Carbon Neutrality and Transparency:

Evidence from a Choice Experiment*

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Abstract

This paper focuses on the impact of transparency in carbon-neutral labeling on consumer's preferences and willingness to pay. In current markets, there is a proliferation of various climate labels representing different concepts but overlapping characteristics, which may lead to consumer confusion. Furthermore, theoretical evidence suggests that a proliferation of labels might promote those labels with lower environmental quality. Therefore, this study aims to empirically understand whether providing information on the percentage of CO_2 offsetting and CO_2 reduction influences consumer preferences for carbon-neutral labels. I conduct a discrete choice experiment among UK tea consumers through an online survey. I use a split sample approach, comparing consumers' willingness to pay for standard carbon-neutral labels and 'transparent' carbon-neutral labels, which additionally disclose the percentage of CO_2 offsetting and CO_2 reduction. Furthermore, I examine the effect of various factors, including concerns about carbon offsetting, trust, and confusion, on consumers' preferences for standard and transparent carbon-neutral labels.

Keywords discrete choice experiment; stated preferences; environmental valuation; climate labeling; carbon neutrality; information asymmetry; environmental transparency

1 Introduction

As the negative effects of climate change become stronger, various strategies, such as carbon-neutral labeling and offsetting, are being implemented. Carbon-neutral certification can be given to products, services, or companies, usually by third parties such as non-governmental organizations (NGOs), governmental organizations, and other independent organizations or companies. To receive a carbon-neutral certification, greenhouse gas emissions (GHGs) must be calculated as carbon dioxide (CO_2) equivalents[1]. Then, all residual GHG emissions not reduced within the entity must be compensated via carbon offset projects outside of the entity.

Multiple climate labels, including carbon-neutral, carbon footprint, and carbon reduction, coexist in the market. Each represents different concepts, even though they may have overlapping characteristics. This can confuse consumers, who might view these different environmental labels as simply different versions of the same concept (Brécard, 2014). Theoretical literature shows that in a market with a proliferation of labels, competition may favor labels that are weaker in terms of their environmental quality (Brécard, 2014; Heyes and Martin, 2017; Brécard, 2017; Heyes and Martin, 2018; Poret, 2019). This is also exemplified by recent developments, such as the EU's planned ban on unverified generic environmental claims, e.g., climate-neutral (European Parliament, 2023), the lawsuit against Delta Air Lines (The Guardian, 2023) for misleading carbon neutrality claims, and Climate Partners' decision to withdraw their carbon-neutral labels (ClimatePartner, 2023; Clean Energy Wire, 2024). At the same time, providing information about label quality may not always improve environmental outcomes, particularly with high information costs and inevitable consumer

[1]In this paper, "CO_2" and "GHG" are used interchangeably. The term CO_2 is used to refer to the carbon dioxide equivalent (CO_2e), measuring the total GHG emissions of a product, expressed as an equivalent amount of CO_2.

confusion (Heyes et al., 2020). It is then an empirical question whether additional information about a label's environmental quality affects consumers' demand. This paper aims to fill this gap by exploring how transparency with regard to the share of CO_2 offsetting and CO_2 reduction on carbon-neutral labels affects consumers' preferences and WTP (willingness to pay).

This study leverages a choice experiment (CE), a stated preference method, for eliciting consumers' preferences and WTP for carbon-neutral labels. An online survey is conducted among tea consumers in the UK using a split-sample approach. The first sub-sample sees a standard carbon-neutral label that lacks information on the share of CO_2 offsetting and CO_2 reduction on the label. Meanwhile, the second and third sub-samples are shown a "transparent" version of the carbon-neutral label, which includes information on the share of CO_2 offsetting and CO_2 reduction. To mitigate potential hypothetical bias, participants are provided with a "cheap talk" script, which explains that people are likely to overstate their preferences in a survey, an "oath script", which asks them to provide honest and accurate responses and a reminder of their budget limitations.

This study aims to understand consumer preferences and their WTP for carbon-neutral labels, focusing on the distinctions between transparent and standard labels. The main research questions include: (i) Are consumers willing to pay for carbon-neutral labels? (ii) Do consumers value transparent carbon-neutral labels more than standard ones, and if so, by how much? (iii) How do consumers' preferences for CO_2 reductions differ from CO_2 offsets? To gain insights into how much consumers can internalize the climate externality through carbon-neutral labels, the study further explores the following question: (iv) How much are consumers willing to pay to offset or reduce one tonne of CO_2 through carbon-neutral labels, and how does this compare to the social cost of carbon estimates?

Next, an interesting question in economics concerns why people adopt pro-environmental behaviors. This study focuses on this question in a context where there is an information asymmetry between consumers and producers, thereby addressing the following question: (v) Which mechanisms are important for consumers' preferences for carbon-neutral labels? Finally, to identify which aspects of sustainability are most important to consumers and how they are valued, this study addresses the next question: (vii) How much are consumers willing to pay for organic and ethical trade labels, and is their WTP higher than for a carbon-neutral label?

The transparency of a carbon-neutral label may refer to various types and levels of information. It can be as simple as defining the nature of the carbon-neutral label, such as the share of CO_2 offsetting and CO_2 reduction, or as detailed as providing information on the specifics of the offset projects. Displaying information on the label may be important, as not all consumers are aware of the meaning of the carbon-neutral label, even if they are familiar with the term 'carbon offsetting.' This information can also help consumers gauge the label's environmental quality, given concerns that CO_2 offsetting might not achieve equivalent atmospheric carbon reductions (Hyams and Fawcett, 2013; Schneider et al., 2015; Becken and Mackey, 2017), indicating CO_2 offsets are less effective than direct CO_2 reductions. Therefore, this study primarily focuses on this very first aspect of transparency, which includes disclosing the share of CO_2 offsetting and reduction on the carbon-neutral label, and an important preliminary step before delving into the other dimensions of transparency.

Transparency on the carbon-neutral label, specifically displaying the share of CO_2 offsetting and CO_2 reduction, can have a two-fold effect. First, it can positively influence demand by increasing trust. On the other hand, depending on the share of CO_2 offsetting and reduction, transparency can increase or decrease demand due to the ethical and practical concerns about carbon offsetting (Carattini and Tavoni,

2016). Similarly, providing more information on the label could either clear up or cause confusion for consumers, which might positively or negatively affect the demand. This study aims to explore these channels that shape consumers' preferences for transparent carbon-neutral labels.

This study contributes to several strands of literature. First, it adds to the literature on corporate social responsibility (Fehr et al., 1993; Shleifer, 2004; Besley and Ghatak, 2007; Bénabou and Tirole, 2010; Falk and Szech, 2013; Bartling et al., 2015) by understanding individuals' pro-social behavior in a hypothetical market setting. Secondly, it aims to contribute to the body of research in the economics of credence goods (Darby and Karni, 1973; Mimra et al., 2016; Wolinsky, 1993; Baksi and Bose, 2007; Dulleck and Kerschbamer, 2006; Huck et al., 2016), as carbon offsetting serves as an example of a credence good, given the difficulty consumers face in evaluating its environmental quality. Third, it aims to contribute to the economics of information asymmetry and transparency (Akerlof, 1978; Kitzmueller and Shimshack, 2012; Ofori and Lujala, 2015), environmental transparency (Brounen and Kok, 2011; Brunnschweiler et al., 2021), as well as the economics of disclosure literature (Grossman and Hart, 1980; Jovanovic, 1982; Guo and Zhao, 2009; Dranove and Jin, 2010). It does so by examining whether transparent carbon-neutral labels enable consumers to assess the environmental quality of such products better, affecting their WTP. In addition, it builds upon the literature about bringing non-normative pro-social behaviors to normative (Sparkman and Walton, 2017; Carattini et al., 2022; Anderson, 2012; Mortensen et al., 2019; Kraft-Todd et al., 2018). It does so by exploring whether increased transparency in environmental labeling can increase the adoption of such green products, which is still a niche market. Furthermore, it builds upon the economics of label competition (Brécard, 2014, 2017; Heyes and Martin, 2018; Poret, 2019; Heyes et al., 2020), and climate labeling literature (Akaichi et al., 2017;

Feucht and Zander, 2018; Grebitus et al., 2013; Onozaka and McFadden, 2011; Birkenberg et al., 2021a). In addition, this study aims to contribute to the literature on carbon offsetting (Blasch and Farsi, 2014; Ziegler et al., 2012; Brouwer et al., 2008; MacKerron et al., 2009; Carattini and Tavoni, 2016; Chen et al., 2018) by estimating consumers' WTP for carbon offsetting when communicated via a carbon-neutral label. Furthermore, it contributes to the literature examining consumers' WTP for various sustainability labels (Janßen and Langen, 2017; Duckworth et al., 2022). Lastly, it aims to contribute to the literature on the application of the CE method (Carlsson and Martinsson, 2001; Hoyos, 2010; Johnston et al., 2017).

