Transparency of Carbon-Neutral Labels: Evidence from a Choice Experiment*

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Abstract

This paper examines the impact of transparency in carbon-neutral labeling on consumer preferences and willingness to pay. The proliferation of climate labels with overlapping characteristics may cause consumer confusion and favor labels with lower environmental quality. This study empirically investigates whether providing information on the percentage of CO_2 offsetting and CO_2 reduction influences preferences. Through a discrete choice experiment survey among UK tea consumers, I compare willingness to pay for standard and transparent carbon-neutral labels. Findings indicate that UK consumers are willing to pay more than the social cost of carbon estimates. I find no significant difference in willingness to pay between transparent and standard labels, although transparent labels with higher CO_2 offsetting shares tend to have a higher willingness to pay on average. Furthermore, relative confusion about transparent labels and limited financial resources may play an important role in consumer preferences.

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

JEL codes C83, C90, D12, D80, D91, Q51, Q54

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 CO_2 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 control group 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 first and second treatment groups 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 (SSC) estimates?

Next, an interesting question in economics concerns why people adopt pro-environmental behavior. 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 how their preferences for organic and ethical trade labels differ from their preferences for carbon-neutral labels?

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 'CO_2 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 CO_2 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 CO_2 reduction, transparency can increase or decrease demand

due to the ethical and practical concerns about CO_2 offsetting (Carattini and Tavoni, 2016). Similarly, providing more information on the label could either clarify or confuse consumers, potentially affecting demand positively or negatively. This study aims to specifically explore these channels, among others.

The findings suggest that consumers value carbon neutrality and are willing to pay a premium for carbon-neutral labels on tea. The average WTP of £0.46 (for reducing and/or offsetting 1 kilogram of CO_2 emissions) is approximately six times higher than the UK's SCC and many other SCC estimates. However, no statistically significant difference was found between WTP for transparent versus standard carbon-neutral labels, although the WTP for the transparent label with a higher CO_2 offsetting share tends to be higher on average.

The general confusion about carbon-neutral labels does not appear to be linked to consumer preferences, whereas relative confusion–when transparent and standard versions are compared–is negatively associated with preferences[2]. Additionally, when the label transparently indicates an equal share of CO_2 offsetting and reduction, limited financial resources are linked to a lower preference for carbon-neutral labels, while climate worry is associated with a stronger preference.

These findings have three key implications for policymakers and companies aiming to nudge consumers. First, if both standard and transparent carbon-neutral labels are present on the market, consumer confusion may lead people to choose the label they find less confusing, even if they trust another label more. This suggests that the way information is communicated matters. Similarly, the proportion of CO_2 offsetting versus CO_2 reduction activities may potentially influence consumer choices (e.g., through biases like large number bias or order bias), particularly if consumers

[2]Notably, this question, like others related to mechanisms, was posed after participants had completed the choice experiment and had only seen one version of the label during their choice-making.

are not fully aware of the differences between these activities or lack pre-existing concerns.

Second, as climate policies become stricter, carbon-neutral labels, as a voluntary market-based mechanism, have the potential to accelerate climate change mitigation, given that consumer willingness to pay exceeds SSC estimates. However, it is important to keep in mind that consumers are willing to pay more for organic and ethical trade labels than for carbon-neutral labels. In survey settings, labels are inherently salient, so it is important to consider how much attention consumers pay to different labels in a real setting. I have not yet checked whether these labels compete or complement, but if they compete, consumers may prefer to allocate their spending to these other aspects of sustainability if they do not trust or find carbon-neutral labels confusing.

Third, the strategy of raising climate change awareness may be effective only if producers provide transparent labels that indicate higher environmental quality, as climate worry is positively associated with consumer preferences only when the label shows an equal share of CO_2 offsetting and reduction. Moreover, as consumers perceive limited financial resources as a barrier to purchasing climate-friendly options, developing cost-effective strategies for CO_2 reductions could play a crucial role in overcoming this challenge.

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 CO_2 offset-

ting 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 CO_2 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 CE design (3.1) and the empirical approach (3.3). Section 4 presents the results, which starts with the preferences and WTP estimation (4.1), followed by the underlying mechanisms of consumers' preferences (4.2), and then the robustness tests (4.3). Finally, Section 4.4 includes the discussion and the conclusion.

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 SSC. This offers insights into the economics literature by understanding consumer preferences in the private provision of a public good setting.

This study finds that UK consumers are willing to pay more than the social cost of carbon estimates, consistent with findings in the existing literature. Previous studies generally indicate a large positive willingness to pay for carbon-neutral labels (Vecchio, 2013; Sporleder et al., 2014; Breustedt, 2014; Drichoutis et al., 2016; Birkenberg et al., 2021b), a finding also supported by a meta-analysis of the literature valuing climate labels (Carattini et al., 2024). However, the hedonic pricing approach used in the same study does not align with these findings, which may be due not only to possible differences between revealed and stated preferences but also to recent growing concerns about CO_2 offsets and the challenge consumers face in assessing the environmental quality of these labels, given their nature as credence goods.

A credence good 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. Similarly, 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. This is why understanding consumers' preferences and WTP and the mechanisms behind them remains important.

Given the link between carbon neutrality and CO_2 offsetting, the economics of CO_2 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. At the same time, 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 CO_2 offsetting does not result in equivalent

CO_2 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) [3].

While these concerns grow, Swiss Airlines started to offer CO_2 offsetting, or a combination of CO_2 offsetting and CO_2 reduction after flight purchases (Swiss International Air Lines, 2024). Except for this example, carbon-neutral labels in the product markets do not clearly indicate the proportion of CO_2 offsetting and CO_2 reduction on the label, to my knowledge. 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, and based on the report by Changing Markets Foundation (2023), even the most carbon-intensive food products, such as beef, are labeled as carbon-neutral.

With these points discussed, it remains an empirical question of 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 the producer-pays principle, social image concerns, 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.

[3] 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.

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 pre-registered online survey[4] is pretested on 157 respondents, and the main survey includes 1,337 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: 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

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

[4]Ozdemir Oluk, Begum. 2024. "Consumer Preferences for Transparent Carbon-Neutral Labels: A Choice Experiment." AEA RCT Registry. August 02. https://doi.org/10.1257/rct.12520-2.0

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 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 control group is shown a standard carbon-neutral label, stating "CO_2 neutral." This indicates the emissions 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. Treatment group 2 and group 3 are shown a "transparent" carbon-neutral label with additional text indicating the proportion of CO_2 offsetting and CO_2 reduction. In treatment group 1, the carbon-neutral label indicates a 95% CO_2 offset and a 5% CO_2 reduction, while in treatment group 2 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.

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-

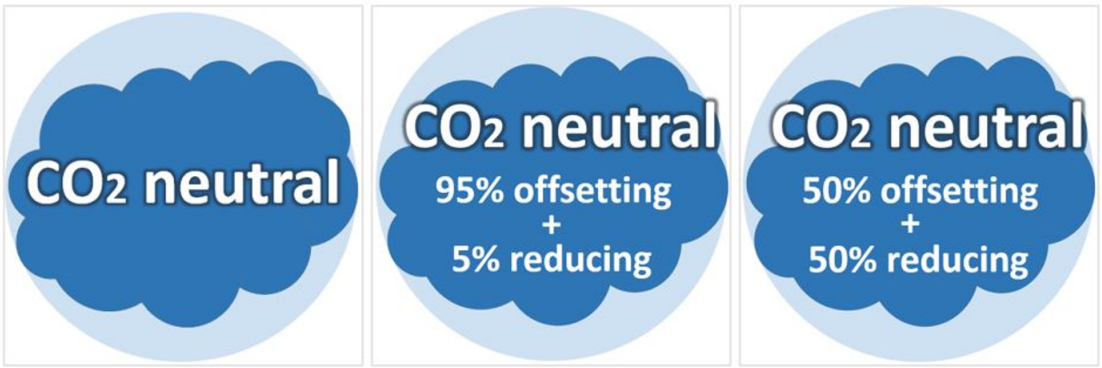

Figure 1: Carbon neutral labels shown to control and treatment groups

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 products and "none of the two" alternatives. 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.12 - A.15 for Ngene syntax and the respective choice designs used for the main survey, and the pre-test.

