled water. The factors were (1) brand name, (2) size (volume), (3) design of the packaging, (4) nature of the cap/how easy to drink from, (5) origin/source of the water, (6) green packaging, (7) price. Fig. 3 reports the frequencies of these factors. It indicates that respondents self-report that they primarily focus on price (84.7%), size (57.7%), and

Table 4
Distribution of responses regarding environmentally conscious values.

Statements from Haws et al. (2014) measuring green consumption values	Disagree strongly (%)	Disagree a little (%)	Neither Agree or Disagree (%)	Agree a little (%)	Agree strongly (%)
It is important to me that the products I use do not harm the environment.	2.4%	6.3%	16.4%	47.1%	27.7%
I consider the potential environmental impact of my actions when making many of my decisions.	4.8%	16.4%	16.6%	43.4%	18.8%
My purchase habits are affected by my concern for our environment.	7.1%	20.6%	14.9%	39.8%	17.6%
I am concerned about wasting the resources of our planet.	3.0%	6.1%	8.7%	39.0%	43.2%
I would describe myself as environmentally responsible.	2.8%	12.3%	22.4%	42.2%	20.4%
I am willing to be inconvenienced in order to take actions that are more environmentally friendly.	5.3%	16.6%	21.8%	39.4%	16.8%
Statements from E. K. Nisbet and J. M. Zelenski (2013) measuring nature relatedness	**Disagree strongly (%)**	**Disagree a little (%)**	**Neither Agree or Disagree (%)**	**Agree a little (%)**	**Agree strongly (%)**
My ideal vacation spot would be a remote, wilderness area.	19.2%	26.9%	9.1%	30.3%	14.5%
I always think about how my actions affect the environment.	5.5%	17.2%	17.6%	44.4%	15.2%
My connection to nature and the environment is a part of my spirituality.	17.2%	22.0%	22.0%	27.3%	11.5%
I take notice of wildlife wherever I am.	2.0%	4.4%	8.7%	44.6%	40.4%
My relationship to nature is an important part of who I am.	4.8%	18.2%	21.8%	35.4%	19.8%
I feel very connected to all living things and the earth.	5.3%	15.2%	26.9%	34.9%	17.6%

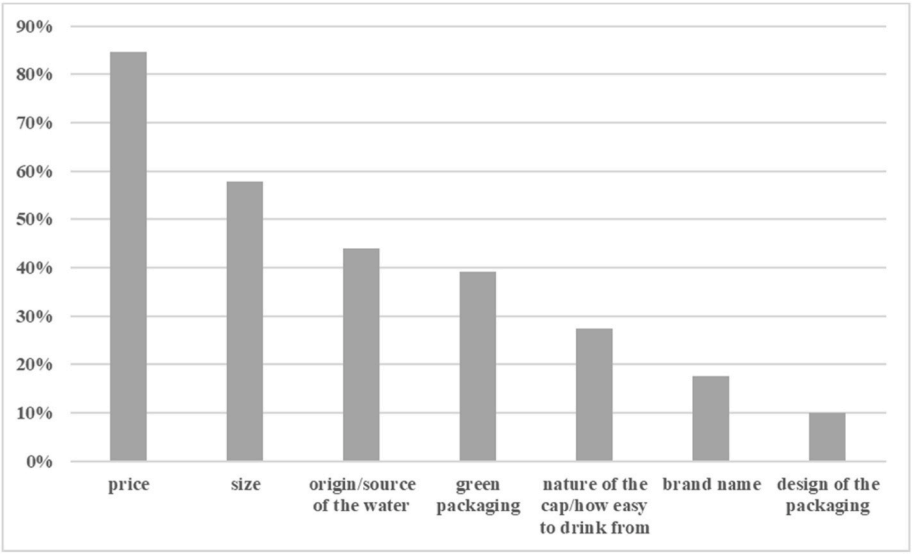

Fig. 3. Factors reported as considered when buying bottled water (% of sample).

origin/source of the water (44.0%) when buying bottled water.

Random parameter logit (RPL) and hybrid random parameter logit (HRPL) model estimates.

Table 5
Preference-space estimates by RPL and HRPL specifications.