The remainder of the paper is outlined as follows: Section 2 provides a theoretical background and a review of the relevant literature. Section 3 details the methodology, including the survey and design (3.1) and the empirical approach (3.2). Section 4 presents the results. It starts with the baseline regressions (4.1) and then examines the underlying mechanisms of consumers' preferences and WTP (4.2). Finally, Section 5 concludes.

2 Background

This section introduces carbon-neutral labels and discusses the theoretical background. Then, it highlights the knowledge gap in understanding transparency in carbon-neutral labels, particularly with regards to the information on the share of CO_2 offsetting and CO_2 reduction. Next, it explores various mechanisms that might influence demand for carbon-neutral labels and increased transparency. Finally, it discusses the implications of this study for corporate social responsibility and policy-making.

A carbon-neutral certified product indicates that its lifecycle GHG emissions have

been reduced and the remaining emissions have been compensated via CO_2 offsetting (ClimatePartner, 2023). These offsetting projects include practices outside the entity, such as reforestation and carbon-storing agricultural practices (Climate Portal, 2023). Many companies and countries have announced their commitment to reach carbon neutrality by 2050 or earlier, and global voluntary carbon markets are expected to increase 15 times by 2030 and 100 times by 2050, potentially reaching $50 billion by 2030 (McKinsey & Company, 2023). However, currently, most products on the market have not yet been labeled carbon-neutral, and opting for carbon neutrality is currently a niche behavior. Therefore, understanding the consumers' demand for carbon-neutral labels can help businesses and policymakers plan effective climate change mitigation through market-based solutions.

The theory of environmental externalities provides insight into the importance of understanding consumers' demand for carbon-neutral labels. If environmental externalities, such as climate change, are overlooked, the social benefits of producing a product may be overestimated without taking into account its environmental impact (Harris and Roach, 2017). By integrating the cost of climate change into the private marginal cost of a product, the pricing reflects its true social impact. This correction might be through different ways, such as a Pigouvian tax that is used to internalize a negative externality to achieve a socially optimum level of output (Pigou, 2017). True prices, accounting for the social costs, eliminate deadweight loss, which is the inefficiency that occurs when supply and demand cannot reach an allocative efficient equilibrium. By understanding the marginal benefit consumers get from mitigating CO_2 emissions through carbon-neutral labels, including their transparent versions, one can assess whether individuals are willing to pay more than the social cost of carbon. This offers insights into the economics literature by understanding consumer preferences in the private provision of a public good.

A credence good is one whose actual value is hard for consumers to evaluate (Wolinsky, 1993) such as products with environmental labels. Furthermore, firms disclose less information in competitive markets than in monopolistic markets (Guo and Zhao, 2009). Given many brands and retailers compete, most environmental labels in the market may lack transparency, which causes an information asymmetry. Akerlof (1978) shows when information between the buyers and the sellers is imperfect, only lower-quality goods remain in the market due to moral hazard. In a market with label proliferation and competition, the theoretical literature supports that consumer confusion may lead to a market that favors labels with lower environmental quality (Brécard, 2014, 2017; Heyes and Martin, 2017, 2018; Poret, 2019). On the other hand, Heyes et al. (2020) indicates that more information does not always result in better environmental outcomes, particularly when there are high information costs and inevitable consumer confusion. Therefore, an empirical question arises: how does the additional information about a label's environmental quality affect consumers' demand?

The existing literature mainly indicates a positive WTP for carbon-neutral labels (Vecchio, 2013; Sporleder et al., 2014; Breustedt, 2014; Drichoutis et al., 2016; Birkenberg et al., 2021b). This is supported by the meta-analysis of existing literature on climate labels, which mainly consists of stated preference studies, while the findings from the hedonic difference-in-differences method indicate a zero WTP (Carattini et al., 2024). Given the link between carbon neutrality and CO_2 offsetting, the economics of carbon offsetting offers insights into the underlying mechanisms of the demand for carbon-neutral labels. The guilt associated with harming the environment (Kotchen, 2009), the warm glow or satisfaction obtained from pro-environmental behavior (Andreoni, 1990), and concerns about self-image (Bénabou and Tirole, 2006; Nyborg et al., 2006) are considered as primary mechanisms motivating contributions

to environmental protection.

CO_2 offsets, as opposed to the real CO_2 reduction, may be increasingly less favored among people. Skepticism in the media about the reliability of CO_2 offsets and corporate greenwashing concerns may influence how consumers perceive environmental labels, including carbon-neutral labels and CO_2 offsetting. Ethical concerns associated with CO_2 offsetting include moral licensing (Dorner, 2019) and putting a price on nature (Aldred, 2012). While the practicality concerns include the argument that carbon offsetting does not result in equivalent carbon reductions from the atmosphere (Becken and Mackey, 2017) due to additionality (Hyams and Fawcett, 2013), credibility concerns (Bumpus and Liverman, 2008; Hooper et al., 2008), and double-counting of emission reductions (Schneider et al., 2015). Although there are also concerns about CO_2 leakages related to CO_2 reductions, this issue is mentioned relatively less in mainstream media but rather more frequently in academic or policy-making contexts.

To my knowledge, carbon-neutral labels in the market do not clearly indicate the proportion of CO_2 offsetting and CO_2 reduction on the label, while this lack of clarity could affect consumers' preferences. Based on the report by Changing Markets Foundation (2023), even the most carbon-intensive food products, such as beef, are labeled as carbon-neutral. While activist pressures may have led many companies to increase their transparency, these pressures may also cause certain companies, not fully informed about the environmental impact of their activities, to become less transparent (Lyon and Maxwell, 2011). According to the European Commission, 53.3% of environmental claims were found to be vague, misleading, or unfounded. Therefore, it remains an empirical question how people value these labels, and how their preferences change when the certifiers are more transparent regarding the environmental quality on the label. This paper aims to address this gap in the literature.

Furthermore, it aims to explore various factors that may influence consumer preferences, including beliefs about CO_2 emissions of the product, social image concerns, beliefs regarding the producer pays principle, and concerns about CO_2 offsetting. It also examines the factors that may be associated with the demand for increased transparency, including the relative trust and confusion in transparent carbon-neutral labels compared to standard carbon-neutral labels.

How consumers value additional information about the shares of CO_2 offsetting and CO_2 reduction on carbon-neutral labels can have implications for both corporate social responsibility and policy making. Although market interactions, such as buying and selling, may lower individuals' pro-social and environmental concerns (Barclay, 2004; Falk and Szech, 2013), if consumers demand socially and environmentally responsible products, sellers usually meet this demand by providing such products (Fehr et al., 1993). Therefore, understanding how consumers value transparent labels may be valuable information for firms and label certifiers, which could help them in designing their labels responsibly. It can also guide policymakers in preventing misleading and confusing labels on the market.

3 Methodology

3.1 Survey and Choice Experiment Design

This section explains the survey's preamble and discusses the choice of methodology, the product, the sample, the attributes and their levels used in the CE, the split-sample approach, and the list of questions following the CE.

The preamble of the survey indicates its goal, which is to understand the effect of sustainability labels on consumer preferences. Participants are informed that their

participation is voluntary, and their responses are kept anonymous and confidential. They are also informed that they can withdraw from the survey at any time without indicating a reason, and if they opt out, their data is not stored. A payment is provided upon completion of the survey. Participants are asked to refrain from checking external information sources while filling out the survey. They can return to previous pages of the survey, but they do not have the option to change their answers after moving to the next page. To proceed, participants must provide their consent to participate in the survey by selecting the corresponding checkbox.

