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

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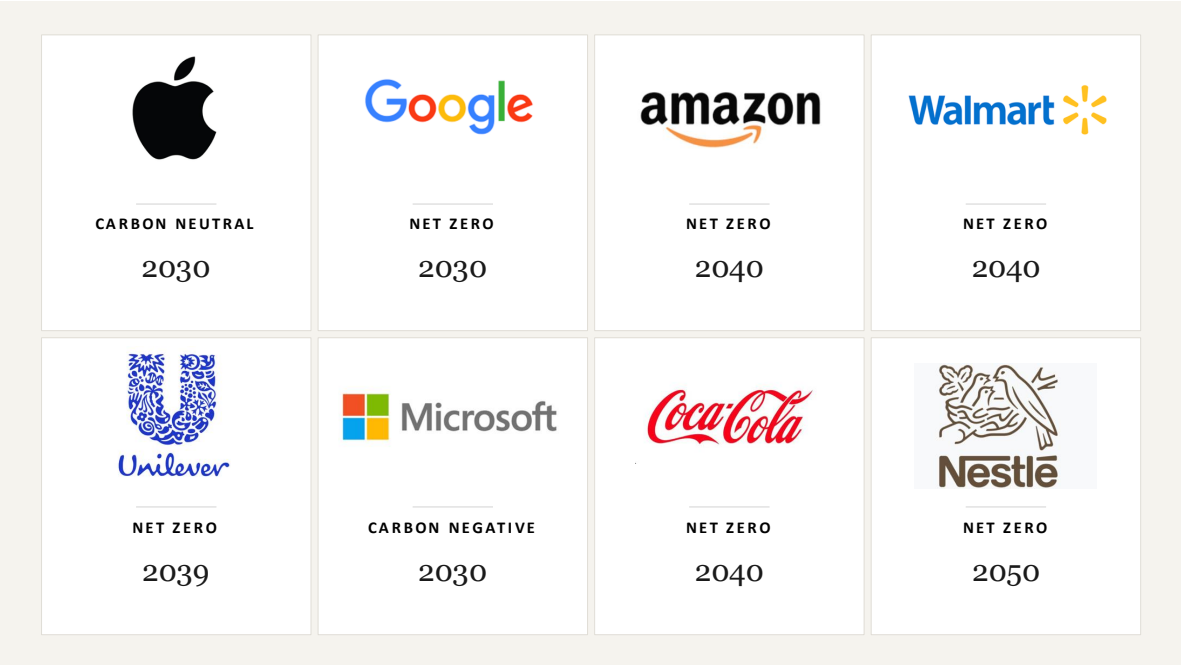
Brief Overview

- Carbon-neutral labels: no information on how neutrality is achieved
- Does transparency about CO_2 offsetting vs. reduction matter for willingness to pay (WTP)?
- Choice experiment with 1,339 UK tea consumers
  1. No evidence that transparency increases WTP
  2. No preference for CO_2 reductions over offsets

Corporate Climate Pledges

- Investor and board pressure; net-zero commitments (Kim and Lyon, 2011; Rogelj et al., 2021)
- 63% of Forbes Global 2000 companies with carbon-neutral or net-zero targets (Net Zero Tracker, 2025)



Carbon-Neutral Labels

Measured

Measurement of emissions associated with the product

Reduced

Reduction of emissions within the firm (e.g., energy efficiency)

Offset

Compensation for emissions through offsetting activities (e.g., reforestation)

Image source: The Guardian (Panther Media GmbH / Alamy)

Carbon Offsets

- 2026 Best Paper Award, AEJ: Applied Economics

American Economic Journal: Applied Economics 2025, 17(1): 1–40
https://doi.org/10.1257/app.20230052

Do Carbon Offsets Offset Carbon?†

By Raphael Calel, Jonathan Colmer,
Antoine Dechezleprêtre, and Matthieu Glachant*

We develop and implement a new method for identifying wasted subsidies and use it to provide systematic evidence of the misallocation of carbon offsets in the Clean Development Mechanism—the world's largest carbon offset program. Using newly constructed data on the locations and characteristics of over 1,000 wind farms in India, we estimate that at least 52 percent of approved carbon offsets were allocated to projects that would very likely have been built anyway. We estimate that the sale of these offsets to regulated polluters resulted in substantially higher global carbon dioxide emissions.(*JEL* H23, O13, Q42, Q54, Q58)

Carbon Offsets: Concerns

- Climate mitigation frameworks prioritize direct CO_2 reductions and treat offsets as a last resort (IPCC, 2022; Axelsson et al., 2024).
- **Practical concerns**
  - Additionality (Schneider and Kollmuss, 2015; Bumpus and Liverman, 2008)
  - Credibility (Hyams and Fawcett, 2013; Hooper et al., 2008)
  - Double counting (Schneider et al., 2015; Trencher et al., 2024)
  - Leakage (Murray et al., 2004)
  - Limited real abatement (Berg et al., 2025; Calel et al., 2025; Groom and Venmans, 2023)
- **Ethical concerns**
  - Moral licensing (Dorner, 2019)
  - Commodification of nature (Aldred, 2012)

Regulatory and Legal Context

- European Parliament has adopted rules to ban unverified environmental claims.

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EU to ban 'climate neutral' claims by 2026

Brussels to crack down on greenwashing of consumer products

Save

Regulatory and Legal Context (cont.)

- UK guidance recommends disclosure of whether neutrality is achieved through reductions or offsetting, and to what extent.

Department for Energy Security & Net Zero

Consultation outcome

Voluntary carbon and nature markets: raising integrity - consultation document (accessible webpage)

Updated 26 March 2026

The FCA's anti-greenwashing rule requires regulated firms to ensure any references to the sustainability characteristics of a product or service are consistent with the actual characteristics and are fair, clear and not misleading[footnote 34]. This would apply to any financial product that had carbon credits as underlying assets. The FCA also has TCFD-aligned disclosure requirements for UK-listed companies through which such companies should ensure their use (if any) of carbon credits is appropriately and accurately disclosed. This also supports third party scrutiny of companies' disclosures, which the Government recognises can play an important role in the integrity of the markets.