Attributes and Model Details	RPL		HRPL	
	Coeff.	S.E.	Coeff.	S.E.
ASC no choice	−6.15*** (−12.66)	0.49	−5.18*** (−7.67)	0.68
UK (Local)	0.97*** (9.02)	0.11	0.96*** (7.08)	0.14
UK (Local) SD	1.75*** (12.58)	0.14	1.52*** (11.85)	0.13
Bio	2.48*** (14.09)	0.18	2.57*** (10.60)	0.24
Bio SD	2.16*** (11.22)	0.19	1.82*** (5.87)	0.31
Donate environmental	0.46*** (4.85)	0.09	0.49*** (4.80)	0.10
Donate environmental SD	0.36** (1.79)	0.20	0.24 (1.10)	0.21
Donate social	0.44*** (4.69)	0.09	0.50*** (5.02)	0.10
Donate social SD	0.40*** (2.48)	0.16	0.34* (1.42)	0.24
Price	−7.53*** (−11.68)	0.64	−7.78*** (−8.10)	0.96
Price SD	8.56*** (6.26)	1.37	10.29*** (3.72)	2.76
Λ_1 (green consumption values – "no-choice")	–		3.57*** (9.00)	0.40
Λ_2 (nature relatedness – biodegradable packaging)	–		0.48** (1.88)	0.26
Observations	4040			
Pseudo	0.48		0.52	
Log-likelihood (0) (for choice model)	−5600.63		−5600.63	
Log-likelihood (final) (for choice model)	−2926.52		−2707.12	
AIC	5875.03		19465.06	
BIC	5944.37		19937.86	

Note: The robust t-values are shown in parentheses below the parameter estimates.; S.E. denotes the robust standard errors.; S.D. denotes the standard deviations.; ASC represents the alternative-specific constant.; ASC-choice, France (Imported), Non-biodegradable, and No donation reported the base levels in the estimates.; ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively; λ_1 and λ_2 denote the effect of the latent variable in the choice model. AIC denotes the Akaike Information Criterion.; BIC denotes the Bayesian Information Criterion.

Firstly, a RPL specification was applied to process the stated preference data. The price attribute was estimated with a lognormal distribution, while a normal distribution was defined for the other attributes using 500 MLHS draws (Hess et al., 2006). Estimates are shown in the "RPL" columns of Table 5. In a subsequent step, environmental consciousness values were introduced into the modeling to gain a deeper understanding of consumer preferences. The estimates for the hybrid random parameter logit (HRPL) model are shown in the "HRPL" columns of Table 5.

The results highlighted in Table 5 indicate that there is a significant improvement in the fit of the model estimated in the hybrid context, extended by the latent variable (Pseudo R^2 in RPL specification: 0.48 – Pseudo R^2 in HRPL specification: 0.52). Similar conclusions can be drawn regarding the estimated parameters for the RPL and HRPL models. Based on the estimated alternative-specific constants, it is apparent that the "no choice" option was significantly less preferred compared to a purchase choice (as indicated by the negative and significant parameter estimation for the "ASC no choice"). The analysis indicates that biodegradable packaging is preferred over non-biodegradable packaging (in line with H1); water imported from France is less preferred than that of domestic origin (supporting H2); and a donation can be seen as preferable to no donation (supporting H3), but there is no clear order of preference between donating for environmental and social purposes (H4 is not supported). As expected, as the price increases, consumer utility decreases. The effect of the latent variable (in this case, environmental values) was estimated by introducing λ parameters (λ_1 and λ_2) in the choice model (as in Equations (8) and (9)). For the "no choice" alternative, one can conclude from the positive coefficient (λ_1) that as the level of green consumption values increases, "no choice" becomes more preferred than one of the buying (supporting H5b). The positive coefficient estimated for the interaction with biodegradable packaging (λ_2) suggests that, as the level of nature relatedness increases, biodegradable packaging becomes more preferable than non-biodegradable packaging (supporting H5a).

Parameter estimates for the structural and measurement equations in the case of the hybrid random parameter logit (HRPL) model.

Tables 6 and 7 reveal that the estimated ζ parameters in the measurement equations are positive and significant. This suggests that as the level of environmentally values increases, the assessment of the examined statements becomes, as expected, more positive. Based on the parameter estimates of the structural equation, one can conclude that respondents with higher materialism are less environmentally consciousness. This is consistent with the findings of Sreen et al. (2020),

Table 6
Preference-space estimates by HRPL specification – measurement equation and structural equation parameters (Haws et al., 2014 scale – in interaction with "no choice").