In CEs, respondents are presented with various hypothetical options and are asked to make choices in a survey (Hanley et al., 2019b; Holmes et al., 2017). These options include different variations of the same product, service, or scenario, each varying in attributes and levels. Including price as one of the choice attributes enables the elicitation of consumers' WTP for different product characteristics, even those that do not have a market price, such as hypothetical sustainability labels.

I choose to leverage a CE instead of the revealed preference methods or other stated preference methods for several reasons. The most important reason is the fact that examples of transparent carbon-neutral labels, with extra information about the shares of CO_2 offsetting and CO_2 reduction, are not available on the market. Therefore, a randomized controlled trial (RCT) would require forming partnerships with a carbon-neutral certifier willing to develop such labels, a company that meets the criteria, and also a retailer. The possibility of achieving this without having to change the main experimental design would be quite challenging. Second, there are certain advantages of using CE compared to other valuation methods. CE can account for consumer trade-offs among various attributes, elicit their marginal WTP (MWTP) for each attribute (Hanley et al., 2019a), and its reduced susceptibility to biases such as "yea-saying", compared to contingent valuation method (CVM) (Adamowicz et al.,

1994). Furthermore, I define the sustainability attributes (carbon neutral, organic, and ethical trade labels) independently in the CE, such that there is no overlap in their meaning, while correlated attributes are a common issue in real-life scenarios (Hanley et al., 2019b), thus would be an additional challenge for a revealed preference study which aims to elicit the WTP for carbon-neutral labels in the market.

There are some limitations of stated preference methods, such as the CVM and CEs, which face criticism because participants are not required to pay for their choices, making them prone to hypothetical bias. Although CEs more closely resemble actual purchases and may appear more realistic, they are still subject to hypothetical bias, depending on the design of the experiment and the tools used to mitigate this bias. Various techniques, including cheap talk (Cummings and Taylor, 1999), honesty priming (Howard et al., 2017), and oath scripts (de Magistris and Pascucci, 2014), have been proposed to mitigate hypothetical bias. In the oath script, participants are asked to promise to provide honest responses. In the cheap talk script, they are informed that survey participants are likely to overstate their WTP in hypothetical surveys and asked to consider how they would feel about spending their money in a real situation. While Carlsson and Martinsson (2001) and Cameron et al. (2002) failed to reject the equality of MWTP in real and hypothetical settings, List et al. (2006) did not find evidence of hypothetical bias for CE when conducted using cheap talk. Bakhshi et al. (2015) find evidence that using an oath script alone or combined with a cheap talk script reduces the WTP, showing that oath scripts are a promising way to mitigate hypothetical bias in stated preference methods (Atkinson and Mourato, 2015). In this study, both a cheap talk script, an oath script, as well as a budget reminder are provided to the survey participants before they proceed to the choice tasks.

This study focuses on tea consumers in the UK for several reasons. Firstly, it is

common for tea products in the UK to have sustainability labels, including carbon-neutral labels, making tea a relevant product to study transparency in carbon-neutral labeling. Second, food systems significantly contribute to climate change, accounting for a third of global anthropogenic GHG emissions (Crippa et al., 2021). Although a box of tea itself may not be considered CO_2-intensive, its frequent consumption can still result in high emissions over time. Third, the UK ranks as the country with the third-highest per capita tea consumption globally (Statista, 2023).

Respondents are asked to consider 80 teabags in their preferred form, equivalent to approximately 200 grams of tea. The type of tea blend (e.g., black, green, herbal) is not specified as a separate attribute because there is a strong preference for black tea in the UK. That is, 74% of people in the UK consume black tea, although they also drink other varieties such as green tea and herbal infusions at the same time (Tea and Infusions Association, 2022). Similarly, the packaging form (loose leaf or teabags) is not included as a separate attribute because 97.5% of tea sold in the UK is in teabag form (Tea and Herbal Association, 2024).

The survey is pretested on 150 respondents, and the main survey includes 1,200 tea drinkers. At the beginning of the survey, screening questions are asked about age, tea consumption and tea purchasing habits. Participants under the age of 18, or those who never consume or purchase tea, are screened out. The CE focuses on a 200-gram box of tea with the following attributes: carbon-neutral label, organic label, ethical trade label, and price.

Table 1 shows the attributes and attribute levels included in the CE: three sustainability labels taking two levels each, with and without the label, and the price that takes seven levels ranging from £0.90 to £6.90 with £1 increments. Price levels must be realistic, neither too low nor too high. However, it can sometimes be beneficial to include prices that fall outside the normal range (Holmes et al., 2017). The

Table 1: Choice attributes and attribute levels

Attributes	**Attribute levels**
Carbon-neutral label	Carbon-neutral label, no label
Organic label	Organic label, no label
Ethical trade label	Ethical trade label, no label
Price	£0.90, £1.90, £2.90, £3.90, £4.90, £5.90, £6.90

price levels in this survey were determined based on the average tea price in the UK, which is £2.46 for 250 grams of tea (Office for National Statistics, 2024), as well as an online search for 100 tea products conducted on Sainsbury's, Tesco, Morrisons, Ocado, and Amazon UK during 2023.

I use a split-sample approach with three different samples. All samples receive identical survey and choice experiment designs. The only difference is in the type of carbon-neutral label, as shown in Figure 2. The first sample is shown a standard carbon-neutral label, stating "CO_2 neutral." This indicates that the products' GHG emissions have either been offset externally, for example, through reforestation projects, or reduced internally within the last five years, such as through more energy-efficient production, or both reduced and offset. Samples 2 and 3 are shown a "transparent" carbon-neutral label additional text indicating the proportion of CO_2 offsetting and CO_2 reduction. In sample 2, the carbon-neutral label indicates a 95% CO_2 offset and a 5% CO_2 reduction, while in Sample 3 the carbon-neutral label indicates a 50% CO_2 offset and a 50% CO_2 reduction. Participants are informed that emissions refer to all GHG emissions measured as carbon equivalents. Depending on their sample, respondents are informed that respective CO_2 offsetting and CO_2 reduction actions, or a combination of both, ensure that the tea product's lifecycle is carbon-neutral.

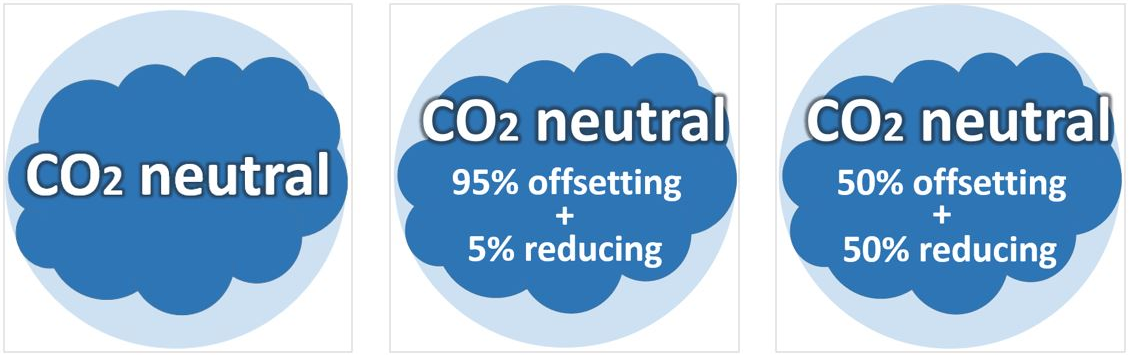

Figure 1: Carbon neutral labels shown to sample 1, 2, and 3

Next, there are two attributes for sustainability labels besides the carbon-neutral label. The organic label indicates products with only organic ingredients and no synthetic pesticides, while the ethical trade label ensures responsible labor practices and guarantees higher prices for exporters based on internationally recognized standards. Participants are informed about the nature of these labels, including the carbon-neutral label before the choice tasks. All three labels are developed by the author and are hypothetical.

Ngene software is used for generating the CE design, consisting of 16 choice tasks, with various combinations of attributes and levels. Figure 2 shows an example choice card shown to sample 1. There are two blocks, which means that each participant sees 8 choice tasks. There are two tea product alternatives and "none of the two" alternative. Restrictions are included to make choice cards more realistic. Alternatives with more labels had to be priced higher than alternatives with fewer labels. In addition to that, for the design of the main survey, additional restrictions are added for the lowest price level (0.9 pounds) and the highest price level (6.9 pounds) tea alternatives. If the price is 0.9 pounds, it should not have any labels; similarly, if it is 6.9 pounds, it must have all labels.

