Sustainable Production and Consumption 61 (2025) 106–117

Contents lists available at ScienceDirect

Sustainable Production and Consumption

journal homepage: www.elsevier.com/locate/spc

The effect of charges, discounts, environmental information, and motivations on consumer preferences for reusable cups: A choice experiment

Bethan Thompson [a,*], Faical Akaichi [a], Luiza Toma [a]

[a] SRUC Edinburgh, King's Buildings Campus, West Mains Road, Edinburgh, EH9 3JG, UK

ARTICLE INFO

Editor: Dr Kuishuang Feng

Keywords:
Consumer preference
Circular economy
Sustainable packaging
Economic incentives
Waste policy

ABSTRACT

Single-use disposable cups are a major contributor to plastic waste due to their widespread use and limited recyclability. In response, policymakers are introducing measures to reduce their consumption and promote reusable alternatives. This study employs a discrete choice experiment with a nationally representative sample to evaluate how regulatory incentives (charges, discounts), persuasive strategies (environmental information prompts), and motivational drivers (perceived threat severity and vulnerability, maladaptive response rewards, response efficacy, self-efficacy, and response costs) influence consumer preferences for single-use, refillable, and returnable cups. We find that a mandatory charge of 25–30 pence is required to reduce disposable cup selection by 50 %, whereas achieving a similar reduction through discounts requires incentives of at least 70 pence. Environmental information prompts had limited effect, slightly increasing preference for returnable cups when offered alone, but not when both reusable options were present. Consumers who were more likely to choose reusable options perceived greater environmental threat, believed their actions to be effective, and felt more capable of acting, supporting Protection Motivation Theory as a valuable framework for understanding behavioural drivers in circular consumption. Policy wise, charges are more efficient than discounts for shifting choices. To increase uptake of reusable cups pair a moderate charge with returnable and refillable options, keep deposits modest, and prioritise practical features that make reuse easy (e.g., simple return points, washing provision) over information alone.

1. Introduction

Reducing the environmental impact of on-the-go beverage consumption is increasingly recognised as a critical step toward more responsible, circular consumption systems. Every year, billions of single-use disposable cups contribute to mounting global waste, with over 4.2 billion used in the UK alone in 2019 (WRAP, 2022). The majority of single-use disposable cups are fibre composite cups which are not easily recycled because it is difficult to separate the plastic lining that makes them waterproof from the cellulose (Mitchell et al., 2014). Improving recycling rates could reduce the environmental footprint of single-use disposable cups by up to 40 % (measured in kilo tonnes of carbon dioxide) but switching to reusable cups could achieve closer to a 66 % reduction (Foteinis, 2020). The reduction in global warming potential of switching to reusable cups depends on the material of the reusable cup and number of reuses (43 uses for plastic, 16 for ceramic, and 111 for metal), as well as the frequency and method of washing and the carbon intensity of the energy grid used for heating water (Fetner and Miller, 2021).

The challenge of reducing single-use cup waste is not solely a technical or economic problem; it depends on consumers making the switch to more responsible forms of consumption. This, in turn, requires transforming the consumption systems that sustain disposability (Gomes et al., 2022). Crucially, this shift cannot rest on individuals, it demands coordinated systemic change. Achieving this transformation is likely to require a combination of regulation, such as implementing charges and discounts, persuasion through information provision, and a deeper understanding of motivational drivers (Borg et al., 2022).

We use a labelled discrete choice experiment (DCE) with a nationally representative sample to estimate how charges, discounts, and other features of reusable cup systems shape choices among single-use, refillable, and returnable cups. A between-subject environmental-

* Corresponding author.
E-mail address: bethan.thompson@sruc.ac.uk (B. Thompson).

https://doi.org/10.1016/j.spc.2025.10.013
Received 6 July 2025; Received in revised form 21 October 2025; Accepted 22 October 2025
Available online 28 October 2025
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information prompt tests whether messaging shifts choices, and Protection Motivation Theory (PMT) measures identify motivational differences between respondent segments. We find that a 25–30p charge is sufficient to halve selection of single-use cups, whereas achieving a comparable reduction via discounts requires ≥70p. Higher deposits suppress selection of returnables, with a slight preference for paying the deposit up front. Segments more inclined toward reusables report higher perceived threat, greater self-efficacy, lower rewards of the status quo, and fewer perceived barriers, consistent with PMT. The information prompt has limited effect.

This is, to our knowledge, the first DCE to jointly evaluate single-use, refillable, and returnable options while testing charges, discounts, deposits, and information alongside PMT. The results indicate that charges are more efficient than discounts for reducing disposable use. To increase uptake of reusables, policymakers and businesses should pair a moderate charge on disposables with widely available reusable options, keep deposits modest, and prioritise practical features that help consumers (e.g., easy return points, washing facilities) over stand-alone information prompts or environmental information campaigns. PMT-based differences also suggest targeting support, building self-efficacy and lowering practical barriers, to sustain reuse across consumer segments.

2. Background

2.1. Charges, discounts and deposits

The EU Directive on single-use plastics requires member states to implement measures to achieve a reduction in the consumption of single-use plastics including single-use disposable cups (European Commission, 2019). In the EU different regimes of discounts (e.g. France) and charges (e.g. The Netherlands) to discourage single-use plastic cups have been implemented with different levels of flexibility (Billie Cup, 2024). Current evidence suggests that charges, where the price of a drink in a single-use cup is increased, are more effective than discounts, where the price of a drink in a reusable cup is reduced, in changing behaviour (Poortinga and Nash, 2019). This is consistent with our understanding of behavioural economic theory where losses are weighed more heavily than gains of the same amount (Kahneman and Tversky, 1979).

Theoretically charges and discounts are two interventions designed to bring about change in behaviour. A review of recent behaviour change techniques and their mechanisms of action shows that material incentives can change behaviour by altering individuals' beliefs about the consequences of their actions and by providing reinforcement (Human Behaviour Change Project, 2025). Changing these antecedents could help to overcome barriers to reusable cup use such as cost and inconvenience (Herweyers et al., 2024).

Empirical evidence on the impact of charges on single-use disposable cup use primarily comes from closed-field trials in settings such as campus coffee shops, where participants are relatively uniform (e.g. students and staff with similar routines and/or socio-demographic characteristics) and therefore not reflective of the wider population (Novoradovskaya et al., 2021; Poortinga and Whitaker, 2018; Sheppard et al., 2025). Only two studies reported in the review by Poortinga and Nash (2019) considered other contexts (Hubbub, 2018; Keep Britain Tidy, 2017) and only one of those introduced a charge as well as a discount (Hubbub, 2018). Other trials are ongoing and some retailers state that they plan to rollout their own schemes combining a discount for reusable cups at 25–30 pence and a 5 pence charge for disposable cups in the UK (Starbucks, 2021). More recent evidence indicates that alternative monetary incentives such as probabilistic rewards could also contribute to increasing reusable cup use (Sheppard et al., 2025). Only one previous choice experiment has been conducted at a Welsh university, which examined the impact of price, framed as a discount on reusable cups, on staff and students' choice between refillable and disposable cups (Harris and Probert, 2009). They found that respondents were willing to spend approximately £0.10 more for coffee in a disposable cup and a greater financial incentive encouraged greater selection of the refillable cup. Given the limitations of the samples across which most studies have been conducted, there is therefore a need to understand how a wider range of consumers are likely to react to single-use cup charges and reusable cup discount. This includes those who primarily purchase cold drinks since these will also be affected by the charge.