Measurement equation parameters	Coeff.	S.E.	Measurement equation parameters	Coeff.	S.E.
ζ_{k1}	1.86*** (9.63)	0.19	ζ_{k5}	1.34*** (11.76)	0.11
σ_{k1_1}	−4.84*** (−12.89)	0.38	σ_{k5_1}	−3.70*** (−12.78)	0.29
σ_{k1_2}	−3.58*** (−11.29)	0.32	σ_{k5_2}	−2.25*** (−9.68)	0.23
σ_{k1_3}	−2.15*** (−7.44)	0.28	σ_{k5_3}	−1.08*** (−5.06)	0.21
σ_{k1_4}	0.50** (1.74)	0.29	σ_{k5_4}	0.86*** (4.00)	0.21
ζ_{k2}	2.20*** (8.15)	0.27	ζ_{k6}	1.43*** (12.33)	0.12
σ_{k2_1}	−4.86*** (−10.84)	0.45	σ_{k6_1}	−3.35*** (−12.11)	0.28
σ_{k2_2}	−2.83*** (−7.59)	0.37	σ_{k6_2}	−1.91*** (−8.02)	0.24
σ_{k2_3}	−1.59*** (−4.56)	0.35	σ_{k6_3}	−0.84*** (−3.74)	0.22
σ_{k2_4}	1.24*** (3.48)	0.36	σ_{k6_4}	1.10*** (4.83)	0.23
ζ_{k3}	2.35*** (11.00)	0.21	**Structural equation parameters**	**Coeff.**	**S.E.**
σ_{k3_1}	−4.63*** (−10.38)	0.45	$\gamma_{\text{Materialism}}$	−0.17*** (−3.39)	0.05
σ_{k3_2}	−2.47*** (−6.50)	0.38			
σ_{k3_3}	−1.39*** (−3.79)	0.37			
σ_{k3_4}	1.41*** (3.84)	0.37			
ζ_{k4}	1.35*** (10.52)	0.13			
σ_{k4_1}	−3.68*** (−12.66)	0.29			
σ_{k4_2}	−2.74*** (−10.93)	0.25			
σ_{k4_3}	−2.06*** (−8.95)	0.23			
σ_{k4_4}	−0.26 (−1.21)	0.21			

Note: The robust t-values are shown in parentheses next to the parameter estimates; S.E. denotes the robust standard errors; ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

who found that materialistic values tend to eliminate environmental concerns by creating a negative association with environmental beliefs, and they also have a negative impact on subjective norms and attitudes towards green products.

5.2. Willingness to pay (WTP) estimates

In this step, WTP parameters were estimated using the WTP-space approach (based on Equation (11)). Table 8 presents the results, revealing that respondents are willing to pay between £0.18 ($0.23) and £0.23 ($0.29) less for an imported product than a domestic one (supporting H2). A premium of £0.47 ($0.60) and £0.49 ($0.63) is apparent for biodegradable packaging (in line with H1). The latter premium is greater than that found by Wensing et al. (2020) for bio-based plastic packaging in Italy but very similar to the premia for recyclable plastic packaging estimated by Herrmann et al. (2022) for Germany. No significant WTPs were estimated for the donations to charity.

Table 7
Preference-space estimates by HRPL specification – measurement equation and structural equation parameters (Nisbet and Zelenski, 2013a,b) scale – in interaction with biodegradable packaging).

Measurement equation parameters	Coeff.	S.E.	Measurement equation parameters	Coeff.	S.E.
ζ_{k1}	0.51*** (6.75)	0.08	ζ_{k5}	2.66*** (8.22)	0.32
σ_{k1_1}	−1.05*** (−8.32)	0.13	σ_{k5_1}	−4.62*** (−5.48)	0.84
σ_{k1_2}	−0.20* (−1.63)	0.12	σ_{k5_2}	−2.45*** (−3.75)	0.65
σ_{k1_3}	0.06 (0.50)	0.12	σ_{k5_3}	−0.83* (−1.43)	0.58
σ_{k1_4}	1.08*** (8.60)	0.13	σ_{k5_4}	1.78*** (3.45)	0.52
ζ_{k2}	0.89*** (7.94)	0.11	ζ_{k6}	1.87*** (10.22)	0.18
σ_{k2_1}	−2.20*** (−10.22)	0.21	σ_{k6_1}	−3.43*** (−7.56)	0.45
σ_{k2_2}	−1.10*** (−5.56)	0.20	σ_{k6_2}	−1.92*** (−4.81)	0.40
σ_{k2_3}	−0.46*** (−2.34)	0.20	σ_{k6_3}	−0.46 (−1.20)	0.38
σ_{k2_4}	1.16*** (5.76)	0.20	σ_{k6_4}	1.52*** (3.71)	0.41
ζ_{k3}	1.46*** (9.82)	0.15	**Structural equation parameters**	**Coeff.**	**S.E.**
σ_{k3_1}	−1.79*** (−5.92)	0.30	$\gamma_{\text{Materialism}}$	−0.12** (−2.00)	0.06
σ_{k3_2}	−0.74*** (−2.48)	0.30			
σ_{k3_3}	0.20 (0.64)	0.31			
σ_{k3_4}	1.77*** (5.24)	0.34			
ζ_{k4}	1.17*** (5.93)	0.20			
σ_{k4_1}	−3.16*** (−11.03)	0.29			
σ_{k4_2}	−2.39*** (−9.84)	0.24			
σ_{k4_3}	−1.69*** (−7.20)	0.23			
σ_{k4_4}	0.14 (0.58)	0.25			