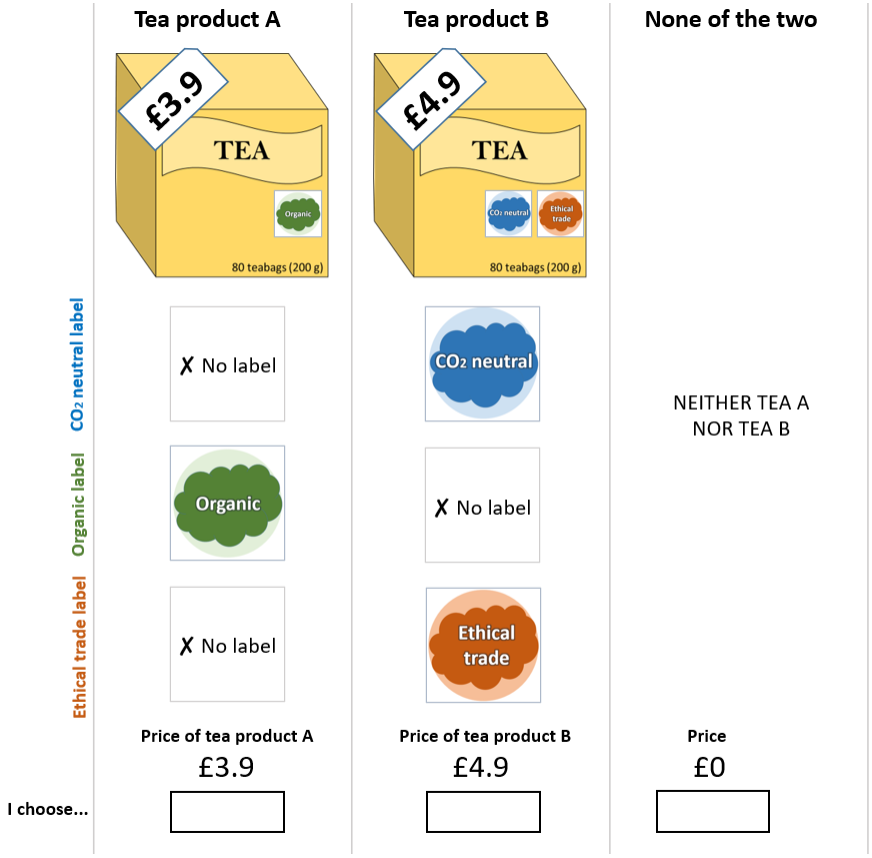

Figure 2: Illustrative choice card for sub-sample 1

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.

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-ended 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.

The next part of the survey involves various statements regarding climate change, climate-friendly products, CO_2 offsetting, CO_2 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.

Next, the participants are reminded about the meaning of CO_2 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 in carbon-neutral labels, the next statement is about their confusion, and the third statement is about their concerns about bout CO_2 offsetting. 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 following section 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 grocery products 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 Data

The online survey data were collected in September 2024 in collaboration with a survey company. Individuals who indicated that they neither purchased nor drank tea,

constituting 14% of the initial group, were disqualified from continuing the survey[5]. Consequently, a total of 1,337 individuals successfully completed the main survey[6].

The sample has an average age of 57 years. Of the sample, 50% are female, 49% have a yearly household income greater than £40,000, 37% holds a Bachelor's degree or higher, and 64% are employed. A summary of all detailed socioeconomic characteristics of tea consumers/drinkers, including age, gender, education, income, and employment, is provided in the Appendix in Tables A.1 and A.4 in Appendix A.1[7].

Among the tea consumers/drinkers, almost 77% of people drink tea daily, and more than 61% purchase tea at least once a month or more frequently. The tea consumption and purchase habits of the sample are provided in more detail in Table A.5 in Appendix A.1. More than 72% of the people indicated that they consume black tea, while the remainder indicated they consume green tea, herbal tea, and other tea blends.

The survey data indicates that tea consumers are generally familiar with sustainability labels on grocery products. Specifically, 13% of participants indicated that the grocery products they usually purchase have a carbon-neutral label on them, 24% indicated an organic label, and 36% indicated a fair trade label (similar to the

[5]Please refer to Tables A.3 and A.2 in Appendix A.1 for the comparison between tea drinkers/purchasers and non-tea drinkers/purchasers in terms of the three covariates (age, gender, and education) used as quota criteria to recruit a representative sample of the UK population before the tea purchase and drink screening questions.

[6]For the pre-test, 157 participants were recruited. The pre-test data is not included in the main survey data.

[7]The following quotas were set before the data collection:

- Age: 18-34 years (30%), 35-54 years (36%), 55+ years (34%)
- Gender: Men and women (50% each). Non-binary and "I prefer not to say" are not subject to quotas.
- Education: Less than post-secondary academic qualification below a degree level (2 years or more) (52%) and above (48%)

ethical trade label used in this survey). Additionally, 30% mentioned that the grocery products they purchase have other types of labels on them, while only 19% indicated that they have no label at all, and 2% expressed no knowledge about the label, which are shown in Table A.5 in Appendix A.1 in more detail.

Participants completed the survey using a desktop (41%), smartphone (56%), or tablet (3%). The survey layout was checked for compatibility across all three devices before the launch, and the devices appear similarly distributed across subsamples (Appendix A.1, Table A.6). Most respondents found the survey and instructions clear, with 99% indicating that the instructions were clear and 93% reporting no confusion with the survey. Detailed information can be found in Appendix A.1, Table A.6.

The following section discusses the empirical approach used to analyze the choice data, aiming to derive WTP estimates for standard and transparent carbon-neutral labels and investigate the mechanisms driving consumer preferences.

3.3 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 mixed logit model (MXL), also referred to as the random parameters logit (RPL) 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. The standard errors are then derived using the delta method.

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 SSC. Any significant differences between the three sub-samples are tested (Poe et al., 2005) to understand how transparency affects consumers' preferences and WTP. Please refer to Appendix C 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 (age, a binary variable for high income, and a binary variable for female). Note that the variables measured on 7-point Likert scales are normalized by dividing the scale value by 7, assuming the same distance between scales.

- Trust: Measured on a 7-point Likert scale, measuring trust in the carbon-neutral labels, normalized by dividing the scale value by 7.

- Confusion: Measured on a 7-point Likert scale, measuring the extent of confusion regarding carbon-neutral labels, normalized by dividing the scale value by 7.

- Concern: Measured on a 7-point Likert scale, measuring the extent of concerns regarding CO_2 offsetting, normalized by dividing the scale value by 7.

- Only trust in transparent labels: Binary variable indicating whether the participant trusts at least one of the transparent carbon neutral labels but not the standard carbon neutral label. This variable is constructed based on participants' responses to a question where all three versions of the carbon-neutral

labels are presented.

- Only confused with transparent labels: Binary variable indicating whether the participant finds at least one of the transparent carbon-neutral labels confusing but not the standard carbon-neutral label. This variable is constructed based on participants' responses to a question where all three versions of the carbon-neutral labels are presented.

- Warm glow: Measured on a 7-point Likert scale, measuring the positive emotions from buying climate-friendly products, normalized by dividing the scale value by 7.

- Guilt: Measured on a 7-point Likert scale, indicating the guilt felt when choosing conventional products over climate-friendly options, normalized by dividing the scale value by 7.

- Social approval: Measured on a 7-point Likert scale, reflecting the perceived social approval of buying climate-friendly products, normalized by dividing the scale value by 7.

- Producer pays: Measured on a 7-point Likert scale, reflecting the belief that producers, not consumers, are responsible for covering the cost of climate change, normalized by dividing the scale value by 7.

- Time restriction: Measured on a 7-point Likert scale, indicating whether limited time prevents participants from choosing climate-friendly products, normalized by dividing the scale value by 7.

- Financial constraint: Measured on a 7-point Likert scale, indicating whether financial limitations prevent participants from purchasing climate-friendly prod-

ucts, normalized by dividing the scale value by 7.

To account for multiple hypothesis testing, p-values are adjusted using the Bonferroni method based on the number of variables in each regression. Standard errors of the choice model coefficients remain unadjusted and are used to derive MWTP standard errors, while p-values for MWTP estimates are adjusted for the three tests (carbon neutral, organic, and ethical trade). Poe tests for subsample differences are similarly adjusted for three comparisons.

4 Results

4.1 Preferences and WTP

This section presents estimations from the MNL and MXL models to understand the effect of each attribute on utility, how likely each attribute is to be chosen over others, and derive the MWTP for each non-cost attribute (carbon-neutral label, organic label, and ethical trade).

Table 2 shows the output of MNL I, and Tables 3 and 4 present results for MXL I and MXL II. All tables report findings for the full sample, as well as for control and treatment groups separately. Estimations were conducted in preference space (PS), meaning the coefficients measure the marginal utility each attribute provides to the consumer.

In the MXL I model in Table 3, the carbon-neutral, organic, and ethical trade attributes are randomized, while the price attribute is fixed. In MXL II (Table 4), all variables, including price, are randomized except for the status quo alternative. The MXL models assume randomized variables follow a normal distribution [8]

[8]The initial means and standard deviations for the MXL models were derived from the MNL I

The MXL models account for unobserved individual heterogeneity by allowing coefficients to vary across individuals. The MXL II model includes a random price coefficient with significant standard deviations for all random parameters, including price, but randomizing all attributes increases model complexity. Across the three models, the likelihood does not improve, making MXL I my preferred model due to its balance between capturing preference heterogeneity and maintaining simplicity.

The findings indicate that the carbon-neutral label attribute is positive and significant, though to a lesser extent compared to the organic and ethical trade labels, which have stronger effects on consumer utility across all models. The negative coefficient for price confirms the expected decrease in utility with higher tea product prices.

MWTP estimates were derived by dividing the negative of the attribute coefficient by the price coefficient for Models MNL I and MXL I, as shown in Tables 5 and 6, respectively. The standard errors for MNL I and MXL I were calculated using the Delta method, while for MXL II, the Krinsky-Robb procedure was used, as shown in Table 7.

The MWTP for the carbon-neutral label ranges between £0.25 and £0.57 and is statistically significant. Findings from MXL I (Table 6) show consumers are willing to pay premiums of approximately £0.57 for the carbon-neutral label, £1.02 for the organic label, and £1.12 for the ethical trade label, which correspond to roughly 14.6%, 26.1%, and 28.7% of the product's price, given the average price level of £3.90 used in the experiment.