Previous studies on the effect of single-use disposable cup charges have focussed on switching to refillable cups where participants were provided with free refillable cups at the beginning of the trial (Poortinga and Nash, 2019). This condition is unrealistic for real-world settings and there are also now two types of reusable cup systems available, those that are refillable, which are owned and brought to the retailer by the consumer, and those that are returnable, which are owned by the retailer and borrowed by the consumer, often with a deposit in the case of takeaway drinks. Returnable cups can be managed by the retailer but might also be managed by separate companies such as in the recent reusable cup pilot across the Highlands (Keep Scotland Beautiful, 2023). Evidence on returnable scheme types and deposit effects is limited to the impact of deposits. A festival-based material flow study suggested deposit-refund models for returnable cups reduce damage and loss compared to non-refundable schemes, indicating deposits may enhance environmental benefits (Šuškevičė and Kruopienė, 2021). Understanding consumer preferences for returnable compared to refillable cups and whether their availability could help support a reduction in single-use disposable cups is important for businesses.

2.2. Environmental information

Theoretically, providing information about the environmental consequences of a behaviour is understood to result in behaviour change by changing knowledge about an issue, beliefs about the consequences of a behaviour and by changing people's attitudes (Human Behaviour Change Project, 2025). Empirically we found two studies that have previously examined the impact of information on reusable cup behaviour. First, a qualitative study comprising 22 interviews in Australia concluded that environmental messaging, mimetic effects as well as infrastructure were important in changing behaviour (Sandhu et al., 2021). Second, a quantitative study by Nicolau et al. (2022) found that consumers more readily brought refillable cups when aware of disposable cup impacts, especially when the topic was personally significant, concluding knowledge interacts with cause importance, supporting some of Sandhu et al.'s (2021) findings regarding clarity on environmental impact and environmental messaging.

2.3. Motivation

Three studies were found that explored different models of behaviour in relation to reusable cup use. Bertossi et al. (2024) highlighted the importance of both value for money and social norms in their Italian vending machine study. The importance of social norms in this context is supported by evidence from Loschelder et al. (2019) that found that a dynamic norm intervention increased use of reusable cups by 17.3 %. In Germany, Keller et al. (2021) assessed preferences for disposable, returnable (refundable), and refillable cups through a survey. Applying the self-regulated behaviour change model (Bamberg, 2013) they found consumers were more likely to bring their own cups than adopt returnable ones, likely due to unfamiliarity or the perception of returnable systems as complementary rather than substitutes.

Protection motivation theory (PMT) (Rogers, 1983) is a model of behaviour originally developed for health-protective behaviour research but has been increasingly used in environmental-protective behaviour research (Kothe et al., 2019). It enables users to explore the role of environmental threat perception in motivating behaviour while also

considering elements of an individual's capabilities and opportunities to engage in the reusable cup use.

PMT proposes that individuals who perceive environmental threats as severe and feel vulnerable to them are more likely to engage in pro-environmental behaviours. This is weighed against maladaptive response rewards, which represent the personal benefits of maintaining current behaviours, in this case, the advantages of using single-use disposable cups. Additionally, PMT suggests that people assess response efficacy (beliefs about the consequences of the behaviour), self-efficacy (confidence in performing the behaviour), which increase the likelihood of engaging in environmental behaviour and response costs (perceived costs of the protective behaviour), which act against it. It therefore contains key behavioural antecedents targeted by our interventions namely beliefs about consequences measured through response efficacy and reinforcement measured through the maladaptive response rewards and response costs.

3. Method

3.1. Discrete choice experiment

A discrete choice experiment (DCE) is a quantitative research technique that asks individuals to choose between two or more (hypothetical) product alternatives described by at least one attribute. We developed a labelled DCE to test whether a single-use disposable cup charge influenced consumer cup choice when purchasing a takeaway non-alcoholic drink. Respondents were randomly assigned to one of four treatments, differing by the number of cup options (three: single-use, returnable, and no purchase; or four: single-use, refillable, returnable, and no purchase) and whether information about the environmental impact of single-use cups was provided. The design assessed (1) how the presence or absence of a refillable cup option affected preferences and (2) how environmental information influenced preferences for single-use, refillable, and returnable cups. The difference between the four treatments is summarised in Table 1. Note that treatments one and two have two additional attributes relating to the returnable cup. The treatments are between subjects.

The environmental information provided to those in treatment 2 and 4 was as follows:

- Single-use disposable cups commonly used for takeaway drinks are the third most prevalent type of litter seen in the UK.
- Due to their plastic (polyethylene) lining most single-use disposable cups are not able to be recycled at most local authority recycling centres meaning they are incinerated or go to landfill. Only 1 in 400 is currently recycled in the UK.
- UK's annual carbon footprint from paper cup consumption is estimated to be 75 kt of carbon dioxide equivalents, which is similar to that of manufacturing 11,500 mid-size passenger cars.
- Switching to a reusable cup could achieve a threefold reduction in carbon emissions as well as reducing littering and waste going to landfill.

Table 1
Treatment groups.

Treatment group	Information	Cup options	Sample	Attributes
Treatment 1	No Information	Four options	300	Cup Type, Charge, Discount, Deposit, Deposit System
Treatment 2	Environmental Information	Four options	300	Cup Type, Charge, Discount, Deposit, Deposit System
Treatment 3	No Information	Three options	300	Cup Type, Charge, Discount
Treatment 4	Environmental Information	Three options	300	Cup Type, Charge, Discount

All respondents were told that they could be purchasing any non-alcoholic drink of their choice in a takeaway cup and that the base price for the drink would be £2. By doing this, we hoped to create a more realistic purchasing situation for the respondents, with the trade-off being that we selected a base price for the drink that was between the lower price of a cold fizzy drink and the higher price of coffee.

3.1.1. Attribute levels

To establish the levels for charges and discounts we reviewed the policy and academic literature. The current recommendation from the Expert Panel on Environmental Charging and Other Measures (EPCOM) is that this charge should take the form of a national mandatory minimum disposable cup charge and should be at least £0.20 aiming to change behaviour of around half the population (EPECOM, 2019). This is based on a summary of the evidence outline here which found charges of between 5p and 25p resulted in reductions of disposable cup use between 4 % and 20 % with most showing a reduction of 15 % or less (Resource Futures, 2022). While the Environmental Audit Committee (EPCOM) recommended a minimum charge of 20p, the most common level used in existing studies has been 25p (or 25 cents) (Resource Futures, 2022). We therefore selected 25p as the central reference point in our design, with equidistant values above and below it to capture variation in behavioural responses across a realistic policy-relevant range. The deposit sizes were determined by market research as to the range of deposits currently charged by retailers for returnable cups. The attribute levels for charges, discounts, and deposits are outlined in Table 2 alongside descriptions of the cup types and deposit types provided to respondents.

3.1.2. Design

Respondents were successively presented with 12 different choice cards and were asked to choose the alternative they prefer most (including the no-purchase option). Each type of cup was described in terms of at least one attribute (charge for the single-use disposable cup, discount for the returnable cup and refillable cup, and deposit amount for the returnable cup and how the deposit would be paid. These four attributes, their levels, and the information provided to respondents about them are described in Table 2. All information about the choice experiment that was provided to respondents can be found in Supplementary Materials 1.