The estimated means from the pre-test were used to create the final CE design with the MNL model. Likely due to the complexity of the model with three dummy variables and restrictions, Ngene cannot find a design where parameter distributions are used as priors. Only means, not distributions, are used as priors. Please refer to Appendix A.1 for the full survey instrument that Sample 1, block 1 receives; and Appendix A.2, Tables A.2 - A.4 for Ngene syntax and the respective choice designs used for the pre-test and the main survey.

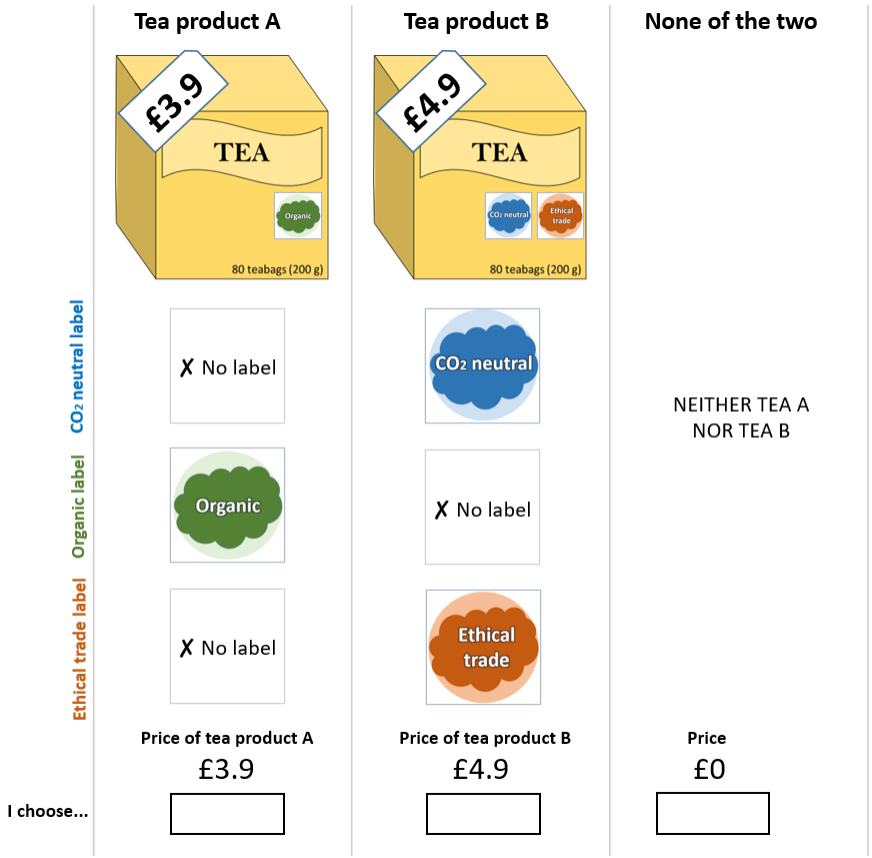

Figure 2: Illustrative choice card for sub-sample 1

To minimize bias, aside from the screening questions, no further questions precede the choice tasks. Instead, the CE is followed by a series of questions. The initial question asks about participants' certainty in their choices. This is assessed on a

scale from one to ten. The objective of this question is to correct the model by accounting for the level of (un)certainty. The next question, designed to detect protest responses, is presented exclusively to participants who consistently select the "none of the two" option in all 8 choice tasks. Reasons such as perceiving the products as overly expensive or preferring to spend money on other environmental responsibility projects will not fall under protest responses. Conversely, participants who express concerns over misleading labels, reject the notion of assigning monetary value to nature, health, or ethical trade practices, or criticize the sufficiency of the information provided about the labels, as well as object to the way the question is asked identified as protest responses.

The next set of questions consists of ANA (attribute non-attendance) questions. There is an open-ended question asking how participants made their choices and which tea characteristics they did not consider when making their choices. For those who stated that they considered all tea characteristics, there is another open-dended question asking their main reason for not considering this tea characteristic/these tea characteristics.

The next four questions comprise an open-ended CVM question, as well as a set of questions for manipulation checks and to gauge participants' attentiveness. The open-ended CVM question that asks the maximum amount that the participants would be willing to pay for a carbon-neutral label. The purpose of this question is to check whether participants' WTP based on the open-ended question aligns with those from the CE as a robustness check. Following this, they are asked to select the correct definition of CO_2 offsetting from response options that include "compensating emissions by investing in activities outside of the company, such as tree planting projects.", "reducing emissions within the company, such as through investments in cleaner production processes.", and an "I do not remember" option. The objective of

this question is to assess whether participants can differentiate between CO_2 reductions and CO_2 offsets, which is the main manipulation. Next, as an attention check, they are asked to indicate the number of different tea product labels shown on the choice cards. Furthermore, the survey asks whether the carbon-neutral label indicated the information on CO_2 offsetting and CO_2 reduction percentages. This question is designed to determine if the manipulation effectively distinguishes between the sample, which is presented with the standard label, and the other two samples, which are presented with transparent labels. Furthermore, it also serves as an attention check.

The next part of the survey involves various statements regarding climate change, climate-friendly products, carbon offsetting, carbon reductions, and carbon-neutral labels, which aim to capture the mechanisms underlying consumers' preferences for carbon-neutral labels. Participants are asked to indicate the extent to which they agree with the statements using a 7-point Likert scale. The first statement is about the level of worry about climate change. The next statements are about the degree to which limited financial resources or lack of time prevent them from purchasing climate-friendly products over conventional ones, exploring the potential reluctance to pay more for carbon-neutral labels due to such constraints. The next two questions focus on emotions, such as warm glow or positive emotions, that may increase when buying climate-friendly products and negative emotions, such as guilt when choosing conventional products over climate-friendly ones. Participants are further asked about the approval of their social environment regarding their choice of climate-friendly products to account for social image effects.

Next, the participants are reminded about the meaning of carbon offsetting, reduction and carbon neutrality. Then, they are again asked to indicate the extent to which they agree with the statements. The first statement is about trust for carbon-neutral labels, which might be an important factor influencing their preferences in case they

do not find the labels credible or consider them a form of greenwashing. Next, the respondents are asked whether they are confused with carbon-neutral labels, which is expected to negatively impact preferences. They are also asked whether they are concerned about CO_2 offsetting, with an expectation that the concern will influence consumer preferences differently depending on the sub-sample they belong to. For instance, in a sub-sample where CO_2 offsetting is 95%, and CO_2 reduction is 5%, concerns about CO_2 offsetting are expected to have a stronger impact on preferences.

Furthermore, the survey respondents are shown three types of carbon-neutral labels, including the two transparent versions, and the standard version simultaneously. They are asked to indicate which label(s), if any, they trust most or find the most confusing to gauge the relative trust in transparent carbon-neutral labels versus standard labels. The next part includes statements about CO_2 offsetting to understand participants' concerns, such as whether CO_2 offsetting effectively reduces emissions, if it allows producers to continue polluting by putting a price tag on emissions, if it creates a misleading sense of relief without promoting significant reductions in emissions, or whether is potentially a form of greenwashing. Then, they are again asked to indicate the extent to which they agree with the statements.

Participants are also asked to consider their real-life grocery shopping experiences and answer three questions. First, they are asked which type of tea they consume the most such as black tea (e.g., Earl grey, English breakfast), green, or herbal; second, they are asked how much they typically pay for tea and which quantity they usually buy. Additionally, they are asked whether the tea they usually purchase has sustainability labels on it and, if so, which ones.

The survey concludes by gathering information about participants' sociodemographic characteristics, except for age, which was asked at the beginning of the survey. This includes education, gender, employment status, income, and membership

in environmental organizations. The last one helps to understand the variation in pro-environmental consciousness among participants.

Additionally, the survey includes a question asking whether the participants think that the survey has a policy effect or effect on tea prices, feedback questions about any confusion regarding the tea choices, unclear instructions, and any other open-ended feedback.