The results show that the MWTP for organic and ethical trade labels is roughly

output in Table 2, using the coefficients as means and calculating the standard deviations as the square root of the sample size multiplied by the estimated standard errors. In the model in Table 3, the price attribute was treated as fixed, so only its initial mean was used. These distributions, derived from the MNL output of the full sample, were consistently applied across all subsample estimations.

1.7-1.9 times larger than that of carbon-neutral labels, consistent with existing literature. Birkenberg et al. (2021a) and Bek (2022) found that fair trade labels have a higher WTP than carbon-neutral labels (WTP ranging between 1.77 and 2.83 euros) in the coffee market, with fair trade WTP values up to 2.4 times larger. However, both studies had small sample sizes (N=80 and N=299, respectively) and were conducted in Germany.

Most importantly, MWTP for the carbon-neutral label translates to an MWTP of £0.46 for reducing or offsetting 1 kg of CO_2, assuming the average CO_2 content of 200 grams of tea is 1.28 kg, based on the 'Plate up for the Planet' carbon calculator. This MWTP is 6.6 times higher than the SSC estimated by the UK government. The WTP for the carbon-neutral label in this study also falls between estimates from the meta-analysis of the existing literature and the hedonic DiD approach using Amazon UK, US, and Germany data in Carattini et al. (2024).

Furthermore, while consumers show higher WTP for transparent labels with more CO_2 offsetting compared to standard labels and transparent labels with equal shares of offsetting and reductions, Poe test results reveal no statistically significant differences between control and treatment groups. This indicates that increased transparency did not significantly affect consumer valuations. The next section discusses the underlying mechanisms behind consumer preferences.

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-2.005***	-2.105***	-1.989***	-1.926***
	(0.082)	(0.145)	(0.140)	(0.139)
Carbon-neutral	0.187***	0.171***	0.217***	0.175***
	(0.035)	(0.061)	(0.061)	(0.062)
Organic	0.616***	0.606***	0.637***	0.605***
	(0.034)	(0.059)	(0.059)	(0.059)
Ethical trade	0.620***	0.646***	0.614***	0.602***
	(0.034)	(0.058)	(0.059)	(0.057)
Price	-0.463***	-0.477***	-0.456***	-0.456***
	(0.016)	(0.028)	(0.027)	(0.028)
Observations	10696	3568	3576	3552
Participants	1337	446	447	444
Log-likelihood	-10229.25	-3361.62	-3440.22	-3423.39

Robust standard errors are in parentheses.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$

Table 2: MNL I (PS estimation)

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-3.028***	-3.308***	-2.972***	-2.825***
	(0.104)	(0.181)	(0.175)	(0.185)
Carbon-neutral (random)	0.377***	0.440***	0.432***	0.269***
	(0.043)	(0.074)	(0.074)	(0.074)
Organic (random)	0.673***	0.634***	0.694***	0.683***
	(0.054)	(0.096)	(0.093)	(0.094)
Ethical trade (random)	0.741***	0.745***	0.715***	0.756***
	(0.054)	(0.095)	(0.094)	(0.091)
Price	-0.662***	-0.680***	-0.649***	-0.659***
	(0.026)	(0.046)	(0.044)	(0.047)
Standard deviations				
$\sigma_{CarbonNeutral}$	1.093***	1.188***	1.047***	1.061***
	(0.049)	(0.093)	(0.083)	(0.082)
$\sigma_{Organic}$	1.435***	1.421***	1.404***	1.463***
	(0.062)	(0.113)	(0.099)	(0.113)
$\sigma_{EthicalTrade}$	1.414***	1.505***	1.344***	1.412***
	(0.061)	(0.110)	(0.105)	(0.105)
Observations	10696	3568	3576	3552
Participants	1337	446	447	444
Log-likelihood	-10229.25	-3361.62	-3440.22	-3423.39

Robust standard errors are in parentheses.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

Table 3: MXL I (PS estimation)

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-3.028***	-3.308***	-2.972***	-2.825***
	(0.104)	(0.181)	(0.175)	(0.185)
Carbon-neutral (random)	0.377***	0.440***	0.432***	0.269***
	(0.043)	(0.074)	(0.074)	(0.074)
Organic (random)	0.673***	0.634***	0.694***	0.683***
	(0.054)	(0.096)	(0.093)	(0.094)
Ethical trade (random)	0.741***	0.745***	0.715***	0.756***
	(0.054)	(0.095)	(0.094)	(0.091)
Price (random)	-0.662***	-0.680***	-0.649***	-0.659***
	(0.026)	(0.046)	(0.044)	(0.047)
Standard deviations				
$\sigma_{CarbonNeutral}$	1.093***	1.188***	1.047***	1.061***
	(0.049)	(0.093)	(0.083)	(0.082)
$\sigma_{Organic}$	1.435***	1.421***	1.404***	1.463***
	(0.062)	(0.113)	(0.099)	(0.113)
$\sigma_{EthicalTrade}$	1.414***	1.505***	1.344***	1.412***
	(0.061)	(0.110)	(0.105)	(0.105)
σ_{Price}	0.734***	0.773***	0.680***	0.735***
	(0.022)	(0.039)	(0.050)	(0.038)
Observations	10696	3568	3576	3552
Participants	1337	446	447	444
Log-likelihood	-10229.25	-3361.62	-3440.22	-3423.39

Robust standard errors are in parentheses.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

Table 4: MXL (PS estimation)

	Full Sample	 **Control**	 **Treatment 1**	 **Treatment 2**
$\text{MWTP}_{\text{Carbon neutral}}$	0.405***	0.359**	0.476***	0.383**
	(0.074)	(0.125)	(0.130)	(0.132)
$\text{MWTP}_{\text{Organic}}$	1.331***	1.272***	1.397***	1.327***
	(0.067)	(0.111)	(0.116)	(0.120)
$\text{MWTP}_{\text{Ethical trade}}$	1.341***	1.356***	1.346***	1.320***
	(0.071)	(0.119)	(0.126)	(0.123)

(i) MWTP is estimated by dividing the negative of the attribute coefficients by the price coefficient.
(ii) Robust standard errors in brackets are obtained using the Delta method.
(iii) Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$
(iv) Poe test results (adjusted for three comparisons) indicate that the bilateral differences between the control and treatment groups are not statistically significant: control vs. treatment 1: Poe statistic = 0.758 (n.s.); control vs. treatment 2: Poe statistic = 0.527 (n.s.); treatment 1 vs. treatment 2: Poe statistic = 0.337 (n.s.).

Table 5: MWTP estimates (MNL I, PS estimation)

	Full Sample	 **Control**	 **Treatment 1**	 **Treatment 2**
$\text{MWTP}_{\text{Carbon neutral}}$	0.569***	0.648***	0.666***	0.408***
	(0.065)	(0.112)	(0.117)	(0.111)
$\text{MWTP}_{\text{Organic}}$	1.017***	0.932***	1.069***	1.037***
	(0.071)	(0.123)	(0.125)	(0.126)
$\text{MWTP}_{\text{Ethical trade}}$	1.120***	1.095***	1.103***	1.148***
	(0.072)	(0.125)	(0.129)	(0.123)

(i) MWTP is estimated by dividing the negative of the attribute coefficients by the price coefficient.
(ii) Robust standard errors in brackets are obtained using the Delta method.
(iii) Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.
(iv) Poe test results (adjusted for three comparisons) indicate that the bilateral differences between the control and treatment groups are not statistically significant: control vs. treatment 1: Poe statistic = 0.543 (n.s.); control vs. treatment 2: Poe statistic = 0.067 (n.s.); treatment 1 vs. treatment 2: Poe statistic = 0.06 (n.s.).

Table 6: WTP estimates (MXL I, PS estimation)

	Full Sample	 Control	 Treatment 1	 Treatment 2
$\text{MWTP}_{\text{Carbon neutral}}$	0.253***	0.334***	0.332***	0.091
	(0.066)	(0.109)	(0.109)	(0.114)
$\text{MWTP}_{\text{Organic}}$	0.966***	0.967***	1.020***	0.965***
	(0.056)	(0.090)	(0.103)	(0.101)
$\text{MWTP}_{\text{Ethical trade}}$	1.100***	1.129***	1.104***	1.103***
	(0.058)	(0.096)	(0.098)	(0.100)

(i) MWTP estimates and the standard errors are estimated by the Krinsky-Robb procedure.
(ii) Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.
(iii) Poe test results (adjusted for three comparisons(indicate that the bilateral differences between the control and treatment groups are not statistically significant: control vs. treatment 1: Poe statistic = 0.494 (n.s.); control vs. treatment 2: Poe statistic = 0.056 (n.s.); treatment 1 vs. treatment 2: Poe statistic = 0.068 (n.s.).

Table 7: WTP estimates (MXL II, PS estimation)

4.2 Mechanisms

This section explores the factors associated with consumer preferences for carbon-neutral labels. Socioeconomic controls and hypothesized mechanisms are integrated into the choice models and adjusted for Bonferroni correction based on the number of variables included in each regression.

The MXL II, MXL III, MXL IV, and MXL V models extend the base model (MXL II) introduced in Table 7 of the previous subsection 4.1 (preferences and WTP). These models incorporate interaction terms to capture the effects of various factors and socioeconomic variables. The variables include age as a continuous variable, a binary indicator for high income (individuals with an annual household income exceeding £40,000 after taxes compared to those with lower incomes or who did not disclose

their income), and a dummy variable for females compared to males, non-binary individuals, and unspecified responses.