Given all the attribute levels, a full factorial design of 50 profiles could be generated. However, this is too much for respondents to see so Ngene Software was used to generate a fractional Bayesian efficient design (ChoiceMetrics, 2018). The efficient design allows the estimation of the impact of all the considered attributes on respondents' choices using only a well selected set of profiles/product alternatives. The final design was obtained after 25,000 iterations with 500 Sobol draws per iteration, achieving a Db-error of 3.45 and 2.51 for the designs used in treatments 1 and 2 and treatments 3 and 4, respectively. Db-error is the most widely used measure of efficiency of the fractional Bayesian efficient design for choice experiments. It takes the determinant of the variance-covariance matrix of the generated design. The lower the Db-error, the higher the efficiency of the design (the better the generated design in capturing respondents' preferences).

The prior parameters used to generate the final design were obtained from the data collected during the piloting of the survey. The role of the pilot was to refine the experimental design. The survey was piloted with 109 respondents, who were not included in the final analysis. It was after the pilot study that the decision to introduce the three-option group as well as a four-option group was taken due to the dominance of the refillable option in the four-cup and to increase the realism of the design to mimic the circumstance when refillable cups are forgotten.

Table 2
Labelled discrete choice experiment attributes and levels.

Attribute/label name	Level	Description
Cup Type	Single-use cup (All treatments)	This is a cup designed for a single use only. It cannot be reused.
	Returnable cup (All treatments)	This is a cup that is owned by the shop but is borrowed by you. You return it to the shop after use. The shop is responsible for washing and sanitising the cup. It may then be used by other people.
	Refillable cup (Treatments 1 and 2)	This is a cup that you own, and you take to the shop to fill up. You keep it after use. You are responsible for washing and sanitising the cup. Only you use this cup.
Charge (only for single-use cups)	£0 £0.15 £0.25 £0.35 £0.45	There are plans to introduce charges for single-use cups. This will be added to the cost of your drink. The options for charge levels that you will see in this survey are:
Discount (only for returnable and refillable cups)	£0 £0.15 £0.25 £0.35 £0.45	Some shops offer discounts for drinks served in reusable cups. This will be deducted from the cost of your drink. The possible options for discount levels that you will see in this survey are:
Deposit (only for returnable cups)	2 3 4 5 6	Amount to be paid for the deposit on a returnable cup.
Deposit type (only for returnable cups)	Deposit paid upfront.	This would mean where you pay a deposit to the shop when you buy your drink, and have it refunded when you return the cup. This deposit is added to the purchase price of the drink but is fully refundable when you return the cup to a branch of the shop and other convenient collection points. There is no time limit on when you can make the return.
	Charge for no return	This means where you pay no deposit when you buy the drink but provide a payment method as security via an app on your phone. You are only charged if you do not return the cup to the shop within 2 weeks. If you return the cup after 2 weeks the deposit will not be refunded. You can instead keep the cup to use again. Cups can be returned to any branch of the shop from which you purchased the drink and other convenient collection points.

3.2. Survey

The survey used in this study had five main parts: 1) screening questions, 2) discrete choice experiment 3) takeaway drink purchasing behaviour questions 4) Likert-scale attitudinal questions based on protection motivation theory (PMT) (Rogers, 1983). The study was approved by the SRUC Social Science Ethics Committee and participants were asked to give their informed consent. A copy of the survey can be found in Supplementary Materials 1.

3.2.1. Takeaway drink purchasing behaviour

At the survey's start, respondents indicated their frequency of purchasing non-alcoholic drinks in reusable takeaway cups using a Likert scale (1 = Never, 5 = Always). After the choice experiment, they reported how often they bought drinks in takeaway cups (1 = Less than once a month, 5 = More than once a day). We also asked if they owned a refillable cup and used it regularly, whether they had previously used a returnable cup, and, if not, whether they had heard of returnable cups. This data helped identify latent classes within the sample alongside socio-demographic variables, facilitating comparisons with existing consumer panel data and supporting future research without additional surveys.

3.2.2. Protection motivation theory

We developed questions for multi-item measures for each PMT concept by drawing on Kothe et al. (2019) and surveys developed by Langbroek et al. (2016), Hunter and Röös (2016), and Bockarjova and Steg (2014). The maladaptive response rewards and response costs needed to be behaviour specific so incorporate many of the motivations and barriers identified by Herweyers et al. (2024) relevant to reusable products in general.

We operationalised all six PMT constructs as advised by Kothe et al. (2019) with brief, behaviour-specific Likert items tailored to takeaway-drink purchases, keeping constructs separate to retain interpretability. These constructs are grouped as those that represent threat appraisal (perceived severity and susceptibility to a threat, weighed against the rewards of not acting) and coping appraisal (beliefs about the effectiveness of the protective option, one's capability to enact it, and its costs). We outline briefly the concepts and how they are measured here. The exact wording of the items in each construct is available in Supplementary Information 1.

3.2.2.1. Threat appraisal. We measured threat appraisal with parallel scales for perceived susceptibility (personal likelihood of being affected) and perceived severity (personal seriousness) for the same seven environmental concerns over a 10-year horizon. Maladaptive response rewards (benefits of the status quo) measured levels of agreement with positive attributes of single-use cups (e.g., convenience, timesaving, taste/temperature, look/feel), capturing the perceived rewards of not switching.

3.2.2.2. Coping appraisal. Self-efficacy is a construct that measures an individual's confidence to reduce single-use cup use now and over time (e.g., "I would find it easy to stick to reducing…", "I feel capable). Response efficacy sometimes called outcome expectancy measured whether engaging in the behaviour of interest (increasing use of reusable cups) is likely to be effective in reducing the same seven environmental concerns measured in severity and susceptibility. Lastly response costs measure the perceived barriers to increasing the use of reusable cups. Here we decided to measure the response costs separately for refillable and returnable systems to reflect distinct frictions.

- *Refillable* (*owned*): remembering, washing time, purchase cost, carrying/inconvenience, potential impact on enjoyment/choice, capability.
- *Returnable* (*borrowed/deposit*): remembering/physical effort to return, deposit cost, hygiene/previous use concerns, distress, carrying/inconvenience, capability.

Item order within each conceptual block of questions on PMT was randomised. All scales used 5-point agreement formats. Construct scores were computed as mean indices (with reverse-scoring where applicable).

3.2.3. Data collection and sampling

Scotland was chosen as the country in which to collect our data due to current policy interest in introducing a charge for single-use cups containing plastic (Scottish Government, 2024). We carried out the research between February and March 2024 on consumer preferences for single use and reusable cups for any takeaway non-alcoholic drinks.

The survey respondents were recruited, and the survey was

administered by Dynata (Dynata, 2024), a market research company, and respondents were therefore compensated for their participation. To qualify for participation survey respondents had to be over 18 and have purchased a non-alcoholic drink in a takeaway cup within the previous three months. We collected 1200 complete responses. Dynata performed data quality checks, including checks for average response times and straight lining to ensure that the final sample was of high quality. In addition, we included a truth telling statement, which has been shown to improve the reliability of results in choice experiments (Caputo and Scarpa, 2022). Quotas were set for age, gender, and employment status to ensure that the sample was representative of the Scottish population based on these criteria from the 2011 Census or the 2022 Census where data was available. Table 3 outlines the socio-demographic characteristics of the sample including income and education. It also shows the composition of the treatment groups.