In the UK, the accuracy and efficacy of green claims made in corporate advertising and marketing are overseen by Competition and Markets Authority (CMA) and Advertising Standards Authority (ASA) respectively. The CMA and the ASA have acted against various UK businesses for making misleading 'carbon neutral' and 'net zero' claims. These have typically involved overstated environmental achievements or failure to fully account for emissions, for example:

- Overreliance on Carbon Credits: Some businesses have claimed 'net zero' status primarily through the purchase of carbon credits without sufficient efforts to reduce their actual emissions across Scopes 1, 2, and 3.
- Premature Claims: Companies have declared themselves 'net zero' or 'carbon neutral' before fully implementing all feasible decarbonisation measures within their value chains.
- Misleading Offsetting Practices: There have been cases where businesses used carbon credits to offset emissions but did not disclose that these were used to address residual emissions only after minimisation efforts.
- Voluntary Actions Misrepresented: Claims of 'carbon neutrality' have sometimes been based on voluntary actions that do not align with independent frameworks for net zero targets.
- No explanation given: Some businesses did not explain how carbon neutrality is being achieved.

Regulatory and Legal Context (cont.)

- The German court ruled that companies must explain what 'climate neutral' means–or else they should not use it in advertising their products (The Wall Street Journal, 2024).

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Companies Must Explain What 'Climate Neutral' Means—or Not Use It, German Court Says

Ruling comes as sustainability chiefs in Europe and the U.S. face stricter regulations on what they can and can't claim about their products' ecological credentials

By Joshua Kirby

Regulatory and Legal Context (cont.)

- Delta Air Lines sued for allegedly false carbon neutrality claim.

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The age of extinction
Carbon offsetting

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Delta Air Lines faces lawsuit over $1bn carbon neutrality claim

US airline pledged to go carbon neutral but plaintiffs say it is relying on offsets that do almost nothing to mitigate global heating

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Regulatory and Legal Context (cont.)

- Climate Partner and Carbon Trust cease to provide carbon-neutral labels.

German certifier withdraws 'climate neutral' label in face of growing criti

#Company climate claims

Clean Energy Wire

Following growing criticism and a wave of court cases against product labels pror neutrality, German certifier ClimatePartner is withdrawing its 'carbon neutral' la will be phased out after a transitional period given that "the regulatory framewor and existing sustainability standards are being questioned," the Munich-based c a press release. ClimatePartner said this will be replaced with the new climate acti "ClimatePartner certified," which "takes into account the increased demands for climate action and in particular the need to reduce greenhouse gas emissions." According to ClimatePartner, the new label sets higher requirements for companies, including mandatory emissions reduction targets, and is also more transparent. Companies wishing to use it on a product must set organisational reduction targets, prove that they have already implemented reduction measures, and "contribute to global climate action by financing climate projects." ClimatePartner head Moritz Lehmkuhl said in an interview last week that the label "climate neutral" the company uses in Germany is "not future-proof."

The Carbon Trust is replacing carbon neutral labels for four new labels that focus on emission reduction and comparisons of products carbon footprints.

As reported by the Grocer, Carbon Trust director John Newton said consumers and businesses were demanding "more rigorous requirements and detail" when it came to making carbon claims. Understanding of the term carbon neutral varied, he added, so focusing on carbon reductions was "simpler."

One of the labels is for products that are reducing emissions according to the company's science-based net zero targets. Another shows how product emissions have been reduced from a specific year.

Two of the labels show product carbon footprint compared to similar products in the same market.

Research Questions

- To what extent do consumers value transparency in terms of shares of offsetting and reduction on carbon-neutral labels?
- Do consumers' preferences differ for CO_2 reductions and CO_2 offsets and if so, how?
- How does the presence of other sustainability labels (organic and ethical trade) is associated with WTP for carbon-neutral labels and transparency?

Consumer Valuation

- Existing evidence on willingness to pay is mixed:
  - positive premium: Gassler et al., 2015; Vecchio and Annunziata, 2015; Drichoutis et al., 2016; Birkenberg et al., 2021; Bek, 2022
  - no premium based on hedonic analysis of actual market data: Carattini et al., 2025

Transparency and Demand

- Transparency may increase demand
  - by reducing information asymmetries (Akerlof, 1970; Darby and Karni, 1973)
- Transparency may also reduce demand
  - if there are practical or ethical concerns regarding carbon offsets (Carattini and Tavoni, 2016)
  - if additional detail creates confusion in markets without standardized labels (Brécard, 2017; Heyes and Martin, 2018)
- Therefore, the net effect depends on:
  - whether consumers distinguish CO_2 offsets from reductions
  - and how they process and value additional information

Contribution

- Consumers' valuation of climate labels (Drichoutis et al., 2016; Akaichi et al., 2017; Feucht and Zander, 2018; Grebitus et al., 2013; Onozaka and McFadden, 2011; Bek, 2022)
  - First evidence on whether transparency in carbon-neutral labels affects consumers' MWTP
- Economics of CO_2 offsetting (Blasch and Farsi, 2014; Ziegler et al., 2012; Brouwer et al., 2008; MacKerron et al., 2009; Carattini and Tavoni, 2016; Bek, 2022; Roemer et al., 2023)
  - Tests whether consumers value offsets differently from reductions
  - Between-subject design reduces contrast and demand effects relative to prior within-subject studies

Contribution (cont.)