3.2 Empirical Approach

According to the Random Utility Model (RUM) (Lancaster, 1966), consumers derive utility from product attributes. While making choices, they have to make tradeoffs between these attributes. RUM assumes consumers choose the option that provides the maximum expected utility (McFadden, 1973).

Following Lancaster's random utility framework, the marginal utility of an individual is expressed as the summation of her marginal utility of attributes. Since a part of this utility is not observable to the researcher, the utility is modeled with both a deterministic and a random part (Train, 2009). The utility of individual i (from a sample of N individuals), where c is the choice situation (among C choice situations), and j is the alternative j (among J alternatives), can be written as follows:

$$U_{icj} = V_{icj} + \epsilon_{icj} \tag{1}$$

The utility has a deterministic component (V_{icj}), and stochastic component (ϵ_{icj}). The deterministic component of alternative j can be expressed as a linear function of its attributes (X_{icj}) and the other explanatory variables (Z_i):

$$U_{icj} = \beta' X_{icj} + \gamma' Z_i + \epsilon_{icj} \tag{2}$$

Note that while estimating the MWTP for attributes in each sub-sample, I do not include additional explanatory variables (Z_i). These variables are incorporated for the analysis of the underlying mechanisms driving consumer preferences.

The multinomial logit (MNL) model, also known as the conditional logit model (McFadden, 1973), has been proposed for analyzing CE data. However, this model has been criticized for its assumptions that preferences are homogeneous across respondents and that the alternatives presented in the choice sets are independent of each other. To address this issue, the random parameters logit (RPL) model, also referred to as the mixed logit model (Revelt and Train, 1998), which allows for individual heterogeneity, is used. Furthermore, some or all of the parameters can be randomized. If both the price and the attribute parameters are randomized, the MWTP for each attribute level is derived using a simulation (Krinsky and Robb, 1986). If either the price or the attribute parameters are fixed, following (Hensher et al., 2005), the MWTP for each attribute level is derived by dividing the negative of the attribute coefficient by the coefficient of price.

To obtain the MWTP for reducing or offsetting CO_2 emissions by 1 kg, the MWTP for the carbon-neutral label is divided by the average CO_2 emissions of tea, which is obtained from online food/drink carbon calculators. This number is then compared with the social cost of carbon estimates and the participants' guesstimates of damage costs.

I run regressions separately for each sub-sample. I test if there are any significant differences between the three sub-samples (Poe et al., 2005; Swait and Louviere, 1993) to understand how transparency affects consumers' preferences and WTP. Please refer to Appendix B for the calculations of the minimum detectable effect sizes.

Finally, to determine which mechanisms are associated with consumers' preferences for carbon-neutral labels, the following are included as independent variables in

the model and interacted with the carbon-neutral label while controlling for socioeconomic variables:

- *TimeRestriction*: 7-point Likert scale, indicating whether limited time prevents participants from choosing climate-friendly products.
- *FinancialConstraint*: 7-point Likert scale, reflecting whether financial limitations prevent participants from purchasing climate-friendly products.
- *WarmGlow*: 7-point Likert scale, reflecting the positive emotions from buying climate-friendly products.
- *Guilt*: 7-point Likert scale, indicating the guilt felt when choosing conventional products over climate-friendly options.
- *SocialApproval*: 7-point Likert scale, reflecting the perceived social approval of buying climate-friendly products.
- *ProducerPay*: 7-point Likert scale, reflecting the belief that producers, not consumers, are responsible for covering the cost of climate change.
- *LabelTrust*: 7-point Likert scale, reflecting trust in the carbon-neutral labels.
- *LabelConfusion*: 7-point Likert scale, reflecting the extent of confusion regarding carbon-neutral labels.
- *ConcernsOffsetting*: 7-point Likert scale, reflecting the extent of concerns regarding CO_2 offsetting.
- *RelativeTrust*: Binary, indicating whether the participant trusts at least one of the transparent labels but not the standard label.

- *RelativeConfusion*: Binary, indicating whether the participant finds at least one of the transparent labels confusing, but not the standard label.

As an extension, (i) ANA information will be integrated by setting attribute coefficients to zero if participants indicated that they did not consider a particular attribute; (ii) a hybrid choice model (HCM) will be used to understand underlying mechanisms; and (iii) a Latent Class Model (LCM) will be used to test the heterogeneity of consumers' preferences.

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Appendix

A Survey

A.1 Survey instrument

This survey is part of a research project conducted by Eawag, the Swiss Federal Institute of Aquatic Science and Technology, and the University of St. Gallen in Switzerland. The project studies the role of sustainability labels on people's preferences for tea products. By participating in this survey, you are contributing to improving our understanding of this topic. Your participation is voluntary, your responses are anonymous and will be kept confidential. You can opt out anytime without providing a reason, in which case your responses will not be stored. You will receive a payment from the survey company after submitting a completed survey. The survey is expected to take 10 minutes.

While you can return to previous pages in the survey, you will not be able to change your answers. We would like to ask you to read each question carefully. Please refrain from seeking information online or from any other source while answering the survey. There is no right or wrong answer, we are simply interested in knowing your opinion.

Please indicate your consent to participate in this study by selecting the appropriate option.

☐ I consent to participate in this study.

☐ I do not consent to participate in this study.

1 What is your year of birth?

[4 digit number]

2 What is your gender?

- Male.
- Female.
- Non-binary.
- I prefer not to say.

3. What is the highest level of education you have completed?

- Primary school
- Secondary school: High school or equivalent
- Post-secondary vocational training (2 and more years)
- Post-secondary vocational training (up to 1 year)
- Post-secondary academic below-degree level qualification (2 and more years)
- Post-secondary academic below-degree level qualification (up to 1 year)
- Bachelors or equivalent first degree qualification (e.g., BA, BSc, BEng)
- Masters or equivalent higher degree level qualification (e.g., MA, MSc, MBA)
- PhD or equivalent doctoral level qualification (e.g., PhD)
- None of above

4 How frequently do you purchase tea?

- Once a week
- Once every two weeks
- Once a month
- Several times a year
- Once a year
- Never

5 How frequently do you drink tea?

- Daily
- Once a week
- Once every two weeks
- Once a month
- Several times a year
- Never

If you are participating in the survey on a smartphone, please turn it to a **horizontal** orientation for the best display of the upcoming survey section.

Imagine that a box of tea containing **80 teabags** (roughly 200 grams) as shown in this figure is your preferred tea type-be it black, green, or herbal tea-and in your favored packaging type, either teabags or loose leaf. In the following questions, you will be asked to choose between various versions of this tea, differentiated by the presence or absence of carbon-neutral, organic, and ethical trade labels, and price. Note that the tea product and the labels are hypothetical and designed for the purpose of this survey.

This specific **carbon-neutral (CO_2 neutral) label** indicates that the product's greenhouse gas emissions, measured in carbon equivalents, have been:

- **offset** (compensated) by investing in activities **outside of the company** such as tree planting projects; **or**
- **reduced within the company** in the last five years, such as through investments in cleaner production processes; **or**
- both **offset** and **reduced**.

This specific **organic label** indicates that the product contains **only organic ingredients** and no synthetic pesticides.

This specific **ethical trade label** indicates that the product is produced following **responsible labor practices**, which guarantee higher prices for exporters based on internationally recognized standards.

If you are participating in the survey on a smartphone, please turn it to a **vertical orientation** for the best display of the remainder part of survey.

In the next questions, you will be asked to choose between two tea products with certain labels and a given price and 'none of the two' option. Note that the questions are hypothetical, i.e. you are not required to pay for your choices at any point in the survey. All you have to do is to indicate your most preferred option as if you were choosing between such products in a supermarket.

We would like to inform you that people are likely to overstate their willingness to pay for a product in a survey and would not pay the stated amount in real life. Please consider how you would feel spending your money on such products in a real-life situation, and answer accordingly.

Please also consider your budget limitations. Depending on the amount you choose to spend on tea, you will have less money available for other products.

Please check the box if you agree with the statement below.

