Regulators Mount Up?
Consumption Decisions, Political Engagement, and Companies' Interests in a Climate-conscious World*

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Abstract

States and the political processes that underpin them appear increasingly ineffective at regulating externalities, most strikingly greenhouse gas emissions. At the same time, individuals are increasingly self-regulating to reduce externalities, e.g., by reducing driving and flying, installing solar panels, and choosing climate-friendly diets. There is evidence that fossil fuel companies have sought to cultivate such conscientious consumption ideas through ad spending. We ask if the two trends are causally related: are individuals less likely to engage in the climate cause through political participation when encouraged to do so through their consumption choices? And if so, what does the magnitude of any such effect compared to and alongside any direct effects on spending imply about companies' (and society's) interest in emphasizing individual responsibility? To investigate, we "embedded" a randomized control trial (RCT) within Scandinavian administrative data. We recruit participants through the digital mailboxes used for official communication with citizens in Sweden. The treatment involves an app that tracks all spending, with vs. without a corresponding carbon footprint calculator. We link the transaction data with administrative records of political participation—whether the participant voted in the 2024 EU elections, etc.—as well as surveys to collect detailed information about political attitudes, preferences, and participation (e.g., party choice in the EU Parliament election, participation in collective action, beliefs and attitudes towards policies, etc).

We submit early stage results as well as a detailed pre-analysis plan for consideration. In our initial results, we find that emphasizing personal responsibility for climate action crowds-*in* political action for climate change in Sweden. That is, for a pre-registered subgroup within our sample (deontologists), exposure to our treatment led to higher participation rates and greener party choices in the EU election. This subsample also expressed greater support for climate change policy and were more likely to cite climate change as a key factor in their party choice. Full results will be available before the conference.

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Note to NBER SI organizers

This document contains a detailed Pre-Analysis Plan (PAP) along with a number of preliminary results. The initial PAP was completed in August 2024 and updated in December 2024 (AEARCTR-0013389); results have been added in March 2025. Although we do not have a full paper yet, data collection is complete, and our initial results are promising. Full results will be ready before the conference in July. We believe this paper will be a strong fit for the conference and would very much value feedback from NBER SI participants at this juncture. We hope this PAP and current results demonstrate that our project is a good fit and that we will be well-prepared to present in the summer.

1 Introduction

Economists have traditionally viewed clearly delineated societal roles as both empirically grounded and normatively desirable: individuals pursue their self-interest; companies maximize profits; and correcting externalities and addressing market failures is the responsibility of the state and best achieved through the democratic process (Bénabou & Tirole, 2010).

Empirically, this clear division of roles and responsibilities appears to have begun to erode, however. The clearest example is our continued trajectory towards potentially catastrophic levels of climate change (Intergovernmental Panel on Climate Change (IPCC), 2023). Countries have largely failed to curb greenhouse gas (GHG) emissions, with their ineffectiveness—as measured against the expected consequences of their inaction—seemingly growing each year (Leonhardt, 2019). On the other hand, consumers increasingly seek to "regulate" externalities themselves (Bénabou & Tirole, 2006; Bénabou & Tirole, 2010), for example by consuming less or not buying from companies engaged in particular activities. The growing prominence of green consumption appears to be in part due to deontologists—who see high or "dirty" consumption as wrong in and of itself (Bénabou et al., 2024; Ellingsen & Mohlin, forthcoming)—and perhaps also to consequentialists who consider lifestyle choices the more effective way to act on their preferences than political engagement (Williamson et al., 2018; De Moor & Verhaegen, 2020, p. 102).

In this paper, we experimentally investigate if the latter trend causally affects the former. More concretely, we ask if strengthening consumers' sense of personal responsibility for their climate footprint causally decreases their political engagement and participation; to what extent doing so decreases their consumption; and what the magnitude of the two responses suggests "brown" companies' interests might be. Our interest in the question

partly comes from prior evidence that "ExxonMobil advertisements worked to shift responsibility for global warming away from the fossil fuel industry and onto consumers" (Supran & Oreskes, 2021, p. 696). There are clearly other plausible explanations for (some) companies' interest in putting focus on individuals' climate footprint[1], but the possibility that doing so erodes states' regulatory effort and effectiveness is intriguing because such effects could lead to a self-fulfilling prophecy dynamic (Benabou & Tirole, 2006).

To investigate, we set up the first randomized control trial that is fully "embedded" within Scandinavian administrative data, in particular Sweden's. We collaborate with a non-profit developer of a personal finance app. The treatment itself is simple: some participants are given a neutral version of the app, and others a green-framing version of the same app. The latter is very similar to existing, widely used websites and apps that inform the user about the climate footprint of their consumption and provide personalized suggestions on ways to consume less or greener. We recruit participants through digital mailboxes used for official communication with citizens in Sweden (from public agencies, banks, etc.). We observe participants' consumption directly: when signing up, participants are asked to give the app access to their "BankID", so that it can use their transactions to compute the user's carbon footprint and provide personalized feedback. We further link data from administrative registers recording both measures of political engagement (e.g., whether the individual voted in the 2024 EU elections) and consumer choices (e.g., take-up of tax refunds for green projects, green stocks and retirement portfolios). Finally, we circulate surveys immediately following the 2024 EU Parliament election in partnership with the Swedish National Election Studies Program (SNES), which is well-recognized and highly trusted for election studies in Sweden, to collect information on voting participation, party choice, and other political attitudes and preferences.[2] Collectively, these data sources give us unparalleled insights into individuals' consumption patterns, political attitudes, and political behaviors.