- Competition between sustainability labels (Onozaka and McFadden, 2011; Akaichi et al., 2020; Brécard, 2014, 2017; Heyes and Martin, 2018; Poret, 2019)
  - Shows that organic and ethical-trade labels crowd out the marginal value of the carbon-neutral claim

Outline

- Survey & Choice Experiment Design
- Empirical Approach
- Results:
  - The Effect of Transparency on Consumer WTP
  - The Role of Competing labels
- Conclusion

Survey

- Pre-registered DCE[1] survey targeting tea consumers in the UK (representative sample)
- 80 teabags (or 200-gram box of tea)
- Pilot: 157 participants
- Main Survey: 1,339 participants[2]

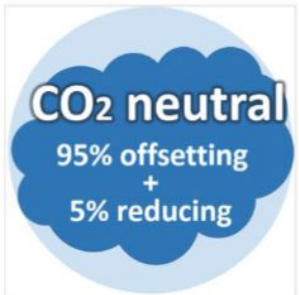
Sample | Covariate balance

Figure 1: Tea product

[1] 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

[2] Analyzed sample: 1,321 participants (protest responses excluded (1%))

Experimental Design

	Control Group	Treatment Group 1	Treatment Group 2
Label explanation	Yes	Yes	Yes
Carbon-neutral label			
CO_2 offset share	No information	%95	%50
CO_2 reduction share	No information	%5	%50
No. of participants	448	447	444

CN label explanation-sample 1 CN label explanation-sample 2 CN label explanation-sample 3

Choice Experiment Design

Attribute	Levels
Carbon-neutral label	Yes / No
Organic label	Yes / No
Ethical trade label	Yes / No
Price (£)	0.90, 1.90, 2.90, 3.90, 4.90, 5.90, 6.90

Table 1: Choice attributes and attribute levels used in the DCE

- 16 choice cards with two blocks
- Two tea product alternatives and 'none of the two' alternative

Main choice design | Pre-test choice design | Survey | Hypothetical bias mitigation

Choice Experiment Design (cont.)

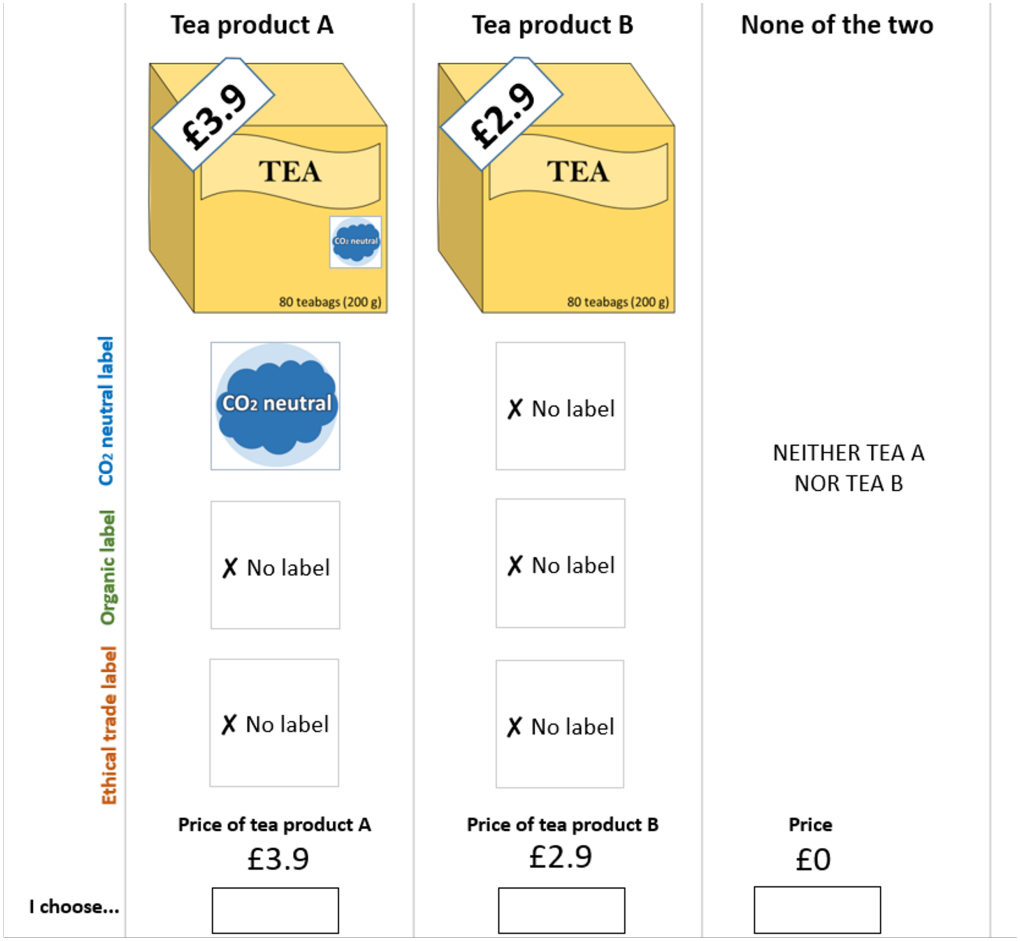


Figure 2: Example choice card shown to control group, block 2

Choice Experiment Design (cont.)

Figure 3: Choice cards shown to the control group, block 1

Empirical Approach

- Random Utility Model (RUM) Lancaster (1966); McFadden (1973): individuals choose the alternative that maximizes utility
- Utility depends on price, product attributes, and unobserved factors:

$$U_{inj} = \alpha_i p_{inj} + \beta_i^\top \mathbf{X}_{inj} + s_{in} + \varepsilon_{inj}$$

- Standard preference-space approach: MWTP is recovered as the ratio of coefficients, $-\beta_i/\alpha_i$
- Issue: when both coefficients are random, this ratio may generate unstable MWTP distributions Hensher et al. (2005); Daly et al. (2012)

Empirical Approach (cont.)

- Mixed Logit WTP-space specification (Train and Weeks, 2005):

$$U_{inj} = -\alpha_i(p_{inj} - \mathbf{w}_i^\top \mathbf{X}_{inj}) + s_{in} + \varepsilon_{inj}$$

$\alpha_i > 0$: utility scale, w_i: MWTP vector, s_{in}: status quo utility

- Experimental group comparisons: Pairwise differences in MWTP across experimental groups tested using the approach by Poe et al. (2005).

- Multiple hypothesis testing: P-values adjusted using the Holm-Bonferroni method (Holm, 1979) to account for multiple comparisons.