The mechanisms included in the analysis are as follows: trust in carbon-neutral labels, confusion with carbon-neutral labels, concerns about CO_2 offsetting, climate worry, warm glow (positive emotions from climate-friendly purchases), guilt (negative feelings when not making climate-friendly choices), social approval (perceived acceptance by others), producer responsibility (the opinion that producers should pay for climate mitigation), time restrictions (limited time for climate-friendly choices), and financial constraints (budget limitations preventing climate-friendly purchases). Summary statistics of covariates across subsamples are provided in Table A.9 in Appendix A.1[9].

Two additional binary variables identify whether consumers only trust or are confused by transparent labels but not standard labels. The summary statistics for the relative trust and the relative confusion variables are provided in Table A.9 in Appendix A.1. Participants' responses regarding which labels they find most confusing or trust the most when shown all labels can be found in Table 8, in the presence of all labels. Note that, same as other factors, these variables are constructed based on questions asked following the CE.

Based on the MXL III, IV, and V models in Table 7, I find that general concern, general trust, and concern for CO_2 offsets are not significantly linked with consumers' preferences for carbon-neutral labels. However, relative confusion appears to play a role, even though this question was asked after the choice experiment as the other questions. Specifically, if consumers find at least one transparent label more confusing than the standard label, they are less likely to choose tea with a carbon-neutral

[9]Additional details on the statements used are provided in Table A.8 in Appendix A.1 Note that the last four statements in Table A.8 are not included in the regressions, as they explore reasons why consumers might be concerned about CO_2 offsetting if they do so.

label, particularly when the share of CO_2 offsetting and CO_2 reduction is equal. This indicates that in a market with various labels with differing transparency levels, consumer confusion may be important. On the other hand, relative trust is not significantly associated with preferences.

Furthermore, climate worry seems to be relevant only if the carbon-neutral label includes an equal share of CO_2 reduction and offsetting. Labels with a larger share of CO_2 offsets or lacking information about this share do not imply the same finding. Warm glow, guilt, producer pays principle, and social approval are also not significantly linked with preferences. At the same time, limited financial resources are significantly associated with lower preferences for carbon-neutral labels, while limited time is not.

Finally, older ages appear to be linked to a higher preference for carbon-neutral labels. However, gender and income are not linked with consumer preferences, nothing that limited financial resources for climate-friendly purchases capture some income effect already. However, more detailed robustness checks will be conducted by examining factors such as education and employment and more income categories.

	Full Sample		**Control**		**Treatment 1**		**Treatment 2**	
	N	Share	N	Share	N	Share	N	Share
Trust (label 1)	314	23.49%	108	24.22%	92	20.58%	114	25.68%
Trust (label 2)	330	24.68%	114	25.56%	124	27.74%	92	20.72%
Trust (label 3)	520	38.89%	178	39.91%	165	36.91%	177	39.86%
Trust (none)	274	20.49%	84	18.83%	99	22.15%	91	20.50%
Confusion (label 1)	342	25.58%	111	24.89%	130	29.08%	101	22.75%
Confusion (label 2)	456	34.11%	164	36.77%	125	27.96%	167	37.61%
Confusion (label 3)	340	25.43%	106	23.77%	117	26.17%	117	26.35%
Confusion (none)	403	30.14%	133	29.82%	147	32.89%	123	27.70%

Label 1 represents the standard carbon-neutral label. Label 2 is the transparent carbon-neutral label with 95% CO_2 offsetting and 5% CO_2 reduction. Label 3 is the transparent carbon-neutral label with an equal share of CO_2 reduction and CO_2 offsetting (50%-50%). Note that the participants were allowed to choose more than one option. This question was asked later in the survey, after the choice experiments, showing all types of labels to all participants.

Table 8: Confusion with and trust for each carbon-neutral label

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-3.028***	-3.304***	-2.973***	-2.828***
	(0.104)	(0.180)	(0.175)	(0.184)
Carbon-neutral (random)	0.419**	0.165	0.591**	0.375
	(0.167)	(0.300)	(0.265)	(0.283)
Organic (random)	0.673***	0.634***	0.693***	0.683***
	(0.054)	(0.097)	(0.093)	(0.094)
Ethical trade (random)	0.740***	0.745***	0.714***	0.755***
	(0.054)	(0.095)	(0.094)	(0.091)
Price	-0.662***	-0.680***	-0.649***	-0.659***
	(0.026)	(0.046)	(0.044)	(0.047)
Interactions				
Carbon-neutral x Trust	-0.131	0.328	-0.026	-0.629
	(0.192)	(0.343)	(0.324)	(0.319)
Carbon-neutral x Confusion	-0.314	0.064	-0.572	-0.368
	(0.185)	(0.340)	(0.300)	(0.312)
Carbon-neutral x Concern	0.364	0.055	0.324	0.805
	(0.201)	(0.394)	(0.330)	(0.321)
Standard deviations				
$\sigma_{CarbonNeutral}$	1.091***	1.188***	1.042***	1.050***
	(0.049)	(0.092)	(0.083)	(0.080)
$\sigma_{Organic}$	1.437***	1.422***	1.408***	1.469***
	(0.062)	(0.113)	(0.099)	(0.114)
$\sigma_{EthicalTrade}$	1.415**	1.506***	1.347***	1.416***
	(0.061)	(0.110)	(0.105)	(0.105)
Observations	10696	3568	3576	3552
Participants	1337	446	447	444
Log-likelihood	-10229.25	-3361.62	-3440.22	-3423.39

Robust standard errors are in parentheses.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

Table 9: MXL III (PS estimation)

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-3.036*** (0.104)	-3.306*** (0.180)	-2.978*** (0.173)	-2.825*** (0.184)
Carbon-neutral	-0.253 (0.232)	-0.512 (0.427)	-0.220 (0.404)	-0.115 (0.367)
Organic	0.673*** (0.054)	0.634*** (0.096)	0.693*** (0.092)	0.687*** (0.094)
Ethical Trade	0.742*** (0.054)	0.749*** (0.095)	0.716*** (0.094)	0.759*** (0.092)
Price	-0.663*** (0.026)	-0.680*** (0.046)	-0.649*** (0.044)	-0.658*** (0.047)
Interactions				
Carbon-neutral x Trust	0.104 (0.197)	0.466 (0.366)	0.204 (0.324)	-0.269 (0.336)
Carbon-neutral x Confusion	-0.259 (0.182)	0.208 (0.330)	-0.575 (0.303)	-0.320 (0.302)
Carbon-neutral x Concern for carbon offsets	0.441 (0.198)	0.094 (0.390)	0.472 (0.334)	0.744 (0.313)
Carbon-neutral x Only confused with transparent labels	-0.381*** (0.077)	-0.403* (0.143)	-0.219 (0.134)	-0.480*** (0.127)
Carbon-neutral x Only trust in transparent labels	-0.055 (0.082)	0.092 (0.146)	-0.090 (0.144)	-0.134 (0.141)
Carbon-neutral x Female	0.031 (0.076)	0.047 (0.144)	0.066 (0.126)	-0.014 (0.127)
Carbon-neutral x Age	0.012*** (0.003)	0.010 (0.005)	0.013* (0.004)	0.011 (0.004)
Carbon-neutral x High income	0.147 (0.079)	0.188 (0.146)	0.166 (0.134)	0.123 (0.139)
Standard deviations				
$\sigma_{CarbonNeutral}$	1.054*** (0.048)	1.147*** (0.091)	1.001*** (0.084)	0.995*** (0.078)
$\sigma_{Organic}$	1.432*** (0.062)	1.425*** (0.114)	1.398*** (0.099)	1.465*** (0.114)
$\sigma_{EthicalTrade}$	1.417*** (0.061)	1.510*** (0.110)	1.351*** (0.105)	1.419*** (0.105)
Number of Observations	10696.00	3568.00	3576.00	3552.00
Number of Participants	1337.00	446.00	447.00	444.00
Log Likelihood	-9151.415	-3012.032	-3037.105	-3094.164

Robust standard errors are reported in parentheses to the right of the estimates.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$

Table 10: MXL IV (PS estimation)