Our initial empirical analyses focus on several measures of political attitudes and be-

[1] A prominent alternative explanation for company interest in greening consumer beliefs and preferences is for example the dynamic complementarity of consumption preferences and production decisions (Besley & Persson, 2023; Aghion et al., 2023). Any causality involving state effectiveness might also run the other way, with consequentialist consumers directing their efforts towards lifestyle adjustments rather than political engagement because states increasingly appear unable to address climate change (Ainscough et al., 2024).

[2] The relationship between this political survey and our treatment was obfuscated in several ways, so that users of the app would not obviously link the survey to our treatment. For one, the survey was circulated by SNES, and our version matched very closely with the look, feel, and content of standard SNES surveys; we simply augmented the standard survey content to include additional prompts that are directly relevant to our research questions. Moreover, the survey was not explicitly climate-focused; it included a battery of other topics besides climate change (e.g., attitudes toward the EU, refugees, food, etc.).

haviors: voting (participation in EU election, greenness of party choice in EU election), revealed preference measures of climate action (donations to a climate cause in a charitable dictator game, signing a climate petition), and policy attitudes and preferences (support for climate policy, importance of climate to EU voting choice, and locus of responsibility for addressing climate change). We find evidence that emphasizing personal responsibility for climate action crowds-*in* political action for climate change. That is, for a pre-registered subgroup within our sample (i.e., deontologists), exposure to our treatment led to higher participation rates and greener party choices in the EU election. Treatment also induced this subsample to express greater support for climate change policy and to be more likely to cite climate change as a key factor in their voting choice. These results are consistent with our pre-registered hypotheses for deontologists and consequentialists,[3] and are unlikely to be driven by experimenter demand effects.[4]

Our results thus far are preliminary. We will complete additional analysis in spring 2025, and updated results will be available by the time of the conference. Our immediate next step is to analyze the consumption data. We will estimate "within-domain" treatment effects of the carbon footprinting app on personal consumption, which will complement the "across-domain" treatment effects on political outcomes described above. Moreover, from the consumption data and survey responses, we will construct additional variables that will be used for both within-domain and across-domain analyses. These variables follow from our PAP and will be used to illuminate heterogeneous treatment effects and potential mechanisms. Among these variables are: users' engagement with the app, users' attitudes toward the app, learning, carbon knowledge, conservation intentions, and baseline carbon footprints, among others.

In what follows, we present our PAP and preliminary results. Sections 2, 3, 4, 5, and 6 are directly from our PAP. Section 7 presents our preliminary results.

[3] Ex ante, and as noted in our PAP, we expected that consequentialists would be more likely to experience crowding-*out* of political actions from our treatment, as these participants might view individual actions as a substitute for broader political engagement (e.g., through the logic of constrained optimization, whereby individuals allocate scarce time/energy/resources to different climate activities). On the other hand, we expected that deontologists would be more likely to experience crowding-*in* of political actions, as they seek moral consistency between their private consumption decisions and political actions.

[4] As described above, we circulated surveys in partnership with SNES, a highly trusted and well-recognized organization in Sweden, to collect data on political outcomes. These surveys were obfuscated and not obviously linked to our treatment app, and they asked questions on a battery of other topics besides climate change (e.g., attitudes toward the EU, refugees, food, etc.). We also included a vignette along the lines of de Quidt et al. (2018) at the conclusion of the endline survey for 30% of our participants, which will allow us to empirically bound potential experimenter demand effects in our study.

2 PAP overview

This project examines responses to being primed to think about one's individual contribution to climate change and related environmental degradation through consumption and life-style choices—one's carbon footprint. To this end, we run an RCT using a mobile app that differentially exposes participants to information about their carbon footprints. The app provides detailed and personalized information based on users' consumption. We investigate how political participation, collective action, consumption, and other behaviors change in response to exposure to this information.

This document outlines our pre-analysis plan. The study will be conducted with subjects in Sweden. The planned dates for the fieldwork are May 2024 to February 2025, with the option for subjects to extend their participation in the experiment.

This project builds a novel data collection infrastructure and involves a number of different contractors to handle various parts of the process. Because of the novelty of this approach and the involvement of multiple parties in the process, it was not feasible to pre-specify some of our recruitment and data collection details until contractors began actual implementation in the field.[5] However, we emphasize that the data remain protected (see below for details of data handling) and inaccessible by our research team at the time of submission of this PAP.[6] Hence, all analyses described in this document are pre-planned, prior to receipt of the data.

3 Sample and treatment

3.1 Recruitment and sample

This project centers on the use of a Swedish carbon footprinting app. Potential participants will receive information about the study in the invitation sent to their digital mailbox[7]. Those who decide to participate will follow a link to a pre-treatment survey, which

[5]For example, we originally intended to recruit participants in a manner that would enable stratification prior to randomization. Our app partner, Svalna, had a program in place for this randomization, but upon launching the trial, we learned that the format of the data sent to Svalna by our survey partner, Enkätfabriken AB, did not allow for stratification in the intended way. Hence, we proceeded with a simple randomization procedure.

[6]Documentation of data receipt will be uploaded to the AEA RCT Registry.