3.3. Data analysis and models

The data was analysed using two choice models: the conditional logit (CL) model to estimate average consumer preferences and the latent class (LC) model to capture preference heterogeneity. LC models were specified with 2, 3, and 4 classes, and the optimal number of classes was determined using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). While these criteria typically guide class selection, relying solely on them can lead to over-complex models or classes with very small, uninterpretable shares (Weller et al., 2020). Beyond two classes, issues with standard error estimation arose, particularly for the four-cup option, so results from the two-class model are presented. The analysis was conducted in R (R Core Team, 2023) using the Apollo package (Hess and Palma, 2019). A technical description of the models is available in Appendix A.

4. Results

4.1. Average consumers' preferences

4.1.1. Four cup option

We found that refillable cups were preferred in the four-cup sample.

Table 3
Socio-demographic characteristics of the sample.

	Population	Percentage sample n = 1200	Percentage treatment n = 300	Percentage treatment 2 n = 300	Percentage treatment 3 n = 300	Percentage treatment 4 n = 300
Gender						
Women	51	51	57	48	44	48
Men	49	49	44	53	58	53
Age						
18–24	11	11	9	13	15	9
25–34	16	17	16	16	20	17
35–44	15	16	14	15	15	20
45–54	16	13	16	14	11	12
55–64	18	18	20	17	18	17
65+	24	24	25	25	22	25
Employment						
Employed (full or part-time)	57	53	56	50	52	54
Retired	16	24	22	27	24	21
Student	10	7	7	6	6	10
Self-employed	8	7	5	8	7	9
Stay-at-home parent or carer/ Other	4/–	4	5	4	6	3
Unemployed	5	5	4	5	5	4
Education						
Postgraduate/Doctorate	–	17	14	20	18	17
University Degree or equivalent	–	30	33	29	27	33
Post-school Vocational or Technical Qualifications	–	13	13	14	14	13
Vocational or Technical Qualifications	–	9	9	9	9	7
Higher Secondary Education	–	15	17	12	14	17
Secondary Education	–	12	12	14	15	8
Other	–	3	3	3	3	5
Income						
Up to £5199	–	2	<3	<3	<3	3
£5200–£10,399	–	4	4	4	4	4
£10,400–£15,599	–	6	5	6	7	6
£15,600–£20,799	–	5	6	5	3	5
£20,800–£25,999	–	9	10	8	10	10
£26,000–£31,199	–	9	10	7	8	9
£31,200–£41,599	–	13	13	14	15	12
£41,600–£51,999	–	13	12	14	13	13
£52,000–£74,999	–	16	17	14	18	16
£75,000–£99,999	–	10	11	8	9	10
£100,000–£124,999	–	4	5	5	3	4
£125,000 or more	–	2	<3	4	<3	3
Prefer not to say	–	6	5	9	5	5

Note percentages may not sum to 100 due to rounding/avoidance of class disclosure.

The refillable cup was chosen 62 % of the time, followed by the disposable cup (17 %), returnable cup (15 %) and opt out (6 %). The results show that the charge had a negative effect on selection of disposable cups (−3.30, $p = 0.00$). The discount had a positive effect on the selection of both the refillable (1.26, p = 0.00) and returnable cups (1.58, p = 0.00). The deposit amount for the returnable cup had a negative effect on selection of returnable cups (−0.34, p = 0.00).

4.1.2. Three cup option

We found that disposable cups were preferred in the three-cup sample. The disposable cup was chosen 46 % of the time, followed by the returnable (34 %) and opt out (20 %). The effect of the charge in this sample was −3.19 (p = 0.00) (Table 4). Consumers expressed a preference for paying the deposit upfront over being charged for failing to return a cup (−0.12, $p = 0.03$). The coefficient for deposit amount was −0.43 (p = 0.00). The discount amount on the returnable cup was not significant in the three-cup model.

Coefficients in the choice models represent the change in utility associated with a one-unit change in the attribute, given the units in which the variable was coded. For monetary attributes (e.g. charge, discount, deposit), which were coded in £, the coefficient indicates the utility change from a £1 increase. For example, the coefficient for Charge (−3.3) implies that a £1 increase reduces utility o average by 3.3. Applied to smaller amounts, a 15p increase (£0.15) would reduce utility by 0.5 utils (−3.3 × 0.15). For non-monetary attributes e.g. returnable system, coefficients represent the difference in utility between the specified levels and the chosen reference category.

4.1.3. Comparison

Following Wensing et al.'s (2020) approach to comparing treated and untreated DCEs we simulated coefficients using the Krinsky and Robb (1986) procedure which takes the coefficients and covariance matrices from the conditional logit models to produce a multivariate normal distribution of coefficients. We then used Poe et al.'s (2005) method to test the proportion of times the estimate from one distribution was greater than that from the other. The positive and negative proportions as well as the result of the two-sided significance test are reported in (Table 4). Of note is the difference in the effect of the discount for the returnable cup. The introduction of the refillable option appears to have changed the way in which respondents value the discount leading to more or less of the unknowns being absorbed by the returnable cup constant. The impact of the deposit amount was also significantly different between the models.

4.1.4. Impact of the environmental information prompt

We ran the conditional logit model on the four-cup samples without (treatment 1) and with (treatment 2) an environmental prompt, and on the three-cup samples without (treatment 3) and with (treatment 4) an environmental prompt. Small differences were observed in cup choice across treatments. In treatment 1, refillable cups were chosen 60.43 % of the time, disposable 18.79 %, returnable 14.66 %, and opt-out 6.12 %. With the prompt (treatment 2), refillable cups were chosen 62.95 %, returnable 15.61 %, disposable 15.65 %, and opt-out 5.79 %, indicating a 2.52 percentage point drop in disposable cup selection with the prompt. Comparing the CL model coefficients for treatments 1 and 2 (Table 5) these differences were not statistically significant ($p > 0.05$). Therefore, we conclude the environmental prompt had no significant impact on consumer preferences.

In treatment 3 (no prompt), disposable cups were chosen 46.94 % of the time, returnable 32.19 %, and opt-out 20.86 %. With the prompt (treatment 4), disposable cups were chosen 45.4 %, returnable 35.03 %, and opt-out 19.57 %, showing a 1.5 percentage point decrease in disposable cup selection. Comparing the CL model coefficients for treatments 3 and 4 (Table 6) we note statistically significant different in the coefficients for the returnable cup ($p < 0.01$) and the charge ($p < 0.05$). This suggests that the environmental information prompt had a slight effect on consumer choice when only the returnable cup was present.

4.2. Latent class models

4.2.1. Four options

Around 28 % of the sample were allocated to class one and 72 % were allocated to class two. We found a difference in the effect of the charge between classes. In class one the estimate was −2.6 ($p = 0.00$) while class two it is −7.1 ($p = 0.00$). In class one a much larger charge would be required to achieve the same reduction in disposable cup selection than in class two. Those in class two were sensitive to refillable discount (2.72, $p = 0.00$) while those in class one were not (0.29, p > 0.05). Those in class two were more sensitive to the deposit amount with an estimate of −0.22 (p = 0.00) in class one and −0.47 (p = 0.00) in class two. Those that reported they currently used a reusable cup more often were more likely to be in class two (0.28, $p = 0.03$). Those that owned and used a refillable cup were also more likely to be in class two (1.08, p = 0.00). Whereas those who were more aware or have previously used a returnable cup were less likely to be in class two (−0.37, $p = 0.01$). Gender, age, purchase frequency nor the information treatment were significant factors in determining group membership. These results are summarised in Table 7 and the full model results can be found in the Appendix D.