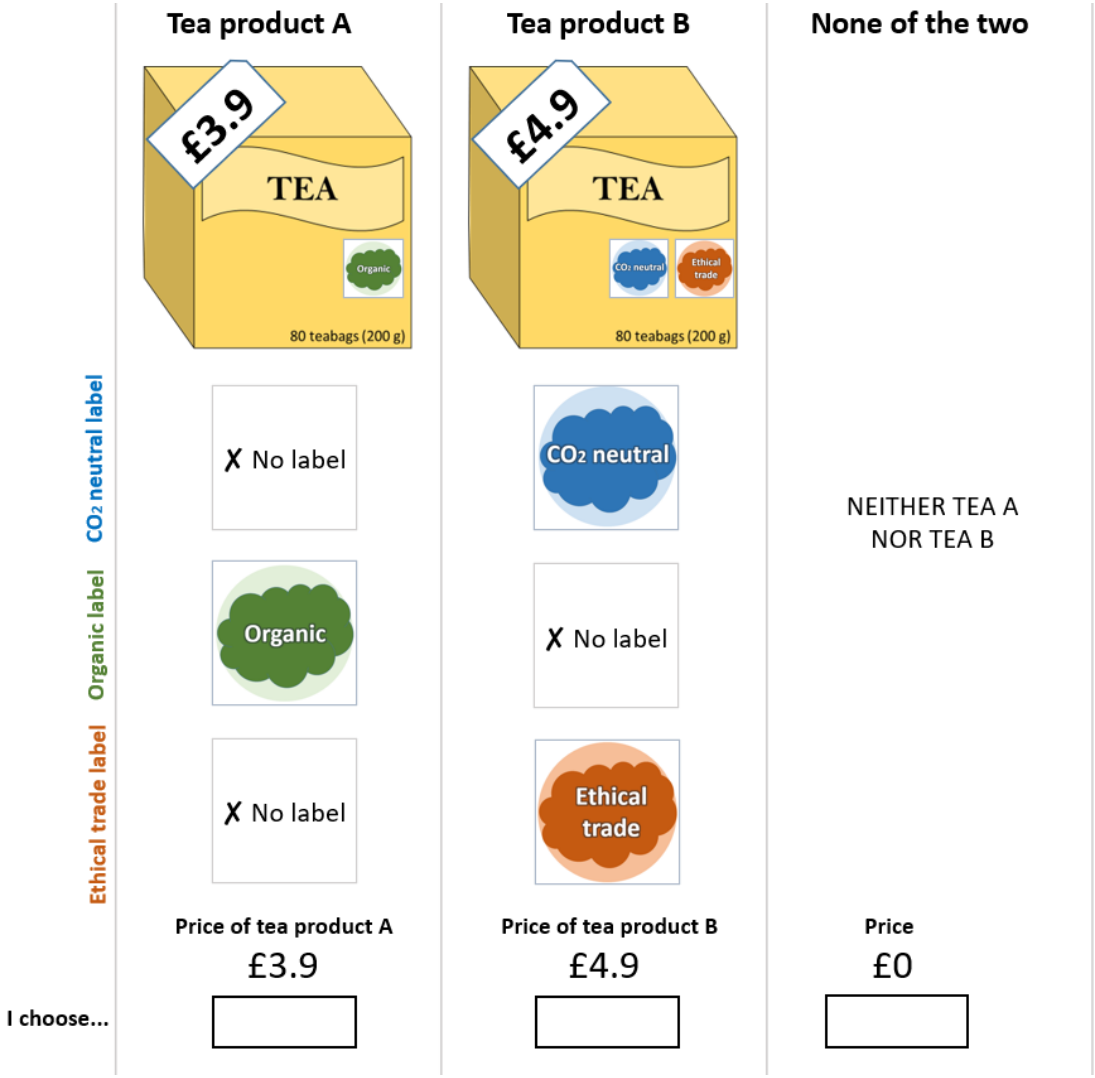
I **understand** the importance of providing truthful answers as if I was making a decision in a real-life setting and promise to provide honest and accurate responses to the questions that follow.

☐

6 Imagine a box containing 80 teabags or 200 grams of loose tea. In the following questions, please indicate which option you prefer the most.

If you are participating in the survey on a smartphone, please keep it in a vertical orientation for the best display.

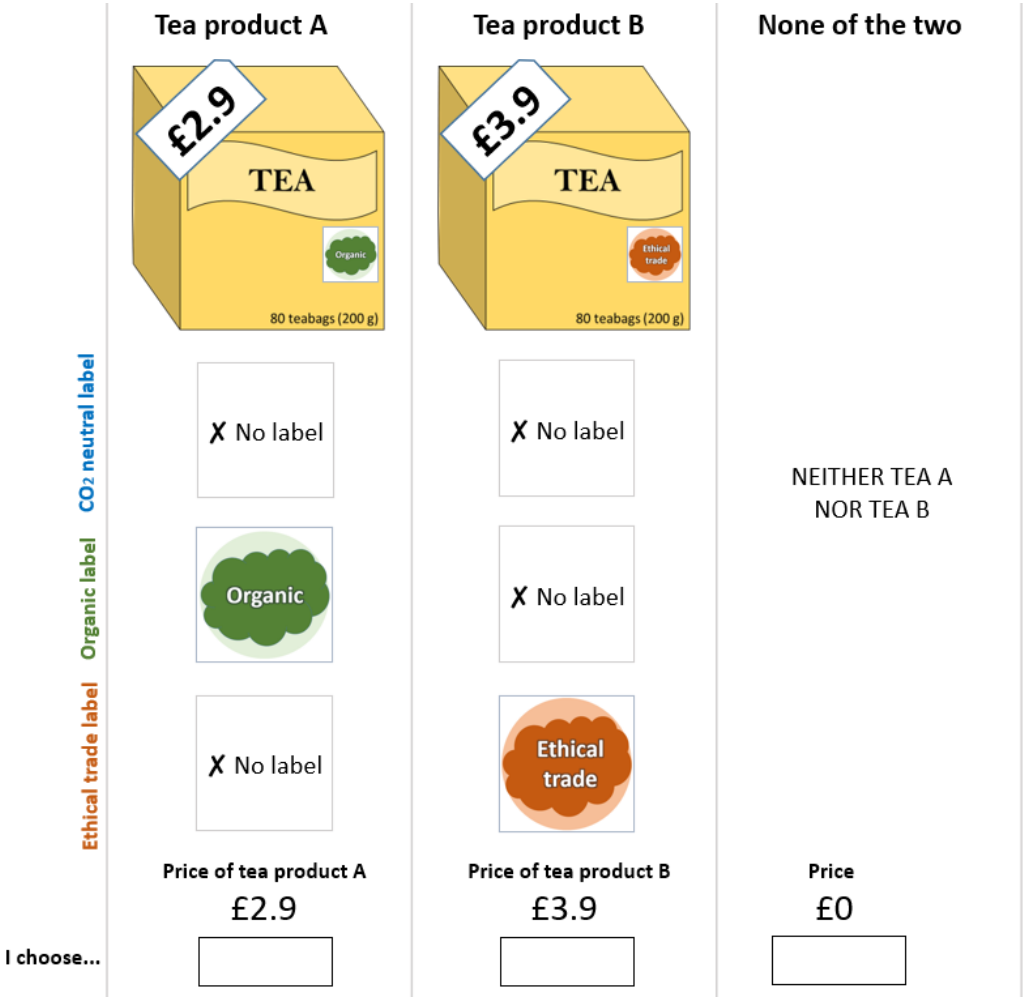
CHOICE CARD 1/8



CHOICE CARD 2/8

	Tea product A	Tea product B	None of the two
			
CO₂ neutral label	✗ No label	CO₂ neutral	NEITHER TEA A NOR TEA B
Organic label	✗ No label	Organic	
Ethical trade label	✗ No label	Ethical trade	
	Price of tea product A £2.9	Price of tea product B £6.9	Price £0
I choose...	☐	☐	☐

CHOICE CARD 3/8



CHOICE CARD 4/8

	Tea product A	Tea product B	None of the two
			
CO_2 neutral label	✗ No label	✗ No label	NEITHER TEA A NOR TEA B
Organic label	✗ No label	Organic	
Ethical trade label	Ethical trade	✗ No label	
	Price of tea product A £4.9	Price of tea product B £4.9	Price £0
I choose...	☐	☐	☐

CHOICE CARD 5/8

	Tea product A	Tea product B	None of the two
			
CO_2 neutral label	✗ No label	CO_2 neutral	NEITHER TEA A NOR TEA B
Organic label	✗ No label	Organic	
Ethical trade label	✗ No label	Ethical trade	
	Price of tea product A	Price of tea product B	Price
	£0.9	£4.9	£0
I choose...			