[7]Digital mailbox ("digital brevlåda") is a Swedish secure electronic service for receiving official documents and communications online, offering greater security and environmental benefits compared to regular mail and email. Unlike regular email, digital mailboxes require identity authentication through BankID, ensuring only authorized users access sensitive information. As of 2023, 70% of Swedes use a digital mailbox; see e.g. "The Swedes and the Internet 2023", The Swedish Internet Foundation, 10-10-2023, Accessed

ends with a link or QR-code that directs participants to download the app Konsumtionskollen ("Consumption checker"), in which a major part of the study will be conducted. After users have fully registered and connected their bank in Konsumtionskollen, it will randomize participants into two versions of the app: the treatment app ("treatment"), with carbon footprinting features, and a neutrally framed version of the app ("control"). In addition, some participants will be used as "pure controls", with no interaction with either version of the app.

We invite people from single adult households so that participants are unlikely to share expenses with another adult, in order to ensure proper feedback on consumption. To participate, subjects must have a smart phone with BankID linked to the bank accounts that they primarily consume from. They must consent to share transaction data and for researchers to link prescribed register data on variables relevant to the study. Exclusion will occur if there are clear indications that survey answers or information provided are incorrect or frivolously stated.

We recruited a sample of around 4500 participants in the app treatments, with around 2250 assigned to treatment and 2250 assigned to control. See power analysis further below. Based on attrition rates in a pilot study with this recruitment mechanism, we contacted roughly 180,000 potential participants via digital mailbox to obtain this sample. We had two recruitment efforts. One recruitment effort sought a representative sample of the Swedish working age population living in single households. The other recruitment effort targeted demographics (18-39 year olds) and geographies that we believe will be most likely to respond to treatment: precincts with a large share of green party voters in the previous election. Note that this targeting will affect the representativeness of our final sample, but it will not affect internal validity because treatment assignment will take place after initial recruitment.

In addition to the app treatments, we assign a number of subjects to two pure control groups. These are subjects who consent to participate and complete the pre-treatment survey but who do not ultimately connect their bank data through the Konsumtionskollen app. There are two primary reasons that this may occur: (i) a subject decides not to download the app and (ii) a subject encounters technical problems at the bank connection stage.[8] For (ii), although the connection and server issues were unpredictable in nature, we note that tech-savvy subjects may be able to overcome technical roadblocks in the recruitment process and more enthusiastic subjects may be more likely to re-attempt a bank connec-

26-06-2024.

[8]Our app partner, Svalna AB, experienced several problems during May 2024 with Tink AB, the service that manages Konsumtionskollen's connection to participants banks. In addition, Svalna AB experienced a server crash on May 15 and 16, 2024 during our recruitment efforts.

tion after Svalna's servers had been restored. These subjects who overcome recruitment hurdles will still be randomized between treatment and control versions of the app, so we maintain internal validity for comparisons between app treatments. However, those who do not end up installing the app for either (i) or (ii) may differ from subjects in our app treatments. When comparing our pure controls to subjects in the app treatments, we will provide balance tables and discuss the role of potential selection. We also hope to receive more information from technical staff at Svalna as to the nature of the connection problems. This might inform our analysis in this regard, for example by letting us focus solely on users experiencing certain types of technical problems that may be plausibly exogenous.

All groups (treatment, control, and pure controls) will receive additional surveys during the course of the study. The surveys will collect data on covariates and additional outcomes, which can be compared across groups. Register data will also be obtained and linked for all groups.

3.2 Treatment

Konsumtionskollen is a mobile app and service developed by Svalna AB. The primary purpose of the study is to evaluate how participants react to this service in multiple dimensions of behavior. Participants answer a number of initial survey questions and are then randomly assigned to a control or treatment group that will see and use different versions of the app.

The treatment group's version of the app is an adapted version of the existing app and climate calculator Svalna, developed by Svalna AB. The app provides feedback on the user's consumption by connecting the user to their bank through a Bank ID signature. In this way, the user allows Svalna to have access to the user's transaction data, which can be analyzed and presented to the user in the app. In the app, the user can see their consumption-based climate footprint, aggregated or broken down into different consumption categories, or specified for each transaction or purchase. The user can get tips on how various behavioral changes can reduce the climate footprint, set their own reduction targets, and compare their emissions with other people who are similar to themselves. The app also presents users with "action cards" that describe measures they can take to reduce their carbon footprints. Users can save these action cards to indicate the actions they would like to undertake, in whole or in part, in the next 6 months. The purpose of the treatment group version of the app is to provide information about the participant's consumption-based climate footprint and encourage lifestyle and consumption changes

that reduce the participant's climate footprint.

The control group will be able to see and use a version of the app that is as similar as possible to the version of the treatment group, while at the same time directly bringing attention to environmental and climate change issues as little as possible. This is achieved by the user receiving feedback on their own consumption in a very similar way, albeit with the focus being on personal financial choices themselves (rather than additionally highlighting their environmental consequences) and with certain functions switched off. The purpose of this is to experimentally isolate the effect of the "climate calculator" and its influence on attitudes and behaviors (as distinct from, for example, the effect of receiving a general information and feedback on one's consumption and how it relates to consumption of other similar households) so as to "prime" attention to the subject's contribution to climate change via their consumption and lifestyle choices.

As described above, subjects who consent to participate but who do not connect to the app will be used as pure controls.