4.2.2. Three options

Around 54 % of the sample were allocated to class one and 45 % of the sample were allocated to class two. Class one was more responsive to

Table 4
Conditional logit results for four and three cup options.

Four options ($n = 600$)				Three options (n = 600)				Comparison of models		
Attribute	Estimate	SE	*P* value	Attribute	Estimate	SE	P value	Poe Test P Value	Positive Proportion	Negative Proportion
Disposable	0.000	NA	NA	Disposable	0.000	NA	NA	NA	NA	NA
Returnable	−0.027	0.017	0.099	Returnable	0.628	0.219	0.004**	0.000***	0.000	1.000
Refillable	0.217	0.106	0.040*	–	–	–	–	NA	NA	NA
No Purchase	−1.791	0.136	0.000***	No Purchase	−1.578	0.108	0.000***	0.021*	0.011	0.990
Charge	−3.289	0.286	0.000***	Charge	−3.190	0.328	0.000***	0.713	0.357	0.643
Deposit Type	−0.121	0.068	0.074	Deposit Type	−0.121	0.057	0.032*	0.976	0.512	0.488
Deposit Amount	−0.340	0.028	0.000***	Deposit Amount	−0.430	0.024	0.000***	0.004**	0.998	0.002
Discount Returnable	1.580	0.323	0.000***	Discount Returnable	0.127	0.771	0.869	0.000***	1.000	0.000
Discount Refillable	1.262	0.190	0.000***	–	–	–	–	NA	NA	NA
AIC 12266.94	**BIC** 12320.54	**AIC** 11764.26	**BIC** 11804.46							

*, **, *** indicate respectively 0.05, 0.01, 0.001 degree of significance.

Table 5
Comparison of conditional logit model results Treatment 1 and Treatment 2 – Four Cup Options.

Attribute	Treatment 1 no environmental prompt (*n* = 300)			Treatment 2 environmental prompt (n = 300)			Comparison of treatments		
	Coefficient	Robust Std Error	Robust P Value	Coefficient	Robust Std Error	Robust *P* Value	Poe Test P Value	Positive Proportion	Negative Proportion
Disposable	0.000	NA	NA	0.000	NA	NA	NA	NA	NA
Returnable	−0.175	0.224	0.434	0.138	0.353	0.696	0.373	0.187	0.813
Refillable	0.194	0.108	0.072	0.243	0.339	0.474	0.849	0.424	0.576
No Purchase	−1.796	0.184	0.000***	−1.786	0.251	0.000***	0.995	0.498	0.502
Charge	−3.031	0.342	0.000***	−3.646	0.690	0.000***	0.314	0.843	0.157
Deposit Type	−0.124	0.088	0.159	−0.120	0.082	0.144	0.991	0.496	0.504
Deposit Amount	−0.340	0.040	0.000***	−0.339	0.043	0.000***	0.989	0.505	0.495
Discount Returnable	1.863	0.502	0.000***	1.272	0.551	0.021*	0.443	0.778	0.222
Discount Refillable	1.162	0.218	0.000***	1.386	0.595	0.020*	0.685	0.342	0.658

*, **, *** indicate respectively 0.05, 0.01, 0.001 degree of significance.

Table 6
Comparison of conditional logit model results Treatment 3 and Treatment 4 – Three Cup Options.

Attribute	Treatment 3 no environmental prompt (n = 300)			Treatment 4 environmental prompt (n = 300)			Comparison of treatment		
	Coefficient	Robust Std Error	Robust P Value	Coefficient	Robust Std Error	P Robust Value	Poe Test *P* Value	Positive Proportion	Negative Proportion
Disposable	0.000	NA	NA	0.000	NA	NA	NA		
Returnable	0.290	0.165	0.078	0.908	0.155	0.000***	0.001***	0.001	0.999
No Purchase	−1.660	0.127	0.000***	−1.508	0.107	0.000***	0.168	0.084	0.916
Charge	−3.611	0.347	0.000***	−2.827	0.265	0.000***	0.046*	0.023	0.977
Deposit Type	−0.121	0.072	0.091	−0.118	0.062	0.057	0.989	0.494	0.506
Deposit Amount	−0.402	0.042	0.000***	−0.455	0.034	0.000***	0.220	0.890	0.110
Discount Returnable	0.332	0.501	0.507	−0.019	0.007	0.010*	0.440	0.780	0.220

*, **, *** indicate respectively 0.05, 0.01, 0.001 degree of significance.

Table 7
Summary of latent class characteristic.

Four option		Three option	
Class 1 (28 %)	Class 2 (72 %)	Class 1 (54 %)	Class 2 (45 %)
• Less responsive to charge • Not responsive to either discount • Less sensitive to deposit amount • No preference for deposit type • More likely to be older • Less likely to have previously used reusable cup • Less likely to own and use refillable • More likely to be aware of returnable cups	• More response to charge • Responsive to refillable discount • More sensitive to deposit amount • Preferred to pay deposit upfront • More likely to be younger • More likely to have previously used reusable cup • More likely to own and use refillable • Less likely to be aware of returnable cups	• More responsive to charge • More responsive to deposit amount • Not responsive to discount • More likely to be older • Less likely to have previously used a reusable cup • Less likely to own a refillable cup • Less likely to be aware of returnable cups	• Less responsive to charge • Less responsive to deposit amount • Responsive to discount • More likely to be younger • More likely to have previously used a reusable cup • More likely to own a refillable cup • More likely to be aware of returnable cups

the charge compared to class two (−4.25, p = 0.00 vs −1.89, $p = 0.00$). The discount on the returnable cup was only a significant attribute in class two (1.31, $p = 0.00$). Class one was more responsive to the deposit with a coefficient of −1.02 (p = 0.00) compared to a coefficient of −0.55 (p = 0.00) in class two. The type of deposit was not a significant attribute in either class.

Class two was more likely to report more frequent reusable cup use (0.26, $p = 0.01$) and more likely to have previously used or at least been aware of returnable cups (0.26, $p = 0.05$). We kept refillable cup ownership and use in this model as we believed the behaviours might be correlated with returnable cup use and we found those in class two were also more likely to own and use refillable cups (0.52, $p = 0.03$). Class two members were more likely to be younger (−0.03, p = 0.00) while gender nor treatment were not distinguishing factors.

4.3. Secondary analysis

We extracted the posterior probability that each respondent would be allocated to class two and transformed this into a 1 when the probability was greater than 50 % and 0 when the probability was less than or equal to 50 %. We calculated the mean scores for each respondent for each Protection Motivation Theory concept and conducted a *t*-test between the classes for each concept to understand more about the motivations class membership.

The results in Table 8 and Table 9 indicate significant differences across the key PMT constructs between the latent classes, which can help us understand the preferences of these groups. As the results are similar for the three and four-option models and class two in each case represents the class that is more responsive to reusable cups, the results are summarised together. Respondents in class two had higher perceived severity and vulnerability to environmental risks on average than those in class one. Those in class one had a higher maladaptive response score on average than those in class two (perceived higher benefits to continuing to use single-use disposable cups). Those who perceived fewer refillable or returnable cup disadvantages were more likely to be in class two. Those in class two were also likely to have higher self-efficacy and higher response efficacy, indicating that they were more

Table 8
Secondary analysis *t*-tests – four cup options.