Note: The robust t-values are shown in parentheses next to the parameter estimates; S.E. denotes the robust standard errors; ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8
WTP calculations for estimated models.

Level of attributes	RPL	HRPL
UK (Local)	0.23*** (0.47)	0.18*** (0.40)
Biodegradable	0.47*** (0.55)	0.49*** (0.57)
Donate 5% of bottle price to an environmental charity	0.04** (0.11)	0.02 (0.02)
Donate 5% of bottle price to a social wellbeing charity	0.02 (0.10)	0.02 (0.06)

Note: ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively. The standard deviations are shown in parentheses below the WTP estimates.

5.3. Consumer segmentation based on nature relatedness and green consumption

This stage of the analysis examines preferences and, through them, willingness to pay, according to consumers' nature relatedness and green consumption values. Segmentation according to these values is justified by the results of the hybrid choice modelling, which showed

that both latent variables have a significant effect on consumer decision-making. The groups were constructed by aggregating the scales of Haws et al. (2014) and E. K. Nisbet and J. M. Zelenski (2013), assigning a median score (representing the level of environmental awareness at the respondent level) for each respondent based on the rating of 6-6 statements, and then classifying the respondents as follows.

- Med = 1|Med = 2 – Non-environmentally conscious group
- Med = 3 – (in terms of environmental consciousness) Neutral group
- Med = 4|Med = 5 – Environmentally conscious group.[2]

Table 9 The results of the RPL model estimates for the groups are presented in Table 9.

The RPL model estimates presented in Table 9 show few differences between the three consumer groups segmented according to their environmental consciousness. Specifically, for all three groups no choice is less preferred than choice; a UK product is more preferred than an imported one; biodegradable packaging is preferred to non-biodegradable plastic; and price increases have a negative effect on consumers' perceived utility. However, differences across the three consumer groups are evident for donations. For this attribute, we see (both for the environment and social charitable donations) that only the environmentally conscious group shows a significant effect at the 1% level. In the neutral group, giving to the environment is significant at 10% and giving to society at 5%, while in the non-environmental group, neither level of the attribute is significant. Charitable donations are only valued by those with greater environmental consciousness values, and even then, the premiums, as discussed below, are modest.

The WTP calculations detailed in Table 10 indicate that respondents are willing to pay between £0.17 ($0.22) and £0.25 ($0.32) more for the domestic product, while for biodegradable packaging there is a non-linear increase in willingness to pay as the level of environmental awareness increases. Namely, while respondents in the non-environmentally conscious group would pay approximately £0.16 ($0.20) more for bio-degradable packaging, the environmentally conscious group would pay £0.68 ($0.87) more. This illustrates how the premia consumers are willing to pay for bio-degradable packaging hinges on their environmental consciousness. For donations to environmental purposes, the environmentally conscious group would pay approximately £0.06 ($0.08) more, while for donating to social purposes, both the neutral and environmentally conscious groups would pay £0.04 ($0.05) more.

5.4. Supplementary study in Taiwan

Finally, to enhance the analysis, we undertook a supplementary study in Taiwan (see Appendix A for further details). This additional choice experiment, also for bottled water, included the attributes of origin, packaging, charity donations, and price. The study found that sampled participants were willing to pay between $0.05 and $ 0.07 less for an imported product than a domestic one. A premium of $0.51 is associated with for biodegradable packaging. Sampled consumers would pay between $0.16 and $0.18 more if they bought a "Donate 5% of the price per bottle to an environmental charity" version and between $0.010 and $0.12 if they bought a "Donate 5% of the price per bottle to a social wellbeing charity" water, compared to a product with no donation. The nature of the premiums for the Taiwan sample are thus in keeping with the main study results for the UK, although willingness to pay for biodegradable packaging is slight lower (circa $0.10 lower) in the case of Taiwan.