3.3 Outcomes and heterogeneity

Our primary outcomes pertain to consumption and political behavior and attitudes.

Consumption will be measured using bank transaction data and register data. We will measure consumption from bank transaction data in terms of daily carbon footprint (kg CO2e), expenditures (SEK), and carbon intensity (kg CO2e/SEK); these consumption outcomes can be further grouped into categories, like food, housing, utilities, transport, etc. based on information from the app. At endline, we will gather survey data from users about their knowledge of the carbon intensiveness of common activities. This outcome will help shed light on users' learning and the informational value of the treatment. We will also analyze the user's choice of action cards to save. We can subset our analysis of consumption outcomes based on the action cards saved by users, which may shed light on mechanisms for the treatment effect.

Political behavior and attitudes will be measured using register and survey data. We will link register data on voting participation as a binary measure of political behavior. To gather further information on political behavior and attitudes, we will conduct a baseline survey, an election survey in partnership with SNES in the week following the EU Parliament elections, follow-up surveys several months into the study, and an endline survey at the end of the study period. Through these surveys, we will ask participants about their political preferences, their voting choice in the EU Parliament elections, their opinion on environmental policies, and their opinion on the role of government and indi-

vidual responsibility for confronting societal challenges. We will also provide subjects an opportunity to donate to an environmental cause and to sign an environmental petition as measures of political behavior. The outcomes of interest here are 1) how green the party is that the participant voted for, 2) self-reported political action on climate issues (participation in a demonstration, signing a petition, contacting a politician, writing a letter to the editor for a newspaper, discussing climate issues in an online forum), 3) willingness to donate to a climate cause. As additional outcomes, we will look at 1) support for climate policies, 2) worry about climate change, 3) the degree to which climate is the reason for choice of party in the EU election, 4) the degree to which the subject believe individuals or society are responsible for addressing climate change, 5) green investments, and 6) signing a climate petition in a follow-up survey. We measure climate policy support as a composite index based on support for three policies that differ in their degree to which they limit individual choice: a ban, a tax, and a nudge. As further specified in section 5.1, we might also create a variable measuring relative support for liberty-preserving climate policies using the same questions. Relevant survey questions are enclosed as part of this PAP.

The heterogeneous effect of our treatment will be examined along a number of dimensions, including interactions thereof: political attitudes and preferences (based on survey questions regarding voting intentions in the EU Parliament elections, political party preferences), environmental attitudes and behaviors (based on baseline carbon footprint and on survey questions regarding desire to live more sustainably, participation in past environmental demonstrations, accuracy in estimating one's own carbon footprint), and ethical world view (based on a trolley dilemma question).

Given the long study period, there may be attrition in our app treatments and pure controls. However, we do not expect differential attrition across groups. If differential attrition does arise, we will use best practices from the literature to assess its implications for our findings. We also note that attrition may differ across our outcome variables, given different timelines and instruments for gathering outcome data. We will analyze each outcome using its own sample; we will also conduct analyses using a consistent sample that can be applied across most outcomes.

4 Data

We have data from three primary sources: (i) the mobile app, (ii) online surveys, and (iii) administrative data from government registers. Outcomes variables are summarized in Table 1.

Through the mobile app, we obtain information on bank transactions, carbon footprints, engagement with the app, and information about the user's lifestyle and living situation. An initial online survey was used to collect information on political attitudes and preferences, environmental self-identity and pro-social identity, environmental values, and ethical worldviews. A political survey was circulated in partnership with SNES shortly after the EU Parliament elections. This survey collected information on participants' choices in the 2024 EU Parliament elections, past political participation, attitudes on politics and political parties in Sweden, and opinions on various policy questions. A follow-up and endline survey will collect additional outcomes, including: a donation task, an opportunity to sign a petition, and a quiz of carbon literacy to assess learning. Register data will be collected on individual demographic characteristics, education, income, utilized tax credits, and financial investments.

Consumption outcomes from the Svalna mobile app and political outcomes from the SNES survey are pre-registered with the initial PAP submission. Also being uploaded to the AEA RCT Registry along with the initial PAP submission are the full set of SNES survey questions, the full set of initial pre-treatment survey questions, and the full set of variables collected in the app.

As noted above, additional outcomes will be collected through a follow-up survey and endline survey. These survey questions are currently in draft form; they may be revised after preliminary analysis of outcomes from short-term consumption and the SNES survey. For our initial PAP submission, we do not fully pre-register these survey questions and outcomes because our preliminary analysis of short-term consumption and SNES survey responses may provide insights on which outcomes, what type of heterogeneity (see subsection 5.1), and what types of mechanisms (see subsection 5.2) might be fruitful and feasible to pursue. Even so, we provide some detailed discussion of our intentions in subsections 5.1 and 5.2 for transparency. Final questions for the follow-up and endline surveys will be uploaded to the AEA RCT Registry before being circulated to subjects. At that time, we will also populate Section 6 of this PAP to pre-register the specific outcomes that will be constructed from those survey questions and to discuss any updates or changes to the plan specified in the initial PAP submission. Given our multiplicity of outcomes, we may employ an algorithmic approach to exclude certain outcomes if variation is insufficient in the data or response rate is too low; such details will also be provided as necessary in Section 6.