Concept	Class 1 mean score	Class 2 mean score	T-statistic	P value	Degrees freedom
Severity	3.387	3.666	−3.715	0.000***	255.824
Vulnerability	3.210	3.405	−2.388	0.018*	297.436
Maladaptive Response	3.335	2.893	6.923	0.000***	324.695
Self-Efficacy	3.350	3.699	−5.926	0.000***	271.462
Disadvantages Refillable	3.179	2.539	9.242	0.000***	310.032
Disadvantages Returnable	3.220	2.960	3.573	0.000***	307.814
Response Efficacy	2.942	3.278	−4.241	0.000***	272.588

*, **, *** indicate respectively 0.05, 0.01, 0.001 degree of significance.

Table 9
Secondary analysis *t*-test - three cup options.

Concept	Class 1 mean score	Class 2 mean score	T-statistic	P value	Degrees freedom
Severity	3.407	3.715	−4.914	0.000***	595.509
Vulnerability	3.168	3.496	−4.877	0.000***	595.450
Maladaptive Response	3.171	2.982	3.103	0.002**	553.875
Self-Efficacy	3.350	3.666	−6.486	0.000***	596.812
Disadvantages Refillable	3.013	2.624	6.233	0.000***	569.080
Disadvantages Returnable	3.252	2.777	8.002	0.000***	544.866
Response Efficacy	2.925	3.351	−6.643	0.000***	593.688

*, **, *** indicate respectively 0.05, 0.01, 0.001 degree of significance.

likely to perceive reusable cups as beneficial and feel more confident using them. These findings are aligned with hypotheses derived from protection motivation theory about the drivers of pro-environmental behaviour. We additionally checked whether any significant differences in PMT constructs could be detected between the treatment groups one and two and treatment groups three and four, however we did not find any significant differences and conclude these are pre-existing motivations and were not affected by the environmental prompt information.

5. Discussion

5.1. Regulation – charges and discounts

We detected a significant effect for a charge on consumer preferences for single-use disposable cups across both the conditional logit models. Based on the results of our four-option conditional logit model (Table 4), to achieve a 50 % reduction in selection of the disposable cup from its baseline probability, a charge of around 25–30 pence would need to be applied when all other attributes were held at baseline level (Fig. 1 – Panel A). This charge level leads to an increase of 19 % (refillable) and 17 % (returnable) cup selection but also increases in the likelihood opting out by 20 % albeit from a low level (5 % to 6 %). In our three-option conditional logit model, we could see that a charge of 30–35 pence was required to achieve a 50 % reduction (Fig. 1 – Panel B). This also led to an increase in the uptake of returnable cups but a 30 % increase in opt outs (7 %–9 %). These results show a greater responsiveness to the charge than has been observed in closed field trials for refillable cups which observed between a 13 % and 20 % reduction in disposable cup use at a charge level of 25 pence (Resource Futures, 2022). In terms of the increase in reusable cup use at this charge level, the increase combined is large than the majority of closed field trials reported by (Poortinga and Nash, 2019).

These models also show the significant reduction marginal gains of increasing charge levels and, therefore, the difficulty in moving beyond a 50 % reduction with a charge alone. Extrapolating further, a charge of around £1.40 would be required to disincentivise nearly all consumers to move away from a single-use disposable cup in the four-option model when all other attributes were set to zero. We also see from our extrapolations of the four-option model that at a charge of around 55 pence, respondents are equally as likely to opt out as purchase a drink in a disposable cup. Though we should note that this value is beyond the values tested in our experiment. A balance must nevertheless be struck between encouraging the uptake of reusable cups and putting off those resistant to reusable cups from purchasing takeaway drinks. Sheppard et al. (2025) examined the effect of a probabilistic reward for using a reusable cup in a context where there is already a $0.25 charge for single use cups. They found a small but statistically significant increase in drinks purchased in a reusable cup within the treated group. Above a certain level of charge, or after a period where a charge has been priced in, alternative financial incentives could be explored.

We detected a significant effect for discounts on consumer preferences for reusable cups in the four but not the three option model. This means it was effective in encouraging uptake of refillable but not returnable cups. Poortinga and Whitaker (2018) found that discounts in a closed field trail were not effective in increasing refillable cup uptake. This difference could be due to the level of familiarity with refillable cups since this study was conducted whereas our results for returnable cups, a less familiar option, was similar. But, as indicated Sheppard et al. (2025) and confirmed by this study it might be that the size of the discount was not high enough to be effective. Based on our four-option conditional logit model (Table 3), to achieve a 50 % reduction in selection of the disposable cup, a discount of around 70 pence would need to be applied to both the refillable and returnable cups when all other attributes were held at baseline level (Fig. 1 – Panel C). While the discount has little to no effect on uptake of returnable cups in the three-option model (Fig. 1 – Panel D). This is higher than the $0.27 required to incentivise respondents to use a refillable cup in Nicolau et al. (2022). It seems that discounts are not as effective as charges in achieving a reduction in disposable cup use, but can still work (Poortinga and Nash, 2019).

A unique insight derived from this study of charges and discounts combined is that as the discount increases, opt-outs also decrease, but as the charge increases, opt-outs increase, meaning that the discounts might not be as effective at reducing disposable cup use, but they are less likely to result in reduced sales. Another unique insight is the impact of deposits on returnable cups is not large, but its impact should not be ignored. Based on our four-option conditional logit model, we see that any increase in the deposit results in a decrease in the uptake of returnable cups and while some of this results in an increase in refillable cups, the likelihood of selecting a disposable cup also increases. Again a balance needs to be struck since other evidence suggests that deposits are important for return rates (Šuškevičė and Kruopienė, 2021). There is clearly demand for a returnable cup and including it as an option will support efforts to reduce disposable cup use but a deposit that is too high will put people off the option, even when combined with a discount.

There are several reasons why our results may be different, and overall, more optimistic on the impact of charges than those obtained in previous studies (Resource Futures, 2022). First, our study was based on a sample representative of the Scottish population by age, employment status and gender, albeit one that had purchased takeaway drinks in the previous three months. This national sampling could give a more accurate indication of consumer sensitivity to a charge at a national level than a sample derived from a small group of coffee shops. Future research would nevertheless benefit from field trials in a much wider range of real-world settings which could preserve representativeness and test how responses differ across context.