6. Discussion

When encountering a less environmentally-friendly product (e.g., water in plastic bottles), consumers can ignore environmental concerns, refrain from purchasing any option, opt for a less damaging version, and/or engage in offsetting/compensatory behavior (Schuermann and Woo, 2022; Xu et al., 2022). This paper considers consumers' valuation of these options, and the extent to which refraining from bottled water purchases depends on environmental consciousness. Regarding the latter, decisions to buy or not buy bottled water were examined through a hybrid choice approach, investigating the impact of environmental consciousness.

6.1. Theoretical implications

The paper contributes to theory and evidence concerning consumer behavior for less environmentally friendly packaged product categories. Specifically, the analysis yields insights into how, when confronted with a less environmentally friendly packaging, consumers value four potential options - i) ignoring environmental concerns, ii) selecting a less environmentally damaging option within the category, iii) opting out of purchasing any option within the category, or iv) seeking to offset the damage in some regard. Regarding the first two options, the results reveal that consumers are willing to pay more for biodegradable packaging. While some previous research suggests a degree of scepticism toward biodegradable packaging (Herrmann et al., 2022) which may lead to consumers being unwilling to pay extra for it (Van Loo et al., 2019), the analysis presented in this paper suggests that it elicits a positive premium, consistent with the results of Grebitus et al. (2020) and Koenig-Lewis et al. (2022). While consumers are willing to pay more for biodegradable packaging, at present the costs of certified biodegradable plastic packaging are similar to, or greater than, the average WTP identified in the UK study (circa $0.50), although prices depend on volume (Swartz, 2024). Consequently, it is difficult therefore for manufacturers to pass on the full additional cost of biodegradable plastics to consumers, when switching from PET containers (Filiciotto and Rothenberg, 2021). Price remains the most important attribute in consumer decision-making.

Regarding the third strategy of opting out of purchasing any option within the product category, the analysis indicates that it is associated with higher levels of green consumption values. This result supports theories of moral consistency in environmentally conscious behavior, where consumers engage in actions consistent with their values to preserve a sense of identity and investments made in their identity signaled to others (Benabou and Tirole, 2011). In this regard the findings echo the conclusions of Mullen and Monin (2016) regarding consumers' choices between green and conventional products. They argue that participants with a strongly pro-environmental identity make choices consistent with their pro-environmental intentions to preserve their cherished identity (Mullen and Monin, 2016).

The final option for consumers is to engage in offsetting behavior, such as donating to a charity (Galan-Ladero et al., 2013). Consequently, the effects of two different causes were tested – a 5% donation of the purchase price to a social wellbeing charity and a similar level of donation to an environmental charity. The effects of the charitable donations on consumers' perceived utility are modest or insignificant. As an option for changing consumer behavior, modest donations of 5% of the purchase price, appear largely ineffectual. Interestingly, we found no difference in the willingness to pay between a charity focused on the environment and a charity focused on social wellbeing. It may be that the modest effect of the charity donations reflects that they do little

[2] In the case where a respondent had a non-integer median (which resulted from the fact that the number of statements was even, 12 in total - e.g., the 6th and 7th value of the ranked values were different and were arithmetically averaged), they were placed in the lower group representing lower environmental awareness. We made this decision from a methodological point of view because the distribution of responses is skewed, probably due to social desirability reasons - people tend to over-estimate 'good behavior' and underestimate 'bad behavior').

Table 9
Preference-space estimates by RPL by environmental consciousness consumer segments.