Results

Control Group

0.55***

(0.08)

Treatment Group 1

0.52***

(0.10)

Treatment Group 2

0.32***

(0.09)

Table 2: MWTP estimates (£)

Holm-corrected p-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Comparison	**Poe-test**
Control vs. Treatment 1	0.40 ($p = 0.80$)
Control vs. Treatment 2	0.03 ($p = 0.15$)
Treatment 1 vs. Treatment 2	0.06 ($p = 0.25$)

Table 3: Holm-adjusted results for pairwise comparisons

Choice output Choices

Robustness Tests

- Choice models
  - Preference space estimations (multinomial logit model, mixed logit model)
  - Relaxing or increasing sample restrictions (e.g., including protest responses, excluding speeders or those who fail attention/manipulation checks)
  - WTP space estimations (multinomial logit model, mixed logit model, increased number of Halton draws, model with error components)
- Contingent valuation method CVM

Mechanisms

- 51% misunderstand offsetting; no evidence of different WTP across experimental groups Understanding of offsetting
- 95/5 label: highest confusion (34.07%) Trust & Confusion
- Tested mechanisms: trust, confusion, offset concerns, climate worry, guilt, social approval, beliefs about polluters pays principle, and resource constraints
- Holm-adjusted Wald tests: no significant pairwise differences

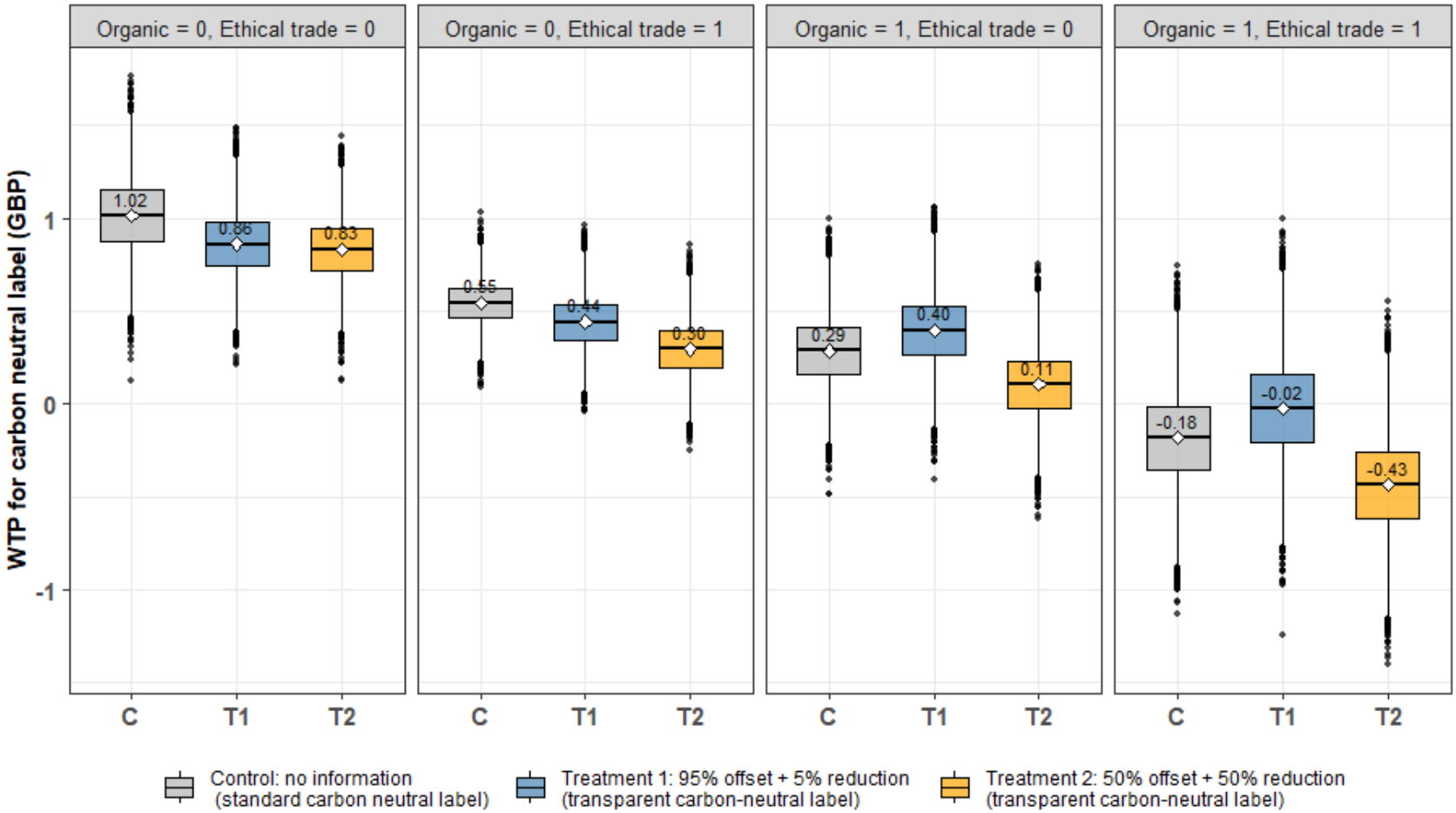
Statements Mechanisms

Heterogeneity

- Some patterns emerge in MWTP for the carbon-neutral label:
  - High income (*household income* $\geq$ *£50,000 after taxes*): associated with higher MWTP in the control (£0.72) and Treatment 2 (£1.24)
  - High education (*Bachelor's degree or above*): associated with higher MWTP in the control (£0.63) and Treatment 1 (£0.76)
  - Age: significant only in Treatment 1, but economically small: about £0.02 lower MWTP per additional year
- However, these subgroup differences are not statistically different across experimental groups after Holm-Bonferroni adjustment

Socioeconomic heterogeneity

Competing Labels



Competing labels

Conclusion

- No evidence that transparency increases WTP
- No evidence of preference for reductions over offsets
- Disclosure may need to be complemented by regulation

Policy implications

The End

Thank you for your attention!

Working Paper

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Appendix

	Non-tea consumers (N = 222)	Tea consumers (N = 1,339)	SMD
Descriptive statistics			
Age	Mean: 50.54 (SD: 16.78)	Mean: 47.54 (SD: 16.52)	0.180
Male, n (%)	111 (50.0%)	653 (48.8%)	0.025
Higher than post-secondary education (up to 1 year), n (%)	52 (23.4%)	491 (36.7%)	-0.292

This table displays descriptive statistics and standardized mean differences (SMDs) between tea consumers and non-tea consumers across age, gender, and education characteristics. Note that the tea consumer sample includes protest responses.