CHOICE CARD 6/8

	Tea product A	Tea product B	None of the two
			
CO_2 neutral label	CO_2 neutral	✗ No label	NEITHER TEA A NOR TEA B
Organic label	Organic	✗ No label	
Ethical trade label	Ethical trade	✗ No label	
	Price of tea product A: £6.9	Price of tea product B: £0.9	Price: £0
I choose...	☐	☐	☐

CHOICE CARD 7/8

	Tea product A	Tea product B	None of the two
			
CO_2 neutral label	✗ No label	✗ No label	NEITHER TEA A NOR TEA B
Organic label	Organic	✗ No label	
Ethical trade label	Ethical trade	✗ No label	
	Price of tea product A £2.9	Price of tea product B £0.9	Price £0
I choose...	☐	☐	☐

CHOICE CARD 8/8

	Tea product A	Tea product B	None of the two
			
CO_2 neutral label	CO_2 neutral	CO_2 neutral	NEITHER TEA A NOR TEA B
Organic label	Organic	✗ No label	
Ethical trade label	✗ No label	Ethical trade	
	Price of tea product A	Price of tea product B	Price
	£4.9	£2.9	£0
I choose...	☐	☐	☐

7 How certain are you about your choices? Please use the slider below to indicate your level of certainty.

Very uncertain (0) ——slider——(10) Very certain

8. Could you please indicate the main reason why you always chose the "neither tea A nor tea B" option? (This question will only be shown to the participants who always chose the "none of the two" option.)

- The products were too expensive.
- I oppose one or more of the labels.
- Insufficient information was provided about the labels or the products.
- I prefer to spend money on other social and environmental responsibility projects.
- I disagree with the way the choice question was asked.
- Other reason, please specify: ...

9. Can you shortly describe how you made your choices?

... (Open-ended)

10. Which tea characteristics did you **not consider** when making your choices? You can choose one, more than one, or none of the characteristics.

- Carbon neutral label
- Organic label
- Ethical trade label
- Price

- None of above (I considered all tea characteristics).

11. What was your main reason for not considering this tea characteristic/these tea characteristics? (This question will only be shown to those who have not chosen the "None of above" option in the previous question .)

...

12. What is the maximum amount you would be willing to pay for **the carbon-neutral label** (shown on the previous choice cards) **in addition to the cost of the tea product?**

£...

13. Which of the following can be considered **carbon offsetting**?

- **Compensating emissions** by investing in activities outside of the company, such as tree planting projects.
- **Reducing emissions** within the company, such as through investments in cleaner production processes.
- I do not remember.

14. How many different **tea product labels** appear on the choice cards?

- 1 label
- 2 label
- 3 labels
- I do not remember.

15. In this survey, did carbon-neutral label include any percentages (%) of carbon offsetting and carbon reduction?

- Yes.
- No.
- I do not remember.

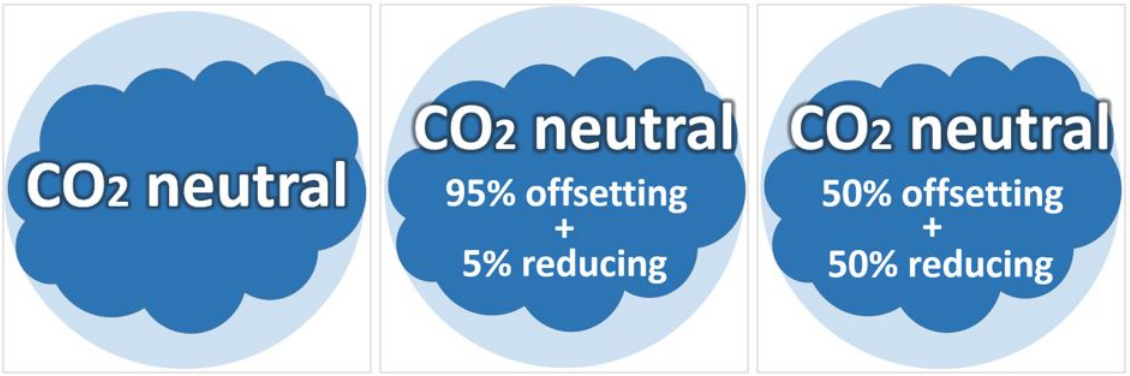
16. Please indicate to which degree you agree or disagree with the following statements.

Statement	Strongly Disagree	Mostly Disagree	Slightly Disagree	Neutral	Slightly Agree	Mostly Agree	Strongly Agree
I worry about climate change.							
Limited financial resources prevent me from buying climate-friendly products instead of the conventional ones.							
Lack of time prevents me from buying climate-friendly products instead of conventional ones.							
My positive emotions increase when I choose climate-friendly products over conventional ones.							
I feel guilty when I buy conventional products instead of climate-friendly ones.							
Most people who are important to me approve of my choice of climate-friendly products over the conventional ones.							
Producers, not consumers, are responsible for covering climate change mitigation costs.							

17. Remember that carbon offsetting involves compensating emissions by investing in projects outside of the company, such as tree planting projects, while carbon reductions occur within the company, such as investments in cleaner production processes. Emission offsetting, reduction, or a combination of both ensures that the entire life-cycle of a product is carbon-neutral.

Please indicate to which degree you agree or disagree with the following statements.

Statement	Strongly Disagree	Mostly Disagree	Slightly Disagree	Neutral	Slightly Agree	Mostly Agree	Strongly Agree
I trust carbon neutral labels.							
I am confused about carbon-neutral labels.							
I am concerned about carbon offsetting.							



Label 1 Label 2 Label 3

Please look at the different types of hypothetical labels shown above carefully, and answer the questions below. You may choose one or more label options, or none.

18. Which label(s) do you trust the most?

- Label 1
- Label 2
- Label 3
- None

19. Which label(s) do you find the most confusing?

- Label 1
- Label 2
- Label 3
- None

20. Please indicate to which degree you agree or disagree with the following statements.

Statement	Strongly Disagree	Mostly Disagree	Slightly Disagree	Neutral	Slightly Agree	Mostly Agree	Strongly Agree
Carbon offsetting effectively reduces carbon emissions.							
Carbon offsetting puts a price tag on emissions, thereby allowing producers to continue polluting.							
Carbon offsetting generates a misleading sense of relief, without encouraging further efforts to reduce emissions.							
Carbon offsetting is a form of greenwashing.							

Please now consider your usual **real-life** grocery shopping.

21. Which type of tea do you consume the most? Please select only one.

- Black tea (e.g., English Breakfast, Early Grey tea)
- Green tea
- Herbal tea
- Other, please specify: ...

22. How much do you typically pay for tea?

- £...
- I do not know.

23. Which tea quantity do you usually buy?

- I usually buy ... **grams** of tea.
- I usually buy ... **teabags**.
- I do not know.

24. Please indicate which sustainability labels the products you buy have.

- Carbon neutral label
- Organic label
- Fair trade label
- No sustainability label
- I do not know
- Other, please specify: ...

Finally, a few questions about yourself.

25. What is your approximate annual household income after taxes?

- Under £10,000
- £10,000 - £19,999
- £20,000 - £29,999
- £30,000 - £39,999
- £40,000 - £49,999
- £50,000 - £59,999

- £60,000 - £69,999
- £70,000 - £79,999
- £80,000 - £89,999
- £90,000 - £99,999
- £100,000 - £129,999
- £130,000 or more

26. What is your current employment status?

- Full or part time employment
- Self-employed
- Unemployed
- Retired
- Looking after family or home
- Full-time student
- None of above

27. Are you a member of any environmental organization?

- Yes
- No

Now, we want to learn about your opinions and experience with this survey.

28. Do you think that your responses in this survey will influence tea product labeling or pricing policies?

- Yes
- No

29. Is there anything about the tea choices that you find confusing or unclear?

- Yes. Please specify what was confusing or unclear: ...
- No.