Attributes and Model Details	RPL (Non-environmentally conscious)		RPL (Neutral)		RPL (Environmentally conscious)	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
ASC no choice	−9.91*** (−4.90)	2.02	−7.21*** (−6.98)	1.03	−4.90*** (−9.13)	0.54
UK (Local)	0.76*** (2.88)	0.26	1.15*** (3.73)	0.31	0.93*** (6.38)	0.15
UK (Local) SD	1.74*** (4.94)	0.35	2.10*** (5.39)	0.39	1.70*** (9.16)	0.19
Bio	1.10*** (4.02)	0.27	1.46*** (5.48)	0.27	3.26*** (12.69)	0.26
Bio SD	1.00*** (2.50)	0.40	1.40*** (4.52)	0.31	2.29*** (9.80)	0.23
Donate environmental	0.31 (1.06)	0.29	0.32* (1.46)	0.22	0.60*** (4.81)	0.12
Donate environmental SD	0.55* (1.38)	0.40	0.10 (0.57)	0.17	0.37* (1.48)	0.25
Donate social	0.26 (1.02)	0.26	0.40** (1.88)	0.21	0.48*** (3.85)	0.12
Donate social SD	0.25 (0.99)	0.25	0.19 (0.23)	0.82	0.56*** (2.62)	0.21
Price	−9.06*** (−5.51)	1.64	−7.33*** (−7.87)	0.93	−7.23*** (−10.96)	0.66
Price SD	8.90*** (3.19)	2.79	5.62*** (5.50)	1.02	10.36*** (5.82)	1.78
Observations	688		840		2512	
Pseudo	0.57		0.51		0.47	
Log-likelihood (0) (for choice model)	−953.77		−1164.49		−3482.37	
Log-likelihood (final) (for choice model)	−413.64		−570.01		−1838.97	
AIC	849.27		1162.03		3699.94	
BIC	899.14		1214.10		3764.06	

Note: The robust t-values are shown in parentheses below the parameter estimates.; S.E. denotes the robust standard errors.; S.D. denotes the standard deviations.; ASC represents the alternative-specific constant.; ASC-choice, France (Imported), Non-biodegradable, and No donation reported the base levels in the estimates.; ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively; AIC denotes the Akaike Information Criterion.; BIC denotes the Bayesian Information Criterion.

Table 10
WTP calculations for the environmental consciousness consumer segments.

Level of attributes	RPL (Non-environmentally conscious)	RPL (Neutral)	RPL (Environmentally conscious)
UK (Local)	0.17*** (0.40)	0.25*** (0.44)	0.22*** (0.48)
Biodegradable	0.16*** (0.24)	0.26*** (0.33)	0.68*** (0.72)
Donate 5% of bottle price to an environmental charity	0.01 (0.10)	0.01 (0.08)	0.06*** (0.12)
Donate 5% of bottle price to a social wellbeing charity	−0.01 (0.10)	0.04** (0.01)	0.04** (0.11)

Note: ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively. The standard deviations are shown in parentheses below the WTP estimates.

directly to attenuate the damage of the purchased product. Where the charity donation fails to relieve the damage of consumption, a warm glow effect may be not emerge (Winterich and Barone, 2011). Consequently, rather than offsets having universal value to consumers, they should be conceptualized as being context dependent in their appeal.

6.2. Managerial and policy implications

The results offer insights and lessons for managers and policymakers. First, managers should be aware of consumers' WTP for biodegradable packaging and compare it against the costs of switching to it from PET containers. Given that price is the most important attribute (as evidenced also in self-reported responses), expansion of the market for biodegradable plastics will hinge on reducing costs, to the point where they are lower than consumers' WTP. Cost reducing innovations, particularly in processes, that reduce costs are therefore vital. The latter should be a priority for research and development seeking to improve the sustainability of packaging. Currently, it would be difficult, in a very competitive market like bottled water, for a mass market manufacturer to switch to biodegradable plastic packaging unilaterally, without substantially reducing their profit margins and/or their market share.

When consumers make decisions regarding the sustainability of packaging, they can only utilize information that is available to them. Consequently, both companies and policymakers bear important responsibilities. It is possible for companies to enhance consumers' purchase intentions by emphasizing the sustainability advantages of packaging (Cammarelle et al., 2021), social norms (Kim et al., 2024) and environmental impacts, increasing the salience of environmental values in decision making. It is incumbent on manufacturers to develop effective communications and targeted marketing strategies that encourage consumers to purchase more environmentally friendly options (Lombardi et al., 2024). Both policymakers and companies are responsible for education and information campaigns to increase consumers' WTP to purchase biodegradable packaging (Cammarelle et al., 2021). In addition, eco-claims on packaging (Giannoutsos et al., 2023), awareness training (Otto et al., 2021) and eco-labelling can all nudge consumers towards more environmentally friendly choices. Nevertheless, amongst consumers with a low degree of environmental consciousness, as highlighted in our results, willingness to pay for biodegradable packaging is modest, and the limits of purely consumer led strategies should be acknowledged.

Policymakers may utilize various policy instruments, such as taxes, choice editing, and education initiatives to encourage uptake of more environmentally friendly packaging (Cammarelle et al., 2021). A mixture rather than a single policy measure is required. As Chang and Hung (2023) argue, reducing the use of single-use products depends on both communications campaigns and persuasion as well as laws and taxes on relevant products. It is important to educate consumers from an early age (Otto et al., 2021), to increase awareness and raise environmental consciousness throughout consumers' lifetimes.