	Full Sample	**Control**	**Treatment 1**	**Treatment 2**
Status quo	-3.036*** (0.104)	-3.312*** (0.181)	-2.980*** (0.173)	-2.831*** (0.184)
Carbon-neutral (random)	0.094 (0.265)	-0.071 (0.506)	-0.102 (0.501)	0.395 (0.376)
Organic (random)	0.670*** (0.054)	0.633*** (0.097)	0.690*** (0.093)	0.679*** (0.094)
Ethical Trade (random)	0.739*** (0.054)	0.747*** (0.095)	0.715*** (0.094)	0.751*** (0.092)
Price	-0.663*** (0.026)	-0.681*** (0.046)	-0.650*** (0.044)	-0.660*** (0.047)
Interactions				
Carbon-neutral x Trust	-0.049 (0.214)	0.264 (0.403)	0.031 (0.358)	-0.424 (0.363)
Carbon-neutral x Confusion	-0.034 (0.179)	0.610 (0.329)	-0.428 (0.300)	-0.221 (0.304)
Carbon-neutral x Concern for carbon offsets	0.145 (0.223)	-0.152 (0.425)	0.244 (0.383)	0.408 (0.368)
Carbon-neutral x Only confused with transparent labels	-0.361*** (0.078)	-0.371 (0.146)	-0.220 (0.134)	-0.508*** (0.126)
Carbon-neutral x Only trust in transparent labels	-0.081 (0.083)	0.054 (0.146)	-0.153 (0.149)	-0.118 (0.138)
Carbon-neutral x Climate worry	0.465 (0.217)	0.017 (0.369)	0.169 (0.377)	1.400*** (0.358)
Carbon-neutral x Warm glow	0.422 (0.252)	0.936 (0.470)	0.165 (0.461)	-0.116 (0.415)
Carbon-neutral x Guilt	0.249 (0.211)	0.331 (0.410)	0.367 (0.385)	0.356 (0.349)
Carbon-neutral x Social approval	-0.030 (0.243)	-0.142 (0.470)	0.446 (0.406)	-0.607 (0.420)
Carbon-neutral x Producer pays	-0.236 (0.195)	-0.367 (0.406)	-0.232 (0.310)	-0.103 (0.318)
Carbon-neutral x Limited resources	-0.682*** (0.184)	-0.337 (0.354)	-0.476 (0.295)	-1.179*** (0.302)
Carbon-neutral x Lack of time	0.012 (0.078)	-0.020 (0.153)	0.069 (0.129)	-0.030 (0.129)
Carbon-neutral x Female	0.012 (0.078)	-0.020 (0.153)	0.069 (0.129)	-0.030 (0.129)
Carbon-neutral x Age	0.011*** (0.003)	0.009 (0.005)	0.013** (0.004)	0.010 (0.004)
Carbon-neutral x High income	0.133 (0.078)	0.188 (0.146)	0.166 (0.134)	0.123 (0.139)
Standard deviations				
$\sigma_{CarbonNeutral}$	1.034*** (0.048)	1.110*** (0.087)	0.984*** (0.085)	0.950*** (0.076)
$\sigma_{Organic}$	1.435*** (0.062)	1.430*** (0.114)	1.411*** (0.100)	1.466*** (0.113)
$\sigma_{EthicalTrade}$	1.422*** (0.061)	1.518*** (0.109)	1.358*** (0.105)	1.423*** (0.105)
Number of Observations	10696.00	3568.00	3576.00	3552.00
Number of Participants	1337.00	446.00	447.00	444.00
Log Likelihood	-9132.8575	-3003.0381	-3089.5178	-3021.8149

Robust standard errors are reported in parentheses.
Bonferroni-corrected p-values and significance: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$

Table 11: MXL V (PS estimation)

	MNL I	MXL I	MXL II	MXL III	MNL IV	MNL V
Status quo	-2.005*** (0.082)	-3.028*** (0.104)	-3.028*** (0.104)	-3.030*** (0.104)	-3.030*** (0.104)	-3.036*** (0.104)
Carbon-neutral	0.187*** (0.035)	0.377*** (0.043)	0.377*** (0.043)	0.514** (0.168)	-0.253 (0.232)	0.094 (0.265)
Organic	0.616*** (0.034)	0.673*** (0.054)	0.673*** (0.054)	0.673*** (0.054)	0.673*** (0.054)	0.670*** (0.054)
Ethical trade	0.620*** (0.034)	0.741*** (0.054)	0.741*** (0.054)	0.740*** (0.054)	0.742*** (0.054)	0.739*** (0.054)
Price	-0.463*** (0.016)	-0.662*** (0.026)	-0.662*** (0.026)	-0.662*** (0.026)	-0.663*** (0.026)	-0.663*** (0.026)
Interactions						
Carbon-neutral x Trust	–	–	–	-0.131 (0.192)	0.104 (0.197)	-0.049 (0.214)
Carbon-neutral x Confusion	–	–	–	-0.314 (0.185)	-0.259 (0.182)	-0.034 (0.179)
Carbon-neutral x Concern	–	–	–	0.364 (0.201)	0.441 (0.198)	0.145 (0.223)
Carbon-neutral x Only confused with transparent labels	–	–	–	–	-0.381*** (0.077)	-0.361*** (0.078)
Carbon-neutral x Only trust in transparent labels	–	–	–	–	-0.055 (0.082)	-0.081 (0.083)
Carbon-neutral x Climate worry	–	–	–	–	–	0.465 (0.217)
Carbon-neutral x Warm glow	–	–	–	–	–	0.422 (0.252)
Carbon-neutral x Guilt	–	–	–	–	–	0.249 (0.211)
Carbon-neutral x Social approval	–	–	–	–	–	-0.030 (0.243)
Carbon-neutral x Producer pays	–	–	–	–	–	-0.236 (0.195)
Carbon-neutral x Limited resources	–	–	–	–	–	-0.682*** (0.184)
Carbon-neutral x Lack of time	–	–	–	–	–	0.012 (0.078)
Carbon-neutral x Female	–	–	–	–	0.031 (0.076)	0.012 (0.078)
Carbon-neutral x Age	–	–	–	–	0.012*** (0.003)	0.011*** (0.003)
Carbon-neutral x High income	–	–	–	–	0.147 (0.079)	0.133 (0.078)
SD						
$\sigma_{\text{Carbon Neutral}}$	–	1.093*** (0.049)	1.091*** (0.049)	1.091*** (0.049)	1.054*** (0.048)	1.034*** (0.048)
σ_{Organic}	–	1.435*** (0.062)	1.437*** (0.062)	1.437*** (0.062)	1.432*** (0.062)	1.435*** (0.062)
$\sigma_{\text{Ethical Trade}}$	–	1.414*** (0.061)	1.415*** (0.061)	1.415*** (0.061)	1.417*** (0.061)	1.422*** (0.061)
σ_{Price}	–	–	0.734*** (0.022)	–	–	–
Observations	10,696	10,696	10,696	10,696	10,696	10,696
Participants	1,337	1,337	1,337	1,337	1,337	1,337
Log-likelihood	-10,229.25	-10,229.25	-10,229.25	-9,163.05	-9,151.42	-9,132.86

Robust standard errors are in parentheses.
Bonferroni-corrected p-values and significance levels: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.
Model Descriptions: MNL I is a Multinomial Logit (MNL) model.
MXL I is a Mixed Logit (MXL) model with randomized label attributes, fixed price.
MXL II is a MXL model with all attributes randomized except for the status quo.
MXL III, IV, and V are MXL models with randomized label attributes, fixed price, and including interaction terms.

Table 12: Comparison of results across six models for the full sample

4.3 Robustness Checks

This section provides further information about survey data and presents the planned future work, which includes robustness tests to ensure the reliability of the findings.

The first robustness check relates to the certainty levels. The data indicates that participants were generally confident in their choices, with over 83% selecting a certainty level of 6 or higher on a scale from 0 to 10. The certainty level will be interacted with the label attributes to check if results change.

The second robustness check relates to perceived consequentiality of the survey. More than 54% of respondents believed their answers could potentially influence tea prices or labeling policies (see Table A.6 in Appendix A.1). This perception of consequentiality suggests that participants took the survey seriously, although it raises concerns about potential biases due to attempts to influence outcomes. To address these concerns, I will compare the WTP estimates between those who perceived the survey as consequential and those who did not, also examining differences across subsamples.

The third robustness check relates to attribute non-attendance. As shown in Table A.7 in Appendix A.1 , attribute non-attendance was notable: 33% did not consider the carbon-neutral label, 34% organic label, 24% ethical trade, and 20% price attribute, whereas 20% considered all attributes. These findings highlight that participants assigned different levels of importance to attributes, emphasizing the need for robustness checks regarding attribute non-attendance. I will interact binary indicators for attribute non-attendance with label attributes to evaluate whether non-attendance to attributes affects my results.

Fourth, I will run robustness checks using sub-samples that exclude observations from participants who did not pass the attention and manipulation checks. The

attention and manipulation checks yielded mixed results. While 62% of participants correctly identified the number of labels on the choice cards, 21% of the control group misinterpreted the carbon-neutral label, compared to 11% and 13% in the treatment groups. Additionally, 49% accurately defined CO_2 offsetting, while others either chose incorrect definitions or did not remember (see Appendix A.1, Table A.6).

Fifth, I will conduct a robustness check related to survey completion time. The average survey duration was slightly longer than anticipated, totaling approximately 14 minutes and 5 seconds, with the choice experiment taking about 3 minutes and 5 seconds. I will exclude speeders as part of these robustness checks.

Sixth, I will validate the findings using open-ended contingent valuation (CVM) questions to compare these distributions with WTP estimates from the choice experiment.

Seventh, I will run mixed logit models in WTP space rather than preference space, as well as mixed latent class models.

Finally, I plan to estimate heterogeneous WTP across categories such as income levels, employment status, gender, and age to determine whether significant differences exist among these groups.

4.4 Conclusion

In the growing criticisms for carbon-neutral labels and CO_2 offsets, this paper investigates whether consumers are willing to pay more for transparent carbon-neutral labels as compared to standard carbon-neutral labels and how their preferences vary between CO_2 offsets and CO_2 reductions.

I find that consumers' WTP for carbon-neutral labels is approximately £0.57, equivalent to a WTP of £0.46 for reducing or offsetting 1 kilogram of CO_2. This value

is 6.6 times higher than the SCC estimated by the UK government. Interestingly, there is no statistically significant difference between WTP for transparent versus standard labels. However, the WTP for transparent labels with a higher share of CO_2 offsetting still tends to be larger on average.