Outcome	Measurement	Data Source
Carbon footprint	kg CO2e (daily)	Svalna transactions[9]
Expenditure	SEK (daily)	Svalna transactions
Carbon intensity	kg CO2e/SEK (daily)	Svalna transactions
Carbon knowledge	% correct on endline quiz	Endline survey
Participation in EU election	Binary	Register data
Greenness of choice in EU election	Green score of chosen party[10]	SNES survey
Political action on climate	Binary	SNES survey
Support for climate policy	Composite index from three questions	SNES survey
Concern about climate	Scale (concerned to unconcerned)	SNES survey
Importance of climate in vote	Scale (important to unimportant)	SNES survey
Locus of responsibility	Scale (indiv. to gov/society)	SNES survey
Green investments	Green stocks and retirement portfolios[11]	Register data
Donation to climate cause	Kronor	Follow-up survey
Signed climate petition	Binary	Follow-up survey

TABLE 1
OUTCOME VARIABLES

5 Analysis

We will assess the effect of treatment on consumption behavior and political action and attitudes.

Although we have multiple outcomes of interest, we focus our power analysis here on the carbon footprint measure. We proceed in this way because we have pilot data on weekly carbon footprints for over 1400 existing Svalna users, allowing for a more informed analysis. It was not possible to gather pilot data on several other outcomes of interest (e.g., voting choice), so power analyses for these outcomes would necessarily be more speculative. Reassuringly, our intended sample sizes are larger than sample sizes in prior work examining similar outcomes (e.g., Jha & Shayo (2019), Cantoni et al. (2019), and Bursztyn et al. (2021)) and also substantially larger than the rough guidance from Haaland et al. (2023) of 700 units per treatment arm for information provision experiments.

We plan to estimate treatment effects using analysis of covariance (ANCOVA), which has advantages over difference-in-difference analysis for producing lower minimum detectable effects (MDEs) (McKenzie, 2012). To assess whether the treatment affects consumption behavior, we can estimate:[12]

$$Y_{it} = \sum_{t=1}^{r} \delta_t + \tau T_{it} + \theta \bar{Y}_{i,PRE} + \rho X_{it} + \epsilon_{it}, \tag{1}$$

[12]We can alternatively use the difference-in-difference estimator of Burlig et al. (2020). As predicted by theory, we find weakly larger MDEs using the Burlig et al. (2020) estimator. Results are available from the authors by request.

where Y_{it} is the carbon footprint of individual i at time t; T_{it} is a treatment indicator of individual i at time t; δ_t is a day-by-year fixed effect; $\bar{Y}_{i,PRE}$ is the mean for individual i over the m pre-treatment periods; X_{it} is a vector of individual level controls; and ϵ_{it} is an idiosyncratic error term. The Average Treatment Effect (ATE) of the carbon calculator on individuals' carbon footprint is thus captured by τ. The daily measure of co2e kg (or appropriate transformations thereof) will be one of the main outcomes for our analysis. For our final analysis, covariates will be chosen using a machine learning method that seeks to reduce residual variance; we will follow best practices from the literature to avoid data mining and to generate valid inference. The full set of possible controls include all pre-treatment survey questions, all profile questions in the app, and a set of pre-treatment consumption variables - all of which are listed in documents uploaded to the AEA RCT Registry along with the initial PAP submission.

Using *ln(co2e + 1)* at the weekly level as the outcome for illustration, Table 2 presents a power analysis.

TABLE 2
ANCOVA POWER CALCULATIONS FOR CONSUMPTION ANALYSIS USING WEEKLY DATA ON CURRENT SVALNA USERS.

	N	MDE	Power	T/C	pre	post	depvar
r1	1000	0.0848	0.8	0.5	52	12	1
r2	1000	0.0845	0.8	0.5	52	12	2
r3	2000	0.0599	0.8	0.5	52	12	1
r4	2000	0.0597	0.8	0.5	52	12	2
r5	3000	0.0489	0.8	0.5	52	12	1
r6	3000	0.0487	0.8	0.5	52	12	2
r7	4000	0.0423	0.8	0.5	52	12	1
r8	4000	0.0422	0.8	0.5	52	12	2
r9	1000	0.0755	0.8	0.5	52	24	1
r10	1000	0.0749	0.8	0.5	52	24	2
r11	2000	0.0533	0.8	0.5	52	24	1
r12	2000	0.0529	0.8	0.5	52	24	2
r13	3000	0.0435	0.8	0.5	52	24	1
r14	3000	0.0432	0.8	0.5	52	24	2
r15	4000	0.0377	0.8	0.5	52	24	1
r16	4000	0.0374	0.8	0.5	52	24	2
r17	1000	0.0716	0.8	0.5	52	52	1
r18	1000	0.0707	0.8	0.5	52	52	2
r19	2000	0.0506	0.8	0.5	52	52	1
r20	2000	0.0499	0.8	0.5	52	52	2
r21	3000	0.0413	0.8	0.5	52	52	1
r22	3000	0.0408	0.8	0.5	52	52	2
r23	4000	0.0358	0.8	0.5	52	52	1
r24	4000	0.0353	0.8	0.5	52	52	2

Notes: Pilot data include 1400+ users, with 286 users comprising a balanced panel necessary for these analyses. Depvar = 1 corresponds to ln(kg CO2e + 1), which is a log transformation of the carbon footprint variable. Depvar = 2 corresponds to the residuals of a regression with dependent variable ln(kg CO2e + 1) against the following regressors: categorical dummies for income rank, number of cars registered (profilencars), number of adults at home (profilehousehold_a), number of children at home (profilehousehold_c), total spending by week (totspend_yw), commuting distance in km (profilecommute_dis) and dwelling type (profilehometype2).