The study has lessons for marketing strategy. It is often assumed that those who are most environmentally conscious, will be most likely to purchase more environmentally-friendly variants of products (Kang and Moreno, 2020). Consequently, companies typically target environmentally conscious consumers when marketing such goods (Mehta and Chahal, 2021). However, importantly for managers in the bottled water industry, the results suggest that this strategy may be inappropriate. Specifically, the "no choice" alternative becomes more preferred as consumers' green consumption values increases. As a result, increasing environmental consciousness may not expand demand for biodegradable packaged water but dampen product category demand.

There is a large body of evidence that domestic brands have an advantage over foreign rivals due to consumer ethnocentrism (Shimp and Sharma, 1987), as well as differences in trust (Kokthi et al., 2022;

Mauracher et al., 2013) and perceptions of quality (Brei, 2018; Jain et al., 2019). As noted by Printezis et al. (2019), these factors combine to make consumers willing to pay a premium for locally produced food and drink. Consequently, marketers often promote the localness of their products when selling to the domestic market, especially for food and drinks (Brei, 2018; Jain et al., 2019). However, while consumers prefer domestic versions and will pay extra for them, the effect of origin on WTP, in our study, is relatively modest. Consequently, while it may be tempting for domestic drinks manufacturers to focus solely on emphasizing their local credentials in domestic markets, this in itself may not provide the basis for commanding a premium price. Brand managers must do more than just point to the localness of their products.

6.3. Limitations and further research

While improving understanding of consumers' responses to a less environmentally friendly packaging, the study is not without limitations which can guide further research. Additional studies, conducted in countries with varying socio-economic and cultural characteristics could replicate the methodology to confirm the generalizability of the findings. Moreover, Fig. 2 suggests that there are attributes such as brand name which affect consumer behavior but were not included in the DCE. While choice experiments with many attributes become too complex for respondents, leading to biased parameter estimates (Greiner et al., 2014), the most salient attributes not included in this study, such brand name and size, warrant further investigation. Future research could also consider consumers' WTP for alternative packaging materials and policy initiatives, such as glass bottles with returnable deposits, which may serve as a basis for more sustainable consumption. Few previous studies consider the effects of charitable donations on consumers' WTP for less and more environmentally friendly products, and this merits further research. Specifically, it would be interesting to investigate in greater detail the factors that determine consumers' valuations of offsets. In addition, since donations are not specific to a type of packaging but can affect consumers' WTP, caution should be exercised in interpreting that consumers regard them as compensatory for less environmentally friendly packaging. Regarding carbon offsets there is a considerable degree of academic and policy scepticism regarding their usefulness (Badgley et al., 2022) and the degree to which consumers regard them as sincere, and how they affect brand image and WTP remains unclear. Moreover, additional latent variables, such as personality traits, could be included in DCE-based research, to further improve understanding of consumers' decision-making. Finally, it is recommended to replicate this study in other countries, especially markets where the quality of tap water is low and the only (or suggested) option is the consumption of bottled water.

7. Conclusions

Concerning less environmentally friendly product categories, such as bottled water, understanding consumer choices is an important challenge for devising strategies to encourage more sustainable consumption patterns. This study investigates UK consumers' attitudes towards bottled water using a DCE. The study finds that consumers are willing to pay a significant premium for biodegradable packaging, but this may be insufficient to cover of the additional costs of biodegradable plastics compared with PET containers. However, the WTP of consumers for biodegradable packaging exceeds the WTP associated with domestic origin and the 5% donation for social wellbeing or environmental charities. Moreover, as consumers' level of nature relatedness increases, biodegradable packaging becomes more preferable than non-biodegradable packaging. Finally, the positive coefficient of the "no choice" alternative suggests that this strategy becomes increasingly preferred as the level of green consumption values increases.