30.Were the instructions clear to you?

- Yes
- No. Please specify what was unclear: ...

31. Do you have any further comments or feedback about the survey?

... [open-ended]

Thank you for your participation in this survey. Your responses are very valuable to us and contribute to the research project by Eawag, the Swiss Federal Institute of Aquatic Science and Technology, and the University of St.Gallen, Switzerland.

If you have any questions or concerns about the survey please contact Begüm Özdemir Oluk (begum.ozdemiroluk@eawag.ch).

Please click "continue" to submit the survey and receive your payment.

A.2 Choice design

This section includes detailed information on the choice designs created for the pre-test and main survey on Ngene using the MNL model. Tables A.2 and A.3 show the syntax used to create pre-test and main survey designs, while Tables A.3 and A.4 show the details of the attributes and combinations for each choice situation, respectively.

Design
;alts = alt1*, alt2*, sq
;rows = 16
;block = 2
;eff = (mnl, d)
;rdraws=halton(500)
;alg = swap(stop=total(20000 iterations))
;cond:
if(alt1.Price = 6.9, alt1.CarbonNeutral = 1 and alt1.Organic = 1 and alt1.Trade = 1),
if(alt2.Price = 6.9, alt2.CarbonNeutral = 1 and alt2.Organic = 1 and alt2.Trade = 1),
if(alt1.Price = 0.9, alt1.CarbonNeutral = 0 and alt1.Organic = 0 and alt1.Trade = 0),
if(alt2.Price = 0.9, alt2.CarbonNeutral = 0 and alt2.Organic = 0 and alt2.Trade = 0),
if(alt1.CarbonNeutral + alt1.Organic + alt1.Trade > alt2.CarbonNeutral + alt2.Organic + alt2.Trade,
alt1.Price > alt2.Price),
if(alt2.CarbonNeutral + alt2.Organic + alt2.Trade > alt1.CarbonNeutral + alt1.Organic + alt1.Trade,
alt2.Price > alt1.Price)
;model:
U(alt1) = b2.dummy[0.294] * CarbonNeutral[1,0] + b3.dummy[0.375] * Organic[1,0]
+ b4.dummy[0.433] * Trade[1,0] + b5[-0.375]* Price[0.90,1.90,2.90,3.90,4.90,5.90,6.90] /
U(alt2) = b2.dummy * CarbonNeutral + b3.dummy * Organic + b4.dummy * Trade + b5 * Price /
U(sq) = b1[-1.575]$

Table A.1: Ngene syntax used for the main survey

Design
;alts = alt1*, alt2*, sq
;rows = 16
;eff = (mnl, d)
;block = 2
;alg = swap(stop=total(50000 iterations))
;model:
U(alt1) = b2.dummy* CarbonNeutral[0,1] + b3.dummy * Organic[0,1] +
b4.dummy * Trade[0,1] + b5 * Price[0.90,1.90,2.90,3.90,4.90,5.90,6.90] /
U(alt2) = b2 * CarbonNeutral + b3 * Organic + b4 * Trade + b5 * Price /
U(sq) = b1[0]
;cond:
if(alt1.CarbonNeutral + alt1.Organic + alt1.Trade > alt2.CarbonNeutral + alt2.Organic + alt2.Trade,
alt1.Price > alt2.Price),
if(alt2.CarbonNeutral + alt2.Organic + alt2.Trade > alt1.CarbonNeutral + alt1.Organic + alt1.Trade,
alt2.Price > alt1.Price),
if(alt1.CarbonNeutral = alt2.CarbonNeutral and alt1.Organic = alt2.Organic and
alt1.Trade = alt2.Trade, alt1.Price = alt2.Price)$

Table A.2: Ngene syntax used for pre-test

Block	Choice Situation	Price AltA (£)	CN AltA	Org AltA	ET AltA	Price AltB (£)	CN AltB	Org AltB	ET AltB
1	1	3.9	No	Yes	No	4.9	Yes	No	Yes
1	2	2.9	No	No	No	6.9	Yes	Yes	Yes
1	3	2.9	No	Yes	No	3.9	No	No	Yes
1	4	4.9	No	No	Yes	4.9	No	Yes	No
1	5	0.9	No	No	No	4.9	Yes	Yes	Yes
1	6	6.9	Yes	Yes	Yes	0.9	No	No	No
1	7	2.9	Yes	Yes	No	0.9	No	No	No
1	8	4.9	Yes	Yes	No	2.9	Yes	No	Yes
2	1	1.9	Yes	No	No	5.9	No	Yes	Yes
2	2	1.9	No	Yes	Yes	4.9	Yes	No	Yes
2	3	0.9	No	No	No	1.9	Yes	Yes	Yes
2	4	1.9	No	Yes	No	1.9	No	No	Yes
2	5	6.9	Yes	Yes	Yes	3.9	No	No	Yes
2	6	5.9	Yes	Yes	No	1.9	No	Yes	Yes
2	7	3.9	Yes	No	No	2.9	No	No	No
2	8	5.9	No	Yes	No	5.9	Yes	No	No

AltA refers to tea alternative A (on the left of the choice card), and AltB refers to tea alternative B (on the right of the choice card).
D error = 0.287, A error = 0.447, B estimate = 73.188, S estimate = 29.530.

Table A.3: Main survey choice design

Block	Choice Situation	Price AltA (£)	CN AltA	Org AltA	ET AltA	Price AltB (£)	CN AltB	Org AltB	ET AltB
1	1	4.9	No	Yes	Yes	1.9	Yes	No	Yes
1	2	1.9	Yes	No	Yes	6.9	No	Yes	Yes
1	3	2.9	No	Yes	No	0.9	No	No	No
1	4	6.9	No	Yes	Yes	3.9	No	No	No
1	5	0.9	No	No	Yes	4.9	Yes	No	No
1	6	0.9	Yes	Yes	No	3.9	No	Yes	Yes
1	7	5.9	No	No	No	6.9	Yes	No	Yes
1	8	4.9	Yes	No	Yes	0.9	No	Yes	No
2	1	2.9	Yes	Yes	Yes	1.9	No	No	Yes
2	2	5.9	Yes	Yes	No	2.9	No	No	Yes
2	3	3.9	No	No	No	6.9	No	No	Yes
2	4	1.9	No	Yes	Yes	6.9	Yes	Yes	No
2	5	2.9	No	No	Yes	5.9	Yes	No	No
2	6	6.9	Yes	No	Yes	3.9	No	Yes	No
2	7	3.9	No	Yes	Yes	0.9	Yes	No	No
2	8	0.9	No	No	No	2.9	Yes	Yes	No

AltA refers to tea alternative A (on the left of the choice card), and AltB refers to tea alternative B (on the right of the choice card).
D error = 0.250, A error = 0.410, B estimate = 100, S estimate = 0.

Table A.4: Pre-test choice design

B Power Analysis

In this section, I discuss the ex-ante power calculations for my main analysis to understand the consumers' WTP differences between samples. This analysis involves three bilateral comparisons, each with subsamples of 400 participants. The objective of the power calculation is to determine the minimum detectable effect size (MDEs) for WTP differences between subsamples, using the formula from Djimeu and Houndolo (2016) and the power calculation sheet from International Initiative for Impact Evaluation (3ie) (2016):

$$\text{MDEs} = \frac{(t_1 + t_2) \times \text{sd}(y)}{\sqrt{p \times (1-p) \times n}}$$

where sd(y) is the pooled total standard deviation of the estimated effect on the outcome variable, p is the proportion of the study that is randomly assigned to the treatment group, n is the sample size, t1 is the t-value corresponding to the significance level (0.05) of the test, t2 is the t-value corresponding to the power of the design (0.80), and MDEs is the minimum detectable effect size. I assume sd(y) follows a truncated normal distribution, and the mean and standard deviation of the distribution are based on both the literature (Bek, 2022; Carattini et al., 2024) and the expectations regarding the differences between the subsamples.

I find that the MDEs is 0.18 pounds for the difference between sample 3 and samples 1 and 2, which corresponds to 18% of the standard deviation. Furthermore, the MDEs for the difference between samples 1 and 2 is 0.36 pounds, which also corresponds to 18% of the standard deviation.