To assess the effect of the treatment on political action and attitudes, we estimate versions of the following general equation:

$$Y_i = \beta_0 + \beta_1 T_i + \gamma \mathbf{X}_i + \epsilon_i \tag{2}$$

where Y_i is an outcome for individual i measured via survey responses or register data, T_i is a treatment indicator of individual i, X_i is a vector of individual characteristics, ϵ_i is an idiosyncratic error term. The ATE are thus captured by τ. The main outcomes of interest are described above in Table 1. For our final analysis, covariates will be chosen

using a machine learning method that seeks to reduce residual variance; we will follow best practices from the literature to avoid data mining and to generate valid inference.

In addition to these main specifications, we will also assess heterogeneity of treatment effects, as described further below.

5.1 Hypotheses

Overall, we expect the treatment to reduce participants' carbon footprints, which can arise from reductions at the intensive (carbon intensity) and extensive (expenditures) margins. For other outcomes (e.g., green voting, signing an environmental petition, donating to climate change mitigation, perceived locus of responsibility for addressing climate change, etc.), it is possible that the treatment may crowd in or crowd out other pro-environmental or pro-social actions (Nyborg & Rege, 2003; Carlsson & Johansson-Stenman, 2012).

Moreover, impacts may vary by consumer type. We have several hypotheses regarding heterogeneity of impacts:

- Political attitudes and preferences: we expect stronger treatment effects on voting outcomes among "swing voters", i.e., those who are not strongly attached to a particular party. We expect weak or null treatment effects among participants who report being strongly attached to a particular party. [Relevant information collected at baseline.]

- Environmental attitudes and behaviors: other things equal, we predict larger reductions in carbon footprints among participants who have strong environmental values and environmental identities, who express a desire to live more sustainably, and who are concerned about climate change. [Relevant information collected at baseline.]

- Baseline carbon footprint: we expect larger reductions in carbon footprints among users who have above-average carbon footprints at baseline. Andor et al. (2020) note that effectiveness of home electricity reports will depend on baseline consumption levels and the carbon intensity of electricity generation. They find that within Germany, households with higher baseline consumption respond more strongly to HERs. Allcott (2011), Ayres et al. (2012), and Ferraro & Price (2013) report similar types of heterogeneities, where higher baseline consumption is associated with stronger treatment effects. [Relevant information collected at baseline.]

- Interactions between environmental attitudes and baseline footprints: Bonan et al. (2021) "find weak evidence that targeting a specific group of utility customers – users

with high baseline energy consumption who behaved pro-environmentally in the past – can lead to energy savings." This suggests that the interaction between self-identity and baseline consumption may also be important.

- Engagement with the app: we expect that engagement with the app is a mediator, whereby more engaged participants will see larger reductions in their carbon footprints. [Relevant information collected throughout study on app usage.]

- Accuracy in estimating one's own baseline carbon footprint: we expect heterogeneous effects among participants who inaccurately estimate their own carbon footprints. Those who overestimate their own carbon footprints may increase their carbon footprints when presented with the treatment, and those who underestimate their own carbon footprints may decrease in response to treatment (Byrne et al., 2018). [Relevant information collected at baseline.]

- Dampening and replacement logic: Kaufmann et al. (2024) note that a consumer may try to conserve, but equilibrium feedback may "dampen" the impact of private actions on aggregate consumption. We predict that consumers who believe that such dampening occurs will be less responsive to treatment than those who do not believe that such dampening occurs. We plan to elicit these beliefs in the endline survey, following the approach of Kaufmann et al. (2024). [Relevant information to be collected at endline.]

- Trolley dilemma: we use participants' trolley dilemma responses as a proxy for whether they have deontological or consequentialist ethics, as in Cornelissen et al. (2013). We hypothesize that our treatment (the carbon footprint calculator) will have differential impacts across these two groups. In particular, we expect consequentialists to experience more crowding-out of other green outcomes (e.g., green voting, signing an environmental petition, participation in climate demonstrations, etc.), as private actions to reduce one's own carbon footprint in the nudged categories will be seen as a substitute for these other green outcomes. If consumers view environmental impact as a constrained optimization problem, then our treatment will make private actions (reducing one's own carbon footprint through consumption changes) more salient as a substitute for other actions. In contrast, we expect rule-based subjects to have less crowding-out or potentially some crowding-in of other environmental behaviors. Here, the treatment may reinforce their environmental identity or encourage them to adopt green behaviors in other aspects of their lives as well. [Relevant information collected at baseline.] As a robustness check, we may also

include an additional open-ended question in our endline survey about subjects' reasoning, following the approach of Kaufmann et al. (2024). [Relevant information to be collected at endline.]

- Errors in carbon footprint calculations: Svalna's assignment of carbon emissions to bank transactions may be imperfect. Errors in carbon footprint calculations (or perceived errors) may attenuate treatment effects due to measurement error, reducing app engagement, and/or reducing participants' faith in the app. We can conduct a subgroup analysis that (a) excludes subjects with severe errors [To be calculated by researchers at endline] or (b) that excludes subjects who report large perceived errors in the endline survey. [Relevant information to be collected at endline.]