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Covariate	Control (Mean)	Treatment 1 (Mean)	Treatment 2 (Mean)	C - T1 (SMD)	C - T2 (SMD)	T1 - T2 (SMD)
Only confused with transparent labels	0.45	0.38	0.50	0.15	-0.09	-0.24
Only trust transparent labels	0.57	0.58	0.55	-0.01	0.05	0.06
Confusion level	4.25	4.16	4.18	0.06	0.05	-0.01
Trust level	4.28	4.21	4.28	0.05	0.00	-0.05
Concern level (for CO_2 offsets)	4.45	4.32	4.34	0.09	0.07	-0.01
Climate worry	4.96	4.79	4.91	0.10	0.03	-0.08
Warm glow	4.43	4.20	4.21	0.15	0.14	-0.00
Guilt	3.80	3.67	3.64	0.08	0.09	0.02
Social approval	4.44	4.29	4.17	0.11	0.20	0.09
Polluter pays	4.97	4.86	4.97	0.08	0.00	-0.07
Financial constraints	4.97	4.74	4.94	0.14	0.02	-0.12
Time restrictions	3.62	3.36	3.55	0.16	0.04	-0.11
Gender (male)	0.51	0.47	0.49	0.09	0.05	-0.04
Age	47.72	47.88	46.73	-0.01	0.06	0.07
High education	0.38	0.36	0.37	0.03	0.02	-0.01
Employed	0.63	0.65	0.66	-0.03	-0.07	-0.04
High income	0.30	0.32	0.33	-0.05	-0.07	-0.02
Not disclosed income	0.09	0.07	0.06	0.10	0.12	0.02

This table continues on the next page, where table notes are provided.

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Covariate	Control (Mean)	Treatment 1 (Mean)	Treatment 2 (Mean)	C - T1 (SMD)	C - T2 (SMD)	T1 - T2 (SMD)
Effectiveness of offsetting	4.37	4.18	4.35	0.14	0.01	-0.12
Putting a price on nature	4.79	4.73	4.70	0.05	0.07	0.02
Moral licensing	4.91	4.87	4.81	0.03	0.07	0.04
Offsetting as greenwashing	4.88	4.71	4.84	0.13	0.03	-0.10
Survey time	16.14	11.41	16.31	0.11	-0.00	-0.10
Familiarity with the label	0.12	0.14	0.12	-0.05	-0.00	0.05
Manipulation checker (percentage info.)	0.50	0.51	0.46	-0.01	0.08	0.09
Attention checker (number of labels)	0.63	0.60	0.63	0.06	0.01	-0.06
Attention checker (definition of CO_2 offsetting)	0.37	0.55	0.52	-0.36	-0.32	0.05
Not consider carbon neutral label (ANA)	0.30	0.35	0.35	-0.10	-0.10	-0.00
Consequentiality	0.52	0.57	0.51	-0.11	0.00	0.12
Member of environmental organization	0.10	0.12	0.11	-0.07	-0.02	0.04
Response certainty	8.03	8.00	8.05	0.02	-0.01	-0.03

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Block	Choice card	Price Alt1	CN Alt1	Org Alt1	ET Alt1	Price Alt2	CN Alt2	Org Alt2	ET Alt2
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

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Block	Choice card	Price Alt1	CN Alt1	Org Alt1	ET Alt1	Price Alt2	CN Alt2	Org Alt2	ET Alt2
1	1	Yes	No	Yes	4.9	Yes	Yes	No	0.9
1	2	No	Yes	No	4.9	Yes	No	No	4.9
1	3	Yes	Yes	No	5.9	Yes	No	Yes	2.9
1	4	Yes	No	No	3.9	No	Yes	Yes	4.9
1	5	No	Yes	No	3.9	Yes	No	Yes	6.9
1	6	No	No	Yes	6.9	No	Yes	No	2.9
1	7	No	Yes	No	0.9	Yes	No	Yes	1.9
1	8	Yes	Yes	No	2.9	No	Yes	Yes	3.9
2	1	Yes	No	Yes	5.9	Yes	Yes	No	5.9
2	2	No	Yes	Yes	2.9	Yes	No	Yes	4.9
2	3	No	Yes	No	1.9	Yes	No	Yes	5.9
2	4	Yes	No	No	0.9	No	Yes	Yes	3.9
2	5	No	Yes	Yes	4.9	Yes	Yes	No	2.9
2	6	No	Yes	No	6.9	Yes	No	No	1.9
2	7	Yes	No	No	6.9	No	Yes	No	0.9
2	8	No	Yes	No	1.9	No	No	Yes	2.9

Choice Design - main survey

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- What is your year of birth?
- What is your gender?
  - Male.
  - Female.
  - Non-binary.
  - I prefer not to say.
- 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

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How frequently do you purchase tea?

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

How frequently do you drink tea?

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

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- Cheap talk: 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.
- Oath Script: 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.
- Budget Reminder: 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.

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Control group:

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**.

Emission offsetting, reduction, or a combination thereof ensures that the entire lifecycle of this tea product is carbon-neutral.

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Treatment group 1:

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

- **95% offset** (compensated) by investing in activities **outside of the company** such as tree planting projects; **and**
- **5% reduced within the company** in the last five years, such as through investments in cleaner production processes.

The combination of emission offsetting and reduction ensures that the entire lifecycle of this tea product is carbon-neutral.

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Treatment group 2:

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

- **50% offset** (compensated) by investing in activities **outside of the company** such as tree planting projects; **and**
- **50% reduced within the company** in the last five years, such as through investments in cleaner production processes.

The combination of emission offsetting and reduction ensures that the entire lifecycle of this tea product is carbon-neutral.

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	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.

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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

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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. [P] indicates the responses that will be categorized as protests.)

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

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- 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?**

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- Can you shortly describe how you made your choices?
  ... (Open-ended)
- 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).
- 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.)