While general confusion with carbon-neutral labels is not significantly associated with preferences for carbon-neutral labels, relative confusion is–which is measured post-choice experiment as other factors– when consumers are shown both transparent and non-transparent versions of the labels. Consumers' pre-existing concerns about CO_2 offsets are not significantly associated with their preferences for carbon-neutral labels, noting that a neutral framing was used for CO_2 offsets in this study, which reflects the realistic scenario where companies are unlikely to portray themselves negatively. Therefore, for companies and policymakers who aim to nudge consumer behavior, communicating additional information about the label in a less confusing way appears to be crucial.

Secondly, I find that consumers' WTP for organic and ethical trade labels is higher than for carbon-neutral labels. I have not yet examined whether these labels compete with or complement each other. However, if they compete, this suggests that consumers may prefer to allocate their spending to these other sustainability aspects, particularly if they lack trust in or find carbon-neutral labels confusing, which is crucial when considering the number of labels a product can receive and how to communicate them effectively.

Finally, when the share of CO_2 offsetting and reduction is equal, I find that climate worry is positively associated with consumers' preference for transparent carbon-neutral labels, whereas limited financial resources are negatively linked to preferences. However, these relationships are not observed in the other two subsamples. This might suggest that promoting climate change awareness among consumers may be

effective only if producers offer transparent labels that clearly communicate a higher level of environmental quality to prevent consumers from struggling to make informed choices due to financial constraints, confusion, and a lack of certainty about the actual environmental impact of products.

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Appendix

A Survey Data

A.1 Descriptive Statistics

his section presents the descriptive statistics of the main survey data. Table A.1 includes the age, gender, and education of the participants, while Table A.4 presents their employment and income. Table A.5 presents participants' tea consumption habits, including their frequency of tea drinking, purchasing habits, and preferences for tea blends. Table A.6 shows the survey clarity, attention checks, and completion time, while Table A.7 presents the levels of certainty, attribute non-attendance, consequentiality, and protest responses of participants. Finally, Table A.8 presents the level of agreement with various statements related to the underlying mechanism of consumers' preferences about using a Likert scale.

	Full		Control		Treatment 1		Treatment 2	
	N	Share	N	Share	N	Share	N	Share
	1337	100.00%	446	16.68%	447	16.72%	444	16.60%
Age								
18 - 34 years	411	30.74%	136	30.49%	134	29.98%	141	31.76%
35 - 54 years	477	35.68%	157	35.20%	161	36.02%	159	35.81%
55+ years	449	33.58%	153	34.30%	152	34.00%	144	32.43%
Gender								
Male	652	48.77%	226	50.67%	210	46.98%	216	48.65%
Female	675	50.49%	217	48.65%	232	51.90%	226	50.90%
Non-binary	9	0.67%	3	0.67%	5	1.12%	1	0.23%
I prefer not to say	1	0.07%	-	0.00%	-	0.00%	1	0.23%
Education								
Primary school	3	0.22%	2	0.45%	1	0.22%	-	0.00%
Secondary school: High school or equivalent	364	27.23%	132	29.60%	125	27.96%	107	24.10%
Post-secondary vocational training (up to 1 year)	55	4.11%	16	3.59%	27	6.04%	12	2.70%
Post-secondary vocational training (2 and more years)	159	11.89%	44	9.87%	58	12.98%	57	12.84%
Post-secondary academic below-degree level qualification (up to 1 year)	82	6.13%	32	7.17%	23	5.15%	27	6.08%
Post-secondary academic below-degree level qualification (2 and more years)	173	12.94%	49	10.99%	50	11.19%	74	16.67%
Bachelors or equivalent first degree qualification (e.g., BA, BSc, BEng)	311	23.26%	111	24.89%	95	21.25%	105	23.65%
Masters or equivalent higher degree level qualification (e.g., MA, MSc, MBA)	140	10.47%	48	10.76%	48	10.74%	44	9.91%
PhD or equivalent doctoral level qualification (e.g., PhD)	39	2.92%	8	1.79%	19	4.25%	12	2.70%
None of above	11	0.82%	4	0.90%	1	0.22%	6	1.35%

This figure displays the number of participants (N) and their share of the total sample.

Table A.1: Summary statistics: age, gender, education

Covariate	**Tea drinkers/purchasers (N= 1339)**	**Non-tea drinkers (N= 80)**
Age	Mean: 47.54 (SD: 16.52)	Mean: 53.65 (SD: 14.71)
Female	Proportion: 50.49%	Proportion: 62.5%
High education	Proportion: 49.59%	Proportion: 31.25%

This table displays the summary statistics (mean and standard deviation or proportion) for tea drinkers/purchasers and never tea drinkers, including age (a continuous variable), female (a binary variable coded as 1 for females and 0 for males, non-binary, or 'prefer not to say' categories), and high education (a binary variable coded as 1 for those with a post-secondary academic qualification below a degree level which is 2 years or more).

Table A.2: Comparison between tea drinkers/purchasers and never tea drinkers

Covariate	**Tea drinkers/purchasers (N= 1339)**	**Non-tea purchasers (N= 142)**
Age	Mean: 47.54 (SD: 16.52)	Mean: 48.79 (SD: 17.64)
Female	Proportion: 50.49%	Proportion: 40.85%
High education	Proportion: 49.59%	Proportion: 40.14%

(ii) This table displays the summary statistics (mean and standard deviation or proportion) for tea drinkers/purchasers and never tea purchasers, including age (a continuous variable), female (a binary variable coded as 1 for females and 0 for males, non-binary, or 'prefer not to say' categories), and high education (a binary variable coded as 1 for those with a post-secondary academic qualification below a degree level which is 2 years or more).

Table A.3: Comparison between tea drinkers/purchasers and never tea purchasers

	Full		Control		Treatment 1		Treatment 2	
	N	Share	N	Share	N	Share	N	Share
	1337	100.00%	446	16.68%	447	16.72%	444	16.60%
Employment								
Full or part time employment	768	57.44%	248	55.61%	260	58.17%	260	58.56%
Self-employed	95	7.11%	32	7.17%	29	6.49%	34	7.66%
Unemployed	83	6.21%	25	5.61%	28	6.26%	30	6.76%
Retired	267	19.97%	90	20.18%	88	19.69%	89	20.05%
Looking after family or home	79	5.91%	30	6.73%	27	6.04%	22	4.95%
Full-time student	32	2.39%	14	3.14%	11	2.46%	7	1.58%
None of above	13	0.97%	7	1.57%	4	0.89%	2	0.45%
Annual household income after taxes								
Under £10,000	76	5.68%	23	5.16%	22	4.92%	31	6.98%
£10,000 - £19,999	180	13.46%	51	11.43%	64	14.32%	65	14.64%
£20,000 - £29,999	252	18.85%	85	19.06%	88	19.69%	79	17.79%
£30,000 - £39,999	175	13.09%	70	15.70%	48	10.74%	57	12.84%
£40,000 - £49,999	140	10.47%	44	9.87%	55	12.30%	41	9.23%
£50,000 - £59,999	103	7.70%	32	7.17%	34	7.61%	37	8.33%
£60,000 - £69,999	69	5.16%	25	5.61%	16	3.58%	28	6.31%
£70,000 - £79,999	50	3.74%	15	3.36%	18	4.03%	17	3.83%
£80,000 - £89,999	43	3.22%	10	2.24%	21	4.70%	12	2.70%
£90,000 - £99,999	31	2.32%	12	2.69%	9	2.01%	10	2.25%
£100,000 - £129,999	69	5.16%	21	4.71%	27	6.04%	21	4.73%
£130,000 or more	49	3.66%	16	3.59%	15	3.36%	18	4.05%
No answer	100	7.48%	42	9.42%	30	6.71%	28	6.31%
Environmental organization membership								
Member	149	11.14%	46	10.31%	55	12.30%	48	10.81%

This figure displays the number of participants (N) and their share.

Table A.4: Summary statistics: Employment and income

	Full		Control		Treatment 1		Treatment 2	
	N	Mean	N	Mean	N	Mean	N	Mean
	1337	100.00%	446	16.68%	447	16.72%	444	16.60%
Tea drinking frequency								
Daily	1033	77.26%	337	75.56%	345	77.18%	351	79.05%
Once a week	140	10.47%	53	11.88%	50	11.19%	37	8.33%
Once every two weeks	62	4.64%	19	4.26%	22	4.92%	21	4.73%
Once a month	37	2.77%	11	2.47%	10	2.24%	16	3.60%
Several times a year	65	4.86%	26	5.83%	20	4.47%	19	4.28%
Tea purchase frequency								
Once a week	253	18.92%	95	21.30%	83	18.57%	75	16.89%
Once every two weeks	273	20.42%	79	17.71%	99	22.15%	95	21.40%
Once a month	507	37.92%	174	39.01%	161	36.02%	172	38.74%
Several times a year	262	19.60%	84	18.83%	87	19.46%	91	20.50%
Once a year	42	3.14%	14	3.14%	17	3.80%	11	2.48%
Preferred tea blend								
Black tea	963	72.03%	318	71.30%	327	73.15%	318	71.62%
Green tea	213	15.93%	76	17.04%	62	13.87%	75	16.89%
Herbal tea	105	7.85%	36	8.07%	39	8.72%	30	6.76%
Other	56	4.19%	16	3.59%	19	4.25%	21	4.73%
Regular grocery shopping								
Carbon-neutral label	168	12.57%	54	12.11%	61	13.65%	53	11.94%
Organic label	321	24.01%	109	24.44%	111	24.83%	101	22.75%
Fair trade label	486	36.35%	168	37.67%	161	36.02%	157	35.36%
No sustainability label	252	18.85%	80	17.94%	82	18.34%	90	20.27%
Other label	403	30.14%	130	29.15%	135	30.20%	138	31.08%
No knowledge about label	26	1.94%	15	3.36%	4	0.89%	7	1.58%
Price & amount	N	Mean	N	Mean	N	Mean	N	Mean
Price paid for tea (£)	1060	7.79	348	10.21	349	5.72	363	7.46
Tea amount (grams)	290	158.18	91	182.65	98	155.33	101	138.90
Tea amount (teabags)	1045	123.47	349	119.62	348	129.46	348	121.34

This figure displays the number of participants (N), along with either their share of the total sample for binary variables or the mean for continuous variables.