Moreover, if perceived relative responsibility of individual vs. society is positively affected by the treatment, a natural follow-up question is if this affects preferences for the *type* of policies to be implemented. Our climate policy questions contain three policies that differ in their degree to which they limit individual choice and hence possibility to exercise personal responsibility: a ban, a tax, and a nudge. We hypothesize that if our treatment shifts perceived responsibility towards the individual, support for liberty-preserving relative to liberty-reducing policies will increase. If locus of responsibility is positively affected, we will measure relative support for liberty-preserving climate policies by subtracting the average support for a ban and a tax from that of a nudge policy.

5.2 Mechanisms and spill-overs

We hypothesize that the treatment will decrease carbon footprints. What are the potential mechanisms for this treatment effect? What additional analyses can shed light on these mechanisms and potential mediators?

- Learning: the informational content of the app may help subjects understand where there are opportunities to reduce their carbon footprints. We can get direct evidence on the 'first stage' through survey questions that test users on their knowledge about the carbon intensiveness of different types of consumption. That is, we can examine whether the treatment improves knowledge. [Relevant information to be collected at endline.] As a complement, we also use data on engagement in the apps sections that likely lead to learning, specifically the section on one's own footprint and the list of potential actions and their effects on emissions.

- Social norms: the nudges from the app may activate social norms. Under social norms, we would expect larger carbon footprint reductions among users who had

above-average baseline footprints. We would expect smaller reductions (or increases in carbon footprints) among those who had below-average baseline footprints. [Relevant information collected at baseline.]

- Behavioral plasticity: we can gain insights on the user's (perceived) behavioral plasticity through the action cards. If we observe stronger treatment effects in activity categories that users identify through action cards, this observation would be consistent with behavioral plasticity modulating treatment effects. [Relevant information collected at baseline.]

- Conservation intentions: we can gain insights on the user's conservation intentions in general through one of our initial survey questions and in specific areas through the action cards. We expect stronger treatment effects among users who indicate a desire to live more sustainability and in activity categories that users identify through action cards. Such observations would be consistent with conservation intentions being a modulator of treatment effects. [Relevant information collected at baseline.]

The treatment may also affect behavior in other domains (e.g., political action). The impact of the treatment on these other domains is more ambiguous. However, there are several different mechanisms that may align with certain observations in the data:

- Moral accounting and moral licensing (Mazar & Zhong, 2010; Ho et al., 2016; Urban et al., 2019): if consequentialists (as characterized by the trolley dilemma) experience crowding-out of other green activities, this evidence would be consistent with moral accounting (Cornelissen et al., 2013). That is, upon conserving more in a nudged category of consumption, consequentialists may reduce conservation in other consumption categories or reduce green actions in other domains through substitution effects. Ho et al. (2016) find evidence of moral licensing (crowding out) when providing social information. This crowding out effect is heterogeneous: those who do better than the norm are less prosocial in the subsequent task, while those who do worse than the norm are more prosocial in the subsequent task; however, the absolute impact on the former group is larger than for the latter. Dorner (2019) finds stronger moral licensing among subjects with stronger pro-environmental attitudes. We can examine whether there are similar patterns of heterogeneity in crowding-out in our data. [Relevant information collected at baseline.]

- Moral consistency: if rule-based agents (as characterized by the trolley dilemma) experience crowding-in of other green activities, this evidence would be consistent

with those agents seeking moral consistency. Among rule-based agents, we may expect more moral consistency within domains (e.g., across consumption categories) than across domains (e.g., between consumption and political action), as agents may "narrowly bracket", treating different domains as distinct from one another. [Relevant information collected at baseline.]

- Perceptions of responsibility: users' willingness to engage in political action may be mediated by their beliefs about whether individuals or government are responsible for addressing environmental problems. Our SNES survey includes questions about the locus of responsibility. Hence, we can analyze whether our treatment shifts perceived responsibility toward the individual, and if so, whether this shift in responsibility results in different levels of political engagement. We include these same questions about the locus of responsibility in the endline survey. From this, we can observe whether additional months of exposure to the treatment leads to a shift in the perceived locus of responsibility between the SNES and endline surveys. [Relevant information collected in SNES survey. Additional information collected in endline survey.]

- Cognitive evaluation theory: nudges from the app may crowd-in other environmental behaviors, particularly if they are seen as acknowledging (Torgler et al., 2009; Carlsson & Johansson-Stenman, 2012). Given this, individuals with stronger environmental self-identity and values may see crowding in of other environmental actions (e.g., political action), as the private action affirms their values and reinforces their desire to act in a pro-environmental manner. [Relevant information collected at baseline. Additional information on subjects' self-reported feelings of affirmation/control collected at endline.]

- Environmental competency: those who are less knowledgeable may see more crowding out of political action, as they respond to the most accessible information (from app messaging). [Relevant information collected at baseline.]

Overall, it is possible for the treatment to crowd-in political actions for some users while crowding-out political actions for other users. In aggregate, these effects may cancel out and lead to an average null effect in the treatment group relative to the control group. However, if both effects are present, we should observe greater variance in political actions (e.g., donations to an environmental cause) in the treatment group relative to the control.