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- 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.
- How many different **tea product labels** appear on the choice cards?
  - 1 label
  - 2 label
  - 3 labels
  - I do not remember.
- In this survey, did carbon-neutral label include any percentages (%) of carbon offsetting and carbon reduction?
  - Yes.
  - No.
  - I do not remember.

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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.							

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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 lifecycle 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.							

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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.

Which label(s) do you trust the most?

- Label 1
- Label 2
- Label 3
- None

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

- Label 1
- Label 2
- Label 3
- None

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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.							

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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%

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	Full sample	Control	Treatment 1	Treatment 2
Means of parameters				
$MWTP_{Carbon\ neutral}$	0.47***	0.55***	0.52***	0.32***
	(0.11)	(0.08)	(0.10)	(0.09)
$MWTP_{Organic}$	1.10***	1.04***	1.15***	1.13***
	(0.07)	(0.09)	(0.11)	(0.10)
$MWTP_{Ethical\ trade}$	1.17***	1.15***	1.14***	1.23***
	(0.07)	(0.11)	(0.12)	(0.11)
μ_{Price}	-0.17***	-0.11	-0.18***	-0.21***
	(0.04)	(0.07)	(0.06)	(0.07)
$\mu_{Status\ quo}$	-4.26***	-4.73***	-3.97***	-4.28***
	(0.19)	(0.33)	(0.27)	(0.29)
Standard deviations of random parameters				
$\sigma_{Carbon\ neutral}$	1.24***	1.31***	1.36***	1.25***
	(0.46)	(0.12)	(0.24)	(0.12)
$\sigma_{Organic}$	1.64***	1.41***	1.57***	1.69***
	(0.10)	(0.14)	(0.14)	(0.10)
$\sigma_{Ethical\ trade}$	1.48***	1.40***	1.43***	1.47***
	(0.12)	(0.19)	(0.15)	(0.15)
σ_{Price}	0.77***	0.78***	0.74***	0.82***
	(0.07)	(0.07)	(0.09)	(0.07)
$\sigma_{Status\ quo}$	2.27***	2.49***	2.12***	2.22***
	(0.13)	(0.24)	(0.18)	(0.19)
Log Likelihood	-8540.44	-2808.57	-2898.27	-2822.83
AIC	17100.88	5637.13	5816.54	5665.67
BIC	17173.54	5698.88	5878.24	5727.21
Pseudo-R^2	0.26	0.28	0.25	0.26
Number of observations	10568	3552	3536	3480
Number of participants	1321	444	442	435

This table reports results from a mixed logit model estimated in WTP space. Robust standard errors are shown in parentheses. Statistical significance is assessed using Holm–Bonferroni-adjusted p-values, applied within each experimental group to the set of four tests (the MWTP coefficients and the status quo parameter): *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

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	 Control	 Treatment 1	 Treatment 2
MWTP$_{\text{Carbon neutral}}$	4.30*** (0.16)	4.41*** (0.17)	4.75*** (0.16)
Holm-Bonferroni adjusted Poe test			
Control vs Treatment 1	0.69 (p = 0.617)		
Control vs Treatment 2	0.98 (p = 0.144)		
Treatment 1 vs Treatment 2		0.92 (p = 0.313)	
Unadjusted Poe test			
Control vs Treatment 1	0.69 (p = 0.617)		
Control vs Treatment 2	0.98 (p = 0.048)		
Treatment 1 vs Treatment 2		0.92 (p = 0.157)	

WTP estimates are based on 10,000 bootstraped samples. Significance levels: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$. Poe test statistics are reported with Holm-Bonferroni adjusted p-values (for three pairwise comparisons).

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	Full sample	Control	Treatment 1	Treatment 2
$MWTP_{Carbon\ neutral} \times$ Understanding the term "offsetting"	0.46***	0.37*	0.33	0.61**
	(0.13)	(0.20)	(0.21)	(0.25)
Means of parameters				
$MWTP_{Carbon\ neutral}$	0.23***	0.36**	0.35**	0.03
	(0.07)	(0.14)	(0.13)	(0.16)
$MWTP_{Organic}$	1.08***	1.04***	1.16***	1.12***
	(0.06)	(0.09)	(0.11)	(0.11)
$MWTP_{Ethical\ trade}$	1.17***	1.14***	1.15***	1.18***
	(0.06)	(0.11)	(0.12)	(0.11)
$\mu_{Status\ quo}$	-4.29***	-4.73***	-3.97***	-4.30***
	(0.17)	(0.33)	(0.26)	(0.30)
μ_{Price}	-0.17***	-0.11	-0.18***	-0.21***
	(0.04)	(0.07)	(0.06)	(0.07)
Standard deviations of random parameters				
$\sigma_{Carbon\ neutral}$	1.22***	1.27***	1.37***	1.17***
	(0.13)	(0.13)	(0.22)	(0.16)
$\sigma_{Organic}$	1.59***	1.41***	1.58***	1.67***
	(0.10)	(0.15)	(0.15)	(0.13)
$\sigma_{Ethical\ trade}$	1.47***	1.39***	1.43***	1.42***
	(0.06)	(0.18)	(0.14)	(0.14)
σ_{Price}	0.79***	0.78***	0.73***	0.84***
	(0.04)	(0.07)	(0.09)	(0.07)
$\sigma_{Status\ quo}$	2.28***	2.50***	2.13***	2.25***
	(0.13)	(0.24)	(0.18)	(0.21)
Log Likelihood	-8532.81	-2806.72	-2897.00	-2818.81
AIC	17087.63	5635.45	5815.99	5659.62
BIC	17167.55	5703.37	5883.87	5727.32
Pseudo R^2	0.27	0.28	0.25	0.26
Number of observations	10568	3552	3536	3480
Number of participants	1321	444	442	435

This table reports the choice model output from the mixed logit model estimated in WTP space. Robust standard errors are reported in parentheses. Holm-adjusted p-values account for 5 comparisons (WTP parameters, the status quo, and interaction term): *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