CRediT authorship contribution statement

Péter Czine: Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Formal analysis, Data curation. **Matthew Gorton:** Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization. **Andrea Bauerné Gáthy:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Aliz Vuk:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Péter Balogh:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology. **Yi-chyang Chou:** Writing – original draft, Conceptualization. **Áron Török:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Matthew Gorton reports financial support was provided by Research England which funds the National Innovation Centre for Rural Enterprise. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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APPENDIX A

Supplementary study in Taiwan

Table A1
Profile of the sample's demographic and socio-economic characteristics

Characteristic	Sample (n = 300)
Gender (%)	
Male	43.3

(*continued on next page*)

Table A1 (*continued*)

Characteristic	Sample (n = 300)
Female	56.7
Age category (%)	
25–29	32.4
30–34	23.7
35–39	15.3
40–44	18.3
45–49	9.0
Prefer not to answer	1.3
Highest level of education achieved (%)	
Junior high	2.0
High school	10.3
Bachelor	59.7
Master	26.3
PhD	1.7
*Income category (%)**	
< $722	18.7
$722– $1443	30.0
$1443 – $2165	18.0
$2165 – $2886	12.3
$2886 <	4.3
Prefer not to answer	16.7

Note: in the study, local currency is converted to EUR with the average exchange rate of 35.465 NTD/EUR applied for the period of the data collection.

Table A2
Attributes, their descriptions, and their levels in the DCE.

Attribute	Attribute levels
Origin of water	Local
	Imported
Packaging	Non-biodegradable
	Biodegradable
Charity donation	No donation
	Donate 5% of the price of each bottle sold to an environmental charity
	Donate 5% of the price of each bottle sold to a social wellbeing charity
Price*	NTD 15 ($0.54)
	NTD 20 ($0.72)
	NTD 25 ($0.90)
	NTD 30 ($1.09)

Note: exchange rate by the time of data collection was applied.

Table A3
Distribution of responses regarding environmentally conscious behavior.

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	All of the time (%)
I follow environmentally friendly issues.	0.7	6.4	49.5	34.6	8.8
I trade off something which may be inconvenient for me in order to be eco-friendly.	2.0	11.9	50.9	26.4	8.8
I bring my own shopping bag when I do shopping.	1.7	7.5	29.1	45.4	16.3
I do recycling in my household.	0.3	2.4	13.2	44.8	39.3
I choose products which cause less environmental impacts during my purchases.	1.4	10.5	53.2	28.8	6.1
I refuse to purchase a particular brand because of its non-eco-friendly behavior/image.	1.0	7.1	32.2	39.7	20.0
I donate to environmental related charities or purchase their products.	11.8	38.3	38.0	9.5	2.4

Table A4
Preference-space estimates by HRPL specification – structural equation parameters

Structural equation parameters	Coeff.	S.E.
γ_{Age_2}	−0.10 (−0.89)	0.11
γ_{Age_3}	0.27*** (3.44)	0.08
$\gamma_{Education_2}$	−0.13** (−1.68)	0.08
$\gamma_{Education_3}$	0.12* (1.33)	0.09

Note: The robust t-values are shown in parentheses below the parameter estimates; S.E. denotes the robust standard errors; ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The effect of the latent variable (in this case, environmentally conscious behavior) was estimated by introducing a λ parameter in the choice model. For the "no choice" alternative, the results indicate that as the level of environmental conscious behavior increases, "no choice" becomes more

preferred than one of the alternatives (alternative 1 or alternative 2). Based on the parameter estimates of the structural equation (Table 4), one can conclude that respondents above the age of 40 and those who completed higher education are more environmentally conscious than younger respondents with lower levels of educational attainment.

Table A5
WTP calculations for estimated models

Level of attributes	RPL	HRPL
Imported	−1.92*** (−3.66)	−1.40*** (−2.57)
Biodegradable	14.23*** (10.93)	14.16*** (10.09)
Donate 5% of bottle price to an environmental charity	4.51*** (8.94)	4.94*** (9.66)
Donate 5% of bottle price to a social wellbeing charity	2.74*** (5.34)	3.36*** (6.49)

Note: The robust t-values are shown in parentheses below the parameter estimates; *** indicates the coefficients are statistically significant at the 1% level.

In the final step, WTP parameters were estimated using the WTP-space approach. Table 5 presents the results, revealing that respondents are willing to pay between NTD 1.40 ($0.050) and NTD 1.92 ($ 0.069) less for an imported product than a domestic one. A premium of NTD 14.16 ($0.51) and 14.23 ($0.52) is apparent for biodegradable packaging. Sampled consumers would pay between NTD 4.51 ($0.16) and NTD 4.94 ($0.18) more if they bought a “Donate 5% of the price per bottle to an environmental charity” version and between NTD 2.74 ($0.099) and NTD 3.36 ($0.12) if they bought a “Donate 5% of the price per bottle to a social wellbeing charity” water, compared to a product with no donation. The estimates for the Taiwan sample are thus in keeping with the main study results for the UK.

Data availability

Data will be made available on request.

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