Second, familiarity may play a role. Previous studies were completed prior to 2018, and since then refillable cups have seen a significant

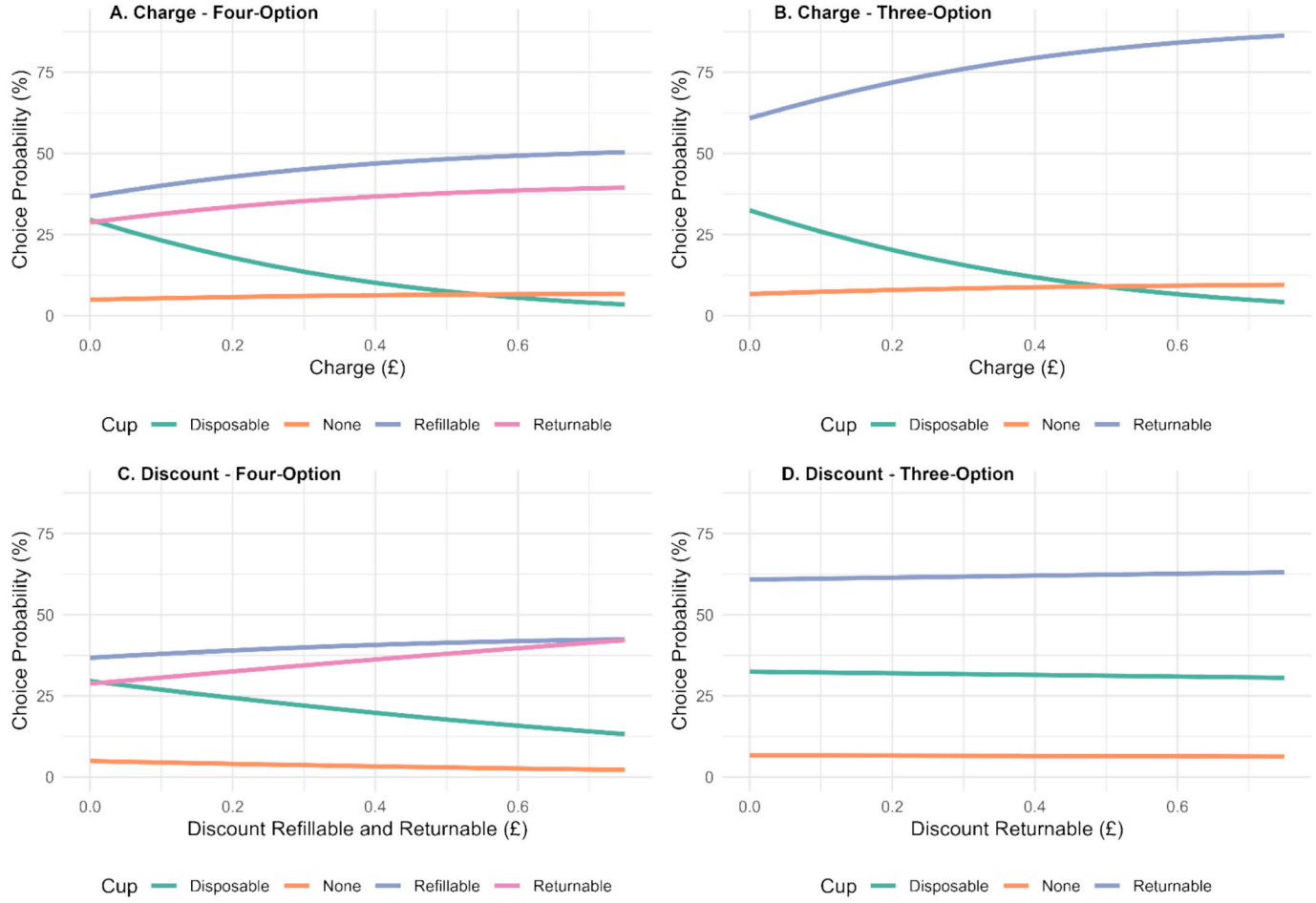


Fig. 1. Choice probability plots derived from conditional logit model results.

increase in use, alongside an increase in other reusable products such as water bottles. We found that those segments that had a stronger preference for reusable had more experience and/or were more aware of them. Therefore, we might also be seeing the impact of increased familiarity with reusable products over the interim five years, despite the challenges that Covid posed. Third, the experiment relied on hypothetical choices without choice-contingent monetary incentives. Although a truth-telling statement was included, which can attenuate hypothetical bias (Caputo and Scarpa, 2022), the absence of economic consequentiality limits strict incentive-compatibility. Because choices involved no real payments, should a 25–30p charge or a 70p discount be applied in practice then real-world results, in terms of reduction/uptake of options may differ when decisions are financially binding (Haghani et al., 2021). The results should not therefore be taken as point-precise policy targets but rather what they are which is hypothetical preference estimates. In general, discrete-choice experiments are, by design, hypothetical; this is a feature as well as a limitation, enabling researchers to test novel products and system designs, vary attributes, and do so at reasonable cost with large, nationally representative samples. By contrast, imposing real budgets and payments typically pushes evaluation toward smaller, costlier pilots or lab-in-the-field studies that offer stronger consequentiality but less representativeness. As outlined, there is evidence from closed pilots (e.g. university cafés) in which choices are financially binding; while these demonstrate consequential behaviour change, their bounded contexts (e.g., captive audiences, specific procurement, institutional settings) limit generalisability to wider retail settings. Finally, we included both hot and cold drinks in scope for this experiment with a base price of £2, while previous studies have focussed on hot drinks with variable base prices (Harris and Probert, 2009; Resource Futures, 2022). The base price was chosen to account for the lower price of cold soft drinks such as cola and these cold drinks purchasing segment might be more sensitive to price changes than those regularly purchasing more expensive hot drinks from coffee shops.

5.2. *Persuasion – environmental information*

We tested whether a prompt about the environmental impact of cups was important however, we did not find strong evidence for the effectiveness of this type of intervention. It made some impact on consumer choice in the 3-cup option model, but not the 4-cup option model where both refillable and returnable cups were offered. Previous studies have found that evoking environmental values, intentions or habits is effective. For example, Novoradovskaya et al. (2021) found that evoking environmental values, intentions or habits was effective at increasing reusable cup use at an Australian university compared to a control group. Participants in the intervention groups were given a reusable cup at the outset and no manipulation to the cost of the drinks or purchasing environment were made. Novoradovskaya et al. (2021) note that some of the short-term improvements seen could be due to the provision of the reusable cup alone, but that longer-term habit change was important. This is certainly consistent with our findings and others' (Poortinga and Nash, 2019) that making using a reusable cup as easy as possible is likely to be a first step to behaviour change. Reflection on these findings suggests that while communicating environmental impact will do no harm and can be beneficial, a more effective use of resources could be increasing the convenience of this option, which could include supporting returnable cups schemes, or providing refillable cup washing stations and/or providing tips on how to incorporate reusable cup use

easily into daily routines. However, further work on how environmental impact is framed to support charges and discounts could be warranted. The first statement indicated that littering and lack of recycling is the norm, implying that most people are not doing the right thing, so respondents might not feel motivated to change. Three of four statements used in our survey were negatively framed, highlighting losses of using disposable cups rather than gains of using reusable cups. A recent systematic review of environmental message framing found no evidence that either negative or positive framing was more likely to result in action (Florence et al., 2022). However, it also recommended trying combinations of different types of frames (positive-negative, self-other, abstract-concrete) to increase effectiveness in different contexts. Future work could evaluate different combinations of message framing alongside convenience enhancements and price signals to test for whom, and under what conditions, such prompts are effective.

5.3. Motivation – protection motivation theory

The latent class models enabled us to understand more about the heterogeneity underlying the average results derived from the conditional logit models. Previous experience with reusable cups, particularly refillable cups appeared to be important for responsiveness to the discount. Familiarity was an important factor identified by in choosing reusable cups (Keller et al., 2021). In the four-option model those who were more responsive to the discount were also more responsive to the charge (class two) while there was a smaller generally less responsive group of consumers (class one) who were resistant to the change. In the three-option model the group that was more responsive to the charge (class one) was different to the group that was more responsive to the discount (class two). Without the refillable option the charge appeared to be more effective in encouraging respondents to select a cup that they would not otherwise have done. Analysis of the PMT constructs revealed that those in class two (three and four option models) who appeared to have stronger preferences for reusable cups were more likely to perceive environmental threats (severity and vulnerability) and believe that reducing disposable cup use would be effective in mitigating these threats (response efficacy). They were less likely to perceive advantages to reusable cup use and more likely to perceive advantages to disposable cup use.