Table A.5: Summary statistics: Tea consumption

	Full		Control		Treatment 1		Treatment 2	
	N	Mean	N	Mean	N	Mean	N	Mean
Survey completion time								
Choice experiment time (min.)	1337	3.05	446	4.63	447	1.85	444	2.67
Full survey time (min.)	1337	14.05	446	14.57	447	11.42	444	16.17
Device								
Smartphone	754	56.39%	242	54.26%	262	58.61%	250	56.31%
Tablet	42	3.14%	12	2.69%	13	2.91%	17	3.83%
Desktop	541	40.46%	192	43.05%	172	38.48%	177	39.86%
Attention and manipulation								
The number of labels								
One label	65	4.86%	28	6.28%	20	4.47%	17	3.83%
Two labels	337	25.21%	104	23.32%	119	26.62%	114	25.68%
Three labels (correct resp.)	827	61.85%	281	63.00%	267	59.73%	279	62.84%
Not remember.	108	8.08%	33	7.40%	41	9.17%	34	7.66%
Percentage info. on label								
Yes (correct for samples 2 & 3)	567	42.41%	95	21.30%	242	54.14%	230	51.80%
No (correct for sample 1)	273	20.42%	163	36.55%	51	11.41%	59	13.29%
I do not remember.	497	37.17%	188	42.15%	154	34.45%	155	34.91%
Definition of CO_2 offsetting								
Correct resp.	653	48.84%	222	49.78%	227	50.78%	204	45.95%
False resp. (CO_2 reduction def.)	478	35.75%	156	34.98%	150	33.56%	172	38.74%
Not remember.	206	15.41%	68	15.25%	70	15.66%	68	15.32%
Survey clarity								
Clear instructions								
No.	10	0.75%	-	0.00%	5	1.12%	5	1.13%
Yes.	1327	99.25%	446	100.00%	442	98.88%	439	98.87%
Confusion with survey								
No.	1246	93.19%	424	95.07%	419	93.74%	403	90.77%
Yes.	91	6.81%	22	4.93%	28	6.26%	41	9.23%

This figure displays the number of participants (N), along with either their share of the total sample for binary variables or the mean for continuous variables.

Table A.6: Summary statistics: survey clarity, and attention

	Full		Control		Treatment 1		Treatment 2	
	N	Share	N	Share	N	Share	N	Share (%)
Certainty level (0-10)								
0 (very uncertain) -2	11	0.82%	3	0.67%	5	1.12%	3	0.68%
2 - 4	38	2.84%	13	2.91%	15	3.36%	10	2.25%
4 - 6	177	13.24%	59	13.23%	62	13.87%	56	12.61%
6 - 8	533	39.87%	180	40.36%	164	36.69%	189	42.57%
8 - 10 (very certain)	578	43.23%	191	42.83%	201	44.97%	186	41.89%
Attribute non-attendance								
Not considered: CN label	443	33.13%	135	30.27%	154	34.45%	154	34.68%
Not considered: Organic label	453	33.88%	129	28.92%	154	34.45%	170	38.29%
Not considered: Ethical trade l.	318	23.78%	98	21.97%	108	24.16%	112	25.23%
Not considered: Price	267	19.97%	104	23.32%	73	16.33%	90	20.27%
Considered all attributes	413	30.89%	145	32.51%	143	31.99%	125	28.15%
Consequentiality								
Yes (policy and price impact).	720	53.85%	231	51.79%	257	57.49%	232	52.25%
No (no impact).	617	46.15%	215	48.21%	190	42.51%	212	47.75%
Consistent SQ responses								
Total responses	31	2.32%	9	2.02%	10	2.24%	12	2.70%
The products were too expensive.	9	0.67%	4	0.90%	2	0.45%	3	0.68%
I oppose one or more of the labels.[P]	3	0.22%	1	0.22%	-	0.00%	2	0.45%
Insufficient information was provided about the labels or the products.[P]	7	0.52%	2	0.45%	2	0.45%	3	0.68%
I prefer to spend money on other social and environmental responsibility projects.	3	0.22%	1	0.22%	2	0.45%	-	0.00%
I disagree with the way the choice question was asked. [P]	2	0.15%	-	0.00%	-	0.00%	2	0.45%
Other reason	7	0.52%	1	0.22%	4	0.89%	2	0.45%

This table displays the number of participants (N) and their share. Protest responses indicated by [P].

Table A.7: Summary statistics: certainty, attribute non-attendance, consequentiality, and protest responses

Table A.8: Agreement to the list of statements - full sample

Statement	**SD**	**MD**	**SltD**	**N**	**SltA**	**MA**	**SA**
I worry about climate change	6.13	5.46	7.70	13.16	27.97	22.51	17.05
Limited financial resources prevent me from buying climate-friendly products	6.06	4.56	8.53	16.98	23.41	21.84	18.62
Lack of time prevents me from buying climate-friendly products	16.53	12.79	19.45	24.46	12.94	8.68	5.16
My positive emotions increase when I choose climate-friendly products	8.38	6.36	9.20	32.16	22.44	13.31	8.15
I feel guilty when I buy conventional products	15.11	11.14	18.77	22.14	16.90	8.60	7.33
Most people approve of my choice of climate-friendly products	5.83	3.66	8.23	47.20	15.78	12.27	7.03
Producers are responsible for climate change mitigation costs	2.39	3.59	8.45	24.01	23.64	21.77	16.16
I trust carbon-neutral labels	5.98	5.98	12.72	31.64	25.28	13.31	5.09
I am confused about carbon-neutral labels	5.09	8.23	14.81	26.85	29.32	10.17	5.53
I am concerned about carbon offsets	5.39	4.64	13.46	30.89	25.36	11.67	8.60
Carbon offsetting reduces carbon emissions	5.76	4.79	12.49	31.34	27.75	12.42	5.46
Carbon offsetting allows producers to continue polluting	1.94	2.92	8.15	30.44	30.67	15.26	10.62
Carbon offsetting is a misleading sense of relief	2.62	1.65	6.28	27.52	31.79	19.00	11.14
Carbon offsetting is a form of greenwashing	1.87	1.94	6.51	33.81	27.90	15.78	12.19

Note: SD - Strongly Disagree, MD - Mostly Disagree, SltD - Slightly Disagree, N - Neutral, SltA - Slightly Agree, MA - Mostly Agree, SA - Strongly Agree.

Covariate	**Full**	**Control**	**Treatment 1**	**Treatment 2**
Trust	0.61	0.61	0.60	0.61
	(0.21)	(0.20)	(0.22)	(0.20)
Confusion	0.60	0.61	0.59	0.60
	(0.21)	(0.20)	(0.21)	(0.21)
Only trust in transparent labels	0.56	0.57	0.57	0.54
	(0.50)	(0.50)	(0.50)	(0.50)
Only confused with transparent labels	0.44	0.45	0.38	0.50
	(0.50)	(0.50)	(0.49)	(0.50)
Concern for carbon offsets	0.62	0.63	0.62	0.62
	(0.21)	(0.20)	(0.22)	(0.21)
Climate worry	0.70	0.71	0.68	0.70
	(0.24)	(0.23)	(0.25)	(0.24)
Warm glow	0.61	0.63	0.60	0.60
	(0.23)	(0.21)	(0.23)	(0.23)
Guilt	0.53	0.54	0.52	0.52
	(0.25)	(0.25)	(0.25)	(0.25)

Standard deviations are in parentheses.

Table A.9: Covariates

Covariate	Full	Control	Treatment 1	Treatment 2
Social approval	0.61	0.63	0.61	0.59
	(0.20)	(0.19)	(0.20)	(0.21)
Producer pays principle	0.70	0.71	0.69	0.71
	(0.21)	(0.20)	(0.22)	(0.21)
Limited resources	0.70	0.71	0.68	0.70
	(0.24)	(0.23)	(0.25)	(0.24)
Lack of time	0.50	0.52	0.48	0.51
	(0.24)	(0.24)	(0.24)	(0.24)
Female	0.50	0.49	0.52	0.51
	(0.50)	(0.50)	(0.50)	(0.50)
Age	47.53	47.74	47.94	46.92
	(16.53)	(16.46)	(16.46)	(16.69)
High Income	0.49	0.49	0.50	0.48
	(0.50)	(0.50)	(0.50)	(0.50)

Standard deviations are in parentheses.