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		Full sample		Control		Treatment 1		Treatment 2	
		N	Share	N	Share	N	Share	N	Share
Trust for label 1		309	23.39%	109	24.55%	90	20.36%	110	25.29%
Trust for label 2		330	24.98%	114	25.68%	124	28.05%	92	21.15%
Trust for label 3		519	39.29%	179	40.32%	164	37.10%	176	40.46%
Trust (none)		264	19.98%	80	18.02%	97	21.95%	87	20.00%
Confusion about label 1		341	25.81%	111	25.00%	130	29.41%	100	22.99%
Confusion about label 2		450	34.07%	162	36.49%	124	28.05%	164	37.70%
Confusion about label 3		336	25.44%	106	23.87%	116	26.24%	114	26.21%
Confusion (none)		393	29.75%	131	29.50%	144	32.58%	118	27.13%

This table is based on participants' responses to the question about which label they trust most and which they find most confusing among the three label options (Label 1, Label 2, Label 3) and the 'none' option. This question was asked after the choice experiment. Multiple selections were allowed. 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 split between CO_2 reduction and CO_2 offsetting (50%-50%).

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Statement	SD	MD	SltD	N	SltA	MA	SA
I worry about climate change.	5.98	5.45	7.57	13.02	28.08	22.79	17.11
Limited financial resources prevent me from buying climate-friendly products.	5.83	4.69	8.55	16.73	23.54	21.88	18.77
Lack of time prevents me from buying climate-friendly products.	16.35	13.02	19.53	24.30	12.94	8.71	5.15
My positive emotions increase when I choose climate-friendly products.	8.02	6.43	9.31	31.87	22.71	13.40	8.25
I feel guilty when I buy conventional products.	14.84	11.36	18.85	21.88	16.96	8.71	7.42
Most people approve of my choice of climate-friendly products.	5.53	3.71	8.10	47.16	15.97	12.34	7.19
Producers are responsible for climate change mitigation costs.	2.35	3.63	8.48	23.54	23.92	21.88	16.20
I trust carbon-neutral labels.	5.90	6.06	12.64	31.26	25.44	13.55	5.15
I am confused about carbon-neutral labels.	5.00	8.25	14.84	26.87	29.37	10.14	5.53
I am concerned about carbon offsets.	5.07	4.69	13.63	30.81	25.28	11.73	8.78
Carbon offsetting reduces carbon emissions.	5.60	4.92	12.49	31.11	27.93	12.41	5.53
Carbon offsetting allows producers to continue polluting.	1.89	2.95	8.02	30.20	30.96	15.37	10.60
Carbon offsetting is a misleading sense of relief.	2.57	1.67	6.28	27.18	32.10	19.15	11.05
Carbon offsetting is a form of greenwashing.	1.74	1.97	6.43	33.61	28.16	15.82	12.26

Values indicate the percentage of respondents who selected each agreement level. SD = Strongly Disagree, MD = Mostly Disagree, SltD = Slightly Disagree, N = Neutral, SltA = Slightly Agree, MA = Mostly Agree, SA = Strongly Agree.

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	Full sample	Control	Treatment 1	Treatment 2
$MWTP_{Carbon\ neutral}$	-0.26	-0.43	-0.25	-0.19
	(0.16)	(0.29)	(0.26)	(0.29)
Main interactions				
$MWTP_{Carbon\ neutral}$ × Only confused with transparent labels	0.03	0.21	0.24	-0.32
	(0.15)	(0.20)	(0.19)	(0.24)
$MWTP_{Carbon\ neutral}$ × Only trust transparent labels	0.65***	0.80***	0.39	0.72**
	(0.14)	(0.23)	(0.20)	(0.23)
$MWTP_{Carbon\ neutral}$ × Concern level	0.18***	0.08	0.30***	0.15
	(0.05)	(0.10)	(0.08)	(0.18)
$MWTP_{Carbon\ neutral}$ × Trust level	0.09	0.16	0.12	-0.05
	(0.05)	(0.08)	(0.07)	(0.09)
$MWTP_{Carbon\ neutral}$ × Confusion level	-0.03	0.01	-0.00	-0.16
	(0.06)	(0.06)	(0.06)	(0.08)
$MWTP_{Carbon\ neutral}$ × Climate worry	0.06	0.01	-0.05	0.25
	(0.05)	(0.10)	(0.08)	(0.22)
$MWTP_{Carbon\ neutral}$ × Guilt	0.12	0.15	0.11	0.13
	(0.05)	(0.07)	(0.08)	(0.13)
$MWTP_{Carbon\ neutral}$ × Social approval	0.18***	0.29	0.21	0.00
	(0.05)	(0.11)	(0.09)	(0.09)
$MWTP_{Carbon\ neutral}$ × Polluter pays	-0.02	-0.01	-0.12	0.03
	(0.04)	(0.09)	(0.06)	(0.09)
$MWTP_{Carbon\ neutral}$ × Financial constraints	-0.18***	-0.16	-0.15	-0.22
	(0.04)	(0.11)	(0.07)	(0.09)
$MWTP_{Carbon\ neutral}$ × Time restrictions	-0.02	-0.08	-0.03	0.06
	(0.04)	(0.07)	(0.06)	(0.06)
Socioeconomic interactions	Yes	Yes	Yes	Yes
Sustainability label attributes, price, status quo	Yes	Yes	Yes	Yes
Standard deviations of random parameters	Yes	Yes	Yes	Yes
Log Likelihood	-8371.60	-2746.65	-2835.84	-2756.99
AIC	16797.20	5547.30	5725.68	5567.97
BIC	16993.37	5714.04	5892.29	5734.15
Pseudo R^2	0.28	0.30	0.27	0.28
Number of observations	10568	3552	3536	3480
Number of participants	1321	444	442	435

This table presents the choice model output from the mixed logit model estimated in WTP space, including interaction variables. Robust standard errors are reported in parentheses. All parameters, except for the interaction terms, are randomized. Significance levels: *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$. Significance stars in the main table are based on Holm-Bonferroni-adjusted p-values for the coefficients in the Holm set (excluding the price parameter and the standard deviations). Pre-registered binary indicators identifying participants who are confused only by transparent labels but not by standard labels, and those who trust only transparent but not standard labels, are based on survey questions 18 and 19 in Section E of the Appendix. The pre-registered psychological and contextual variables–confusion, trust, concern, climate worry, guilt, social approval, and beliefs about the polluter-pays principle–along with resource constraints (financial and time), are measured using the statements in the first ten rows of Table A.6 in the Appendix.