Overall PMT constructs significantly distinguished consumer segments, with greater reusable cup uptake associated with higher perceived threat (severity, vulnerability), stronger response and self-efficacy, and fewer perceived disadvantages of reusable options. Bockarjova and Steg (2014) also showed that all Protection Motivation Theory constructs significantly influenced electric vehicle adoption, a finding that resonates with our results, where significant differences emerged between groups across the full model. Hunter and Röös (2016) found that self-efficacy and response efficacy predicted intentions to adopt climate-mitigating food behaviours, with certain threat/risk dimensions also proving influential, though response costs were not. Langbroek et al. reported that higher self-efficacy and response efficacy were associated with electric vehicle adoption, although the effect was only significant at $p < 0.1$ and does not meet the conventional 0.05 threshold. As their analysis incorporated these constructs within a much larger model, this may partly explain why the associations were less pronounced than in studies focusing more directly on PMT variables.

5.4. Policy and industry implications

One novel aspect of our study was the inclusion of a returnable as well as a refillable type of reusable cup. We found in the four-option latent class model that there was a consumer segment that preferred a returnable takeaway cup over a refillable takeaway cup. While this group were slightly less sensitive to the charge, they generally switched to a returnable rather than a refillable cup as the charge increased. This segment tended to be older and purchase takeaway drink less frequently and therefore might not have a much use for their own refillable cup but would be happy to use a returnable cup if available. In the three-option model we also saw that the charge was effective in increasing the uptake of returnable cups, even though this option was less familiar to people. In the three-option latent class model, we observed a distinct segment that expressed a preference for returnable over disposable cups. This is useful for businesses to know, both those selling takeaway drinks and those that might provide services to the food and drinks industry. While making these types of cups available (Keep Scotland Beautiful, 2023), the evidence from this research suggests that businesses could support the switch to reusable cups by making returnable cups available more widely. The size of the deposit did matter in determining preference and therefore businesses need to balance the need to encourage cup return with no putting consumer off taking up the reusable cup option. We also found that there was a slight preference for paying the deposit up front over being charged for not returning the cup, but this was not significant in all models and means that business could set up either deposit system.

Our latent class analysis and subsequent secondary analysis indicate that it is familiarity and convenience that are important for reusable cup preferences. Current reusable cups use, refillable cup ownership and returnable cup use and awareness were the key factors distinguishing the latent classes. In the secondary analysis we found that perceived practical advantages of disposable cups made reusable cup selection less likely while fewer perceived disadvantages of reusable cups made reusable cup selection more likely. Self-efficacy was important for returnable cup but not refillable cup selection. Environmental concerns (severity and vulnerability) nor response efficacy (how effective reusable cups would be addressing environmental concerns) were important.

Our study assumes that the application of the charge will be mandatory and at a set level for all retailers of takeaway drinks based on EPCOM recommendations (EPECOM, 2019). However, if the charge is applied in a different way e.g. it is voluntary, or retailers can select the level of the charge then the impact will be very different depending on both the charging decision and the competitive power of the shop. Future research on the analysis of takeaway drinks purchases from EU member states implementing different discount and charge regimes will provide a useful natural experiment to look at the effectiveness of the different approaches on a large scale.

To fully understand the impact of a single-use disposable charge on the environment, the evidence from this choice experiment can only go so far. It is important to understand how consumer choice translates into the number of disposable cups not used versus the impact of the new choice on the environment. We did not find a significant difference in either the four-option or the three-option models between the latent classes regarding frequency of takeaway drinks purchased, so those that buy more takeaway drinks appeared just as willing as those that purchased fewer takeaway drinks to be open to using reusable options. However, we did find that those who had a stronger preference for either type of reusable cup was in the majority. This information obtained from this study could be combined with existing environmental modelling to provide a more nuanced picture of the impact of single-use disposable cup reductions (Fetner and Miller, 2021; Foteinis, 2020; Resource Futures, 2022). Additional behaviour research would also be beneficial to understand any rebound effects such as the increase in bin bag sales identified by Taylor (2019) after the implementation of a carrier bag ban in California.

A key limitation of this study is that while we modelled choices between cup types, we did not capture subsequent patterns of use. All cups, whether disposable, returnable or refillable, carry environmental costs in production, and the benefits of the latter two only materialise when they are reused multiple times (Fetner and Miller, 2021). Our design captures a one-off choice, which may overstate the environmental benefits if sustained behaviour is not achieved. Emerging research in this area indicates that consumers tend to underestimate the efforts required by reuse to the extent that they may be over optimistic in their

preferences, particularly those that have limited experience of reuse (Miao et al., 2025). Responses may also have been shaped by social desirability bias whereby respondents overstate pro-environmental preferences to align with perceived social norms, and by experimenter demand effects whereby participants adjust their choices in line with what they believe the researcher expects. Future research should therefore integrate behavioural insights with lifecycle analysis to assess the thresholds at which reusable systems deliver net benefits, and explore interventions that support repeated use, such as deposit schemes, convenient return points, and habit-formation strategies.

6. Conclusion

This study is the first to employ a discrete choice experiment to comprehensively evaluate consumer preferences for single-use, refillable, and returnable cups, while simultaneously testing the effects of varying levels of charges, discounts, and deposits. By combining these interventions with an environmental information prompt and insights into consumer motivations, the research offers a holistic view of the factors influencing takeaway cup choice.

Our findings suggest that regulation, through mandatory charges, is an effective mechanism to reduce disposable cup use and increase adoption of reusable alternatives. Charges were consistently more impactful than equivalent discounts, though they may pose a slight risk of reducing sales. Discounts, while less effective overall, could still play a complementary role in incentivizing reusable cup use in certain contexts. Notably, persuasion through environmental prompts had minimal influence on consumer choices, indicating that regulatory and economic measures are likely to drive greater change.

These results hold significant implications for policymakers. They provide actionable guidance for implementing effective strategies under the EU Single-Use Plastics Directive (European Commission, 2019) and Scotland's evolving sustainability framework (Scottish Government, 2024). Furthermore, by applying Protection Motivation Theory (PMT), this study highlights the critical motivational differences between consumer groups, identifying those more inclined to adopt reusable cups and those resistant to change. This behavioural insight is essential for designing targeted interventions that address both consumer and industry barriers, ensuring a robust and sustainable transition away from single-use disposable cups.

CRediT authorship contribution statement

Bethan Thompson: Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Faical Akaichi:** Writing – review & editing, Software, Methodology, Formal analysis, Conceptualization. **Luiza Toma:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization.

Funding

This project was funded under "Building the circular economy: sustainable technologies, green skills and upscaling behaviours – C4" part of the Scottish Government's Environment Natural Resources and Agriculture Strategic Research Programme 2022–27. Input was provided from Scottish Government colleagues on the initial conceptualization and study design.

During the preparation of this work the author(s) used ChatGPT5 to revise and refine aspects of the text to improve its clarity. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.spc.2025.10.013.

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