Table A.9: Covariates

A.2 Choice data

This section presents the choice experiment data. Table A.10 summarizes the overall choice design, including the different blocks, choice scenarios (cards), and respective attribute levels. Table A.11 details the specific choices available to participants within each block, presenting the number of alternatives (Alt A, Alt B, Alt SQ) and their respective distribution percentages for each choice card.

Block	Choice card	Price AltA	Price AltB	CN AltA	CN AltB	Organic AltA	Organic AltB	ET AltA	ET AltB
1	1	3.9	4.9	No	Yes	Yes	No	No	Yes
1	2	2.9	6.9	No	Yes	No	Yes	No	Yes
1	3	2.9	3.9	No	No	Yes	No	No	Yes
1	4	4.9	4.9	No	No	No	Yes	Yes	No
1	5	0.9	4.9	No	Yes	No	Yes	No	Yes
1	6	6.9	0.9	Yes	No	Yes	No	Yes	No
1	7	2.9	0.9	Yes	No	Yes	No	No	No
1	8	4.9	2.9	Yes	Yes	Yes	No	No	Yes
2	1	1.9	5.9	Yes	No	No	Yes	No	Yes
2	2	1.9	4.9	No	Yes	Yes	No	Yes	Yes
2	3	0.9	1.9	No	Yes	No	Yes	No	Yes
2	4	1.9	1.9	No	No	Yes	No	No	Yes
2	5	6.9	3.9	Yes	No	Yes	No	Yes	Yes
2	6	5.9	1.9	Yes	No	Yes	Yes	No	Yes
2	7	3.9	2.9	Yes	No	No	No	No	No
2	8	5.9	5.9	No	Yes	Yes	No	No	No

Table A.10: Choice design

Block	Subsample	N Alt A	N Alt B	N Alt SQ	Total	AltA	AltB	AltSQ
1	1	318	188	168	674	47.18%	27.89%	24.93%
1	2	362	165	147	674	53.71%	24.48%	21.81%
1	3	402	171	101	674	59.64%	25.37%	14.99%
1	4	226	203	245	674	33.53%	30.12%	36.35%
1	5	308	251	115	674	45.70%	37.24%	17.06%
1	6	173	332	169	674	25.67%	49.26%	25.07%
1	7	337	282	55	674	50.00%	41.84%	8.16%
1	8	110	447	117	674	16.32%	66.32%	17.36%
2	1	433	155	75	663	65.31%	23.38%	11.31%
2	2	506	103	54	663	76.32%	15.54%	8.14%
2	3	204	420	39	663	30.77%	63.35%	5.88%
2	4	258	342	63	663	38.91%	51.58%	9.50%
2	5	123	313	227	663	18.55%	47.21%	34.24%
2	6	77	537	49	663	11.61%	81.00%	7.39%
2	7	149	296	218	663	22.47%	44.65%	32.88%
2	8	186	147	330	663	28.05%	22.17%	49.77%

Table A.11: Choices: detailed information

B 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

	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	Organic	✗ No label	
Ethical trade label	✗ No label	Ethical trade	
	Price of tea product A £3.9	Price of tea product B £4.9	Price £0
I choose...	☐	☐	☐

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

	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	✗ No label	Ethical trade	
	Price of tea product A £2.9	Price of tea product B £3.9	Price £0
I choose...	☐	☐	☐

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...	☐	☐	☐

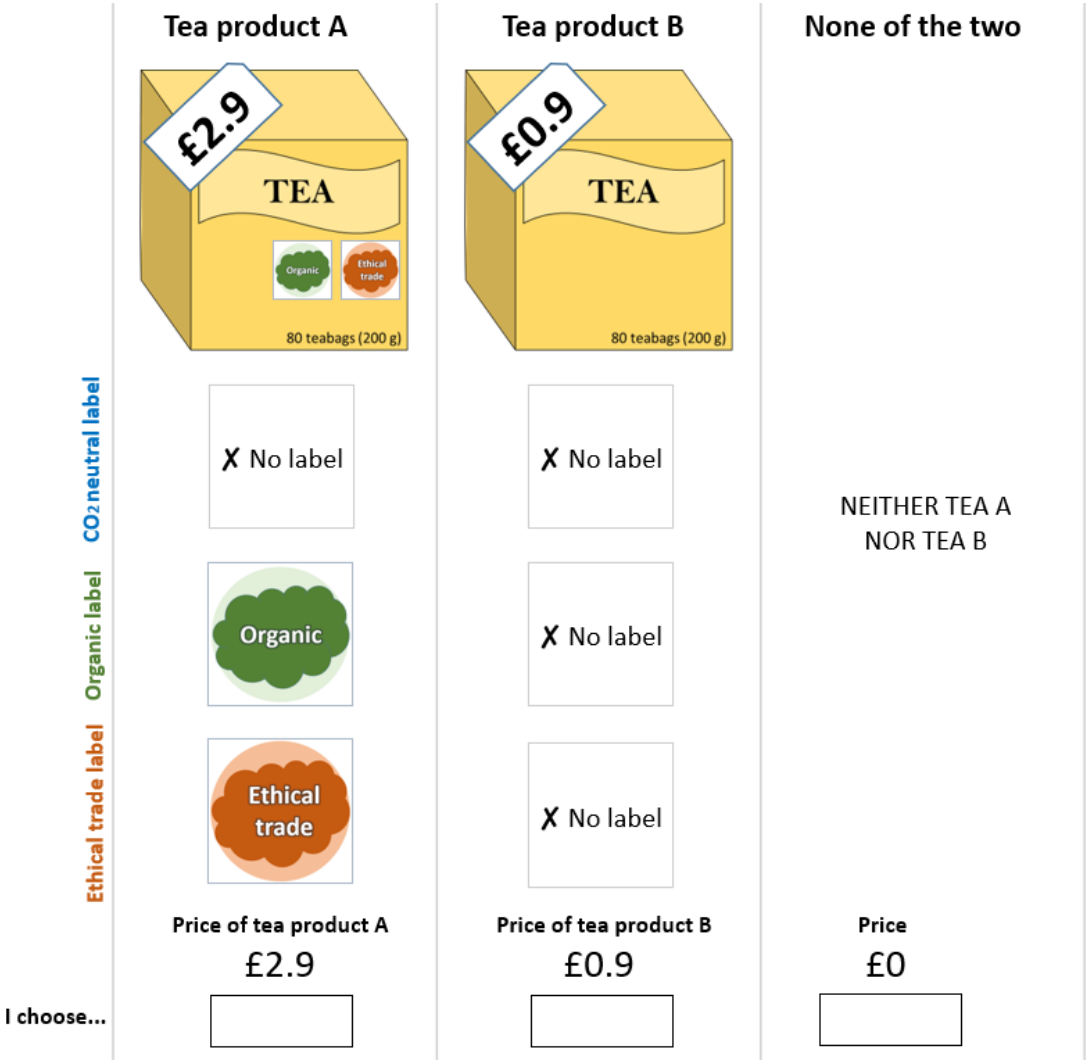
CHOICE CARD 5/8

	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 £0.9	Price of tea product B £4.9	Price £0
I choose...	☐	☐	☐

CHOICE CARD 6/8

	Tea product A	Tea product B	None of the two
			
CO2 neutral label	CO2 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	Price of tea product B	Price
	£6.9	£0.9	£0
I choose...	☐	☐	☐

CHOICE CARD 7/8



CHOICE CARD 8/8

	Tea product A	Tea product B	None of the two
			
CO₂ neutral label	CO₂ neutral	CO₂ neutral	NEITHER TEA A NOR TEA B
Organic label	Organic	✗ No label	
Ethical trade label	✗ No label	Ethical trade	
	Price of tea product A £4.9	Price of tea product B £2.9	Price £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.

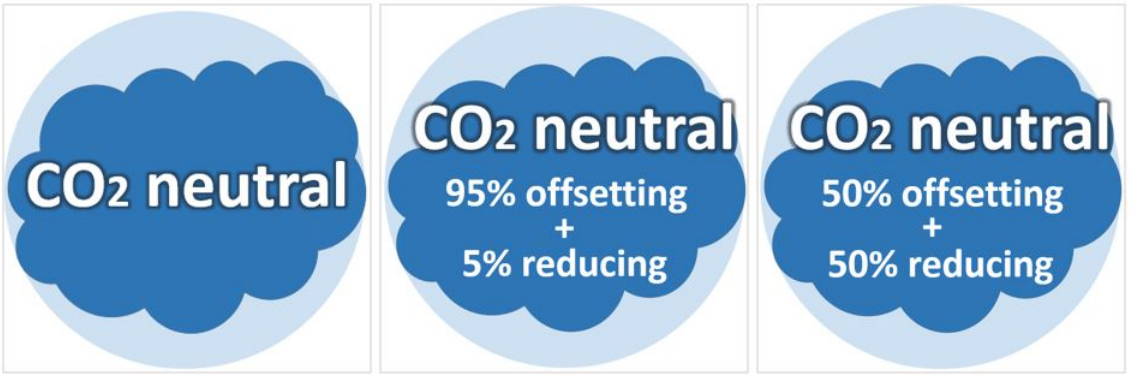
16. Please indicate to which degree you agree or disagree with the following statements.

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 grocery 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.12 and A.13 show the syntax used to create main survey and the pre-test designs respectively, while Tables A.14 and A.15 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.12: 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.13: 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.14: 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.15: Pre-test choice design

C 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 my 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.