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	Full sample	Control	Treatment 1	Treatment 2
Means of the parameters				
$MWTP_{Carbon\ neutral}$	0.95***	1.01***	0.89***	0.99***
	(0.15)	(0.20)	(0.17)	(0.18)
$MWTP_{Organic}$	1.70***	1.60***	1.80***	1.70***
	(0.20)	(0.36)	(0.18)	(0.17)
$MWTP_{Ethical\ trade}$	1.75***	1.70***	1.80***	1.73***
	(0.21)	(0.33)	(0.20)	(0.16)
β_{Price}	-0.17***	-0.10	-0.19***	-0.20***
	(0.05)	(0.07)	(0.06)	(0.08)
$\beta_{Status\ quo}$	-4.02***	-4.56***	-3.77***	-4.23***
	(0.23)	(0.38)	(0.28)	(0.34)
Interactions				
$MWTP_{Carbon\ neutral}$ x $MWTP_{Organic}$	-0.21	-0.32	0.11	-0.53
	(0.19)	(0.32)	(0.30)	(0.30)
$MWTP_{Carbon\ neutral}$ x $MWTP_{Ethical\ trade}$	-0.22	-0.31	0.01	-0.48
	(0.17)	(0.26)	(0.28)	(0.24)
$MWTP_{Organic}$ x $MWTP_{Ethical\ trade}$	-0.34	-0.29	-0.54	-0.26
	(0.18)	(0.39)	(0.29)	(0.25)
$MWTP_{Carbon\ neutral}$ x $MWTP_{Organic}$ x $MWTP_{Ethical\ trade}$	-1.29***	-1.18***	-1.58***	-0.78
	(0.29)	(0.38)	(0.45)	(0.37)
Covariances				
Cov (Carbon neutral, Organic)	0.69***	0.52***	0.81***	0.67***
	(0.14)	(0.12)	(0.14)	(0.09)
Cov (Carbon neutral, Ethical trade)	0.91***	0.95***	0.88***	0.76***
	(0.21)	(0.20)	(0.13)	(0.08)
Cov (Organic, Ethical trade)	0.41***	0.63***	0.42***	0.34***
	(0.10)	(0.12)	(0.11)	(0.08)
Standard deviations of random parameters	Yes	Yes	Yes	Yes
Log Likelihood	-8302.66	-2721.48	-2813.28	-2746.64
AIC	16639.32	5476.96	5660.55	5527.28
BIC	16762.83	5581.94	5765.46	5631.92
Pseudo R^2	0.28	0.30	0.28	0.28
Number of observations	10568	3552	3536	3480
Number of participants	1321	444	442	435

This table reports the choice model output from the MXL model estimated in WTP space. Robust standard errors are reported in parentheses. Holm-adjusted p-values account for 8 comparisons (WTP parameters, the status quo, and interaction terms): *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

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Appendix

	Full sample	Control	Treatment 1	Treatment 2
Socioeconomic interactions				
$MWTP_{\text{Carbon neutral}}$ x Male	0.01	-0.09	0.41	-0.15
	(0.12)	(0.23)	(0.21)	(0.23)
$MWTP_{\text{Carbon neutral}}$ x Age	-0.01	-0.00	-0.02**	-0.01
	(0.00)	(0.01)	(0.01)	(0.01)
$MWTP_{\text{Carbon neutral}}$ x High education	0.55***	0.63*	0.76**	0.40
	(0.13)	(0.25)	(0.28)	(0.27)
$MWTP_{\text{Carbon neutral}}$ x Employed	-0.09	-0.06	0.01	-0.08
	(0.13)	(0.27)	(0.25)	(0.26)
$MWTP_{\text{Carbon neutral}}$ x High income	0.75***	0.72**	0.50	1.24***
	(0.13)	(0.25)	(0.24)	(0.25)
$MWTP_{\text{Carbon neutral}}$ x Not disclosed income	-0.29	-0.68*	0.16	-0.47
	(0.16)	(0.27)	(0.40)	(0.79)
Means of parameters				
$MWTP_{\text{Carbon neutral}}$	0.13	0.29	-0.09	-0.03
	(0.12)	(0.20)	(0.22)	(0.24)
$MWTP_{\text{Organic}}$	1.07***	1.05***	1.16***	1.10***
	(0.06)	(0.09)	(0.10)	(0.12)
$MWTP_{\text{Ethical trade}}$	1.16***	1.19***	1.16***	1.12***
	(0.06)	(0.10)	(0.12)	(0.11)
$\mu_{\text{Status quo}}$	-4.23***	-4.63***	-3.93***	-4.22***
	(0.17)	(0.31)	(0.26)	(0.29)
μ_{Price}	-0.17***	-0.11*	-0.18***	-0.21***
	(0.04)	(0.07)	(0.06)	(0.07)
Standard deviations of random parameters	Yes	Yes	Yes	Yes
Log Likelihood	-8480.40	-2790.12	-2869.27	-2800.80
AIC	16992.80	5612.25	5770.55	5633.59
BIC	17109.05	5711.05	5869.28	5732.07
Pseudo R^2	0.27	0.28	0.26	0.27
Number of observations	10568	3552	3536	3480
Number of participants	1321	444	442	435

This table reports the choice model output from the mixed logit model estimated in WTP space. Robust standard errors are reported in parentheses. Holm-adjusted p-values account for 10 comparisons (WTP parameters, the status quo, and interaction terms): *** $p \leq 0.01$, ** $0.01 < p \leq 0.05$, * $0.05 < p \leq 0.1$.

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Appendix

- Demand side market forces fail to sort label quality.
- Firms would need to demonstrate *direct* emission reductions before relying on offsetting
- Reduction requirement thresholds could be set according to sector-level abatement feasibility
- Offset quality can be verified *through* mandatory standardized auditing

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