5.3 Multiple hypothesis testing

We will investigate the robustness of our results to multiple hypothesis testing (MHT) following best practices in the literature. To this end, we group our outcomes from Table 1 into several families:

- Consumption: Carbon footprint, Expenditure, Carbon intensity
- Political Action: Participation in EU election, Greenness of choice in EU election, Political action on climate
- Political Attitudes: Support for climate policy, Concern about climate, Importance of climate in vote
- Revealed Measures: Signed climate petition, Donation to climate cause, Green investments
- Potential mediators: Carbon knowledge, Locus of responsibility

There are two common strategies for handling MHT: using indices for each family of outcomes (Kling et al., 2007; Anderson, 2008) and accounting for the false discovery rate in each family (Anderson, 2008). We will use both approaches for the families of outcomes defined above. For the latter, we follow common practice using a false discovery rate of 5%.

6 Updates to initial PAP submission

For logistical reasons, the follow-up and endline surveys were combined into a single survey, which was circulated on December 5, 2024 (henceforth, "endline survey"). This survey contains questions described in the original PAP, including questions about dampening logic, carbon literacy and learning, perceived errors in carbon footprint calculations, and revealed measures of political action. We also made several additions to collect further information on mechanisms, as described below. The full survey will be uploaded along with this updated PAP.

Our baseline survey collected information on environmental self-identity to shed light on whether cognitive evaluation theory is a potential mechanism for the treatment effect. We included additional questions in the endline survey to shed light on this mechanism. In particular, we asked a series of questions to understand whether subjects viewed the app as acknowledging or controlling. We asked subjects to use a Likert scale to rate their agreement with the following:

- The app made me feel satisfied with my consumption choices. [Acknowledging/Positive]
- I often looked forward to receiving feedback from the app. [Acknowledging/Positive]
- Sometimes I felt anxious about receiving feedback from the app. [Controlling/Negative]
- The app made me feel bad about my consumption choices. [Controlling/Negative]
- I felt the app was controlling or intrusive.[Controlling/Negative]
- The app was interesting and informative.[Acknowledging/Positive]

Our endline survey also included a number of self-perception questions. These questions shed additional light on potential mechanisms for treatment effects. We asked subjects to use a Likert scale to rate their agreement with the following:

- The app made me more aware of my consumption decisions. [Self-perception of treatment effect, first stage (awareness)]
- The app influenced my consumption decisions. [Self-perception of treatment effect, reduced form (consumption)]
- My political commitment and opinions changed during the course of the study. [Self-perception of potential crowding-in or crowding-out]

To probe for potential experimenter demand effects (EDE), we included a vignette along the lines of de Quidt et al. (2018) at the conclusion of the endline survey for 30% of our participants. This vignette pertains to crowding-in vs. crowding-out. There were three versions of the vignette: two EDE treatments and one control. Each version was circulated to 10% of the overall sample and re-asked about the subject's opinion on a carbon tax. The two EDE treatments provided additional information about our study's intentions: "In this study, you were encouraged to consume more environmentally friendly. Some researchers believe that such encouragement can weaken (strengthen) support for environmental policies, which is what we want to investigate in this study. Given this, please indicate again what you think about the following policy proposal."We seek to gauge the potential influence of EDE in our study by comparing responses across groups.

7 Preliminary results

7.1 Summary Statistics

Table 3 presents summary statistics for participant characteristics, including variables for standard demographic variables, location and living situation, car ownership and commuting distance, self-reported diet, availability of bank transaction data, and pre-treatment carbon footprint and spending. We observe strong balance between the treatment and control groups across the board, with only one variable (residing in a large town) exhibiting differences between groups at the 10% significance level.

Table 4 shows summary statistics for the pre-treatment survey. Here, we present variables for survey engagement, environmental attitudes and preferences, trolley dilemma responses, and voting intentions. We again observe strong balance between the treatment and control groups throughout this table, with just one variable (intention to vote for the Liberals in the EU Parliament elections) exhibiting differences between groups at the 10% significance level.

Table 5 displays summary statistics for the SNES survey, including variables for vote choice, greenness of vote, assessment of political parties' environmental reputations, attitudes on three climate policies, importance of climate in the voting choice, locus of responsibility, and survey engagement. We do not observe significant differences between group averages on any of these variables, suggesting null average treatment affects in the aggregate. However, as we will show below, we do find significant treatment effects for certain subpopulations that we pre-registered in our PAP.

TABLE 3
SUMMARY STATISTICS: CHARACTERISTICS

	Full sample				Treatment		Control		Difference (3)-(2)
	(1)				(2)		(3)		(4)
	Mean/b	Sd	Min	Max	Mean/b	Sd	Mean/b	Sd	Mean/b
Female	.563	.496	0	1	.564	.496	.563	.496	-.000739
Age	31.1	9.52	18	65	30.9	9.56	31.4	9.48	.448
Region									
Big City (Stockholm, Gothenburg, Malmö)	.492	.5	0	1	.478	.5	.506	.5	.028
Large town	.336	.472	0	1	.353	.478	.319	.466	-.0342*
Commuting town	.114	.317	0	1	.115	.319	.112	.316	-.003
Rural town	.058	.234	0	1	.0534	.225	.0625	.242	.00913
Dwelling									
Apartment	.948	.221	0	1	.948	.221	.948	.222	-.000183
House	.0517	.221	0	1	.0516	.221	.0518	.222	.000183
Adults in household	1.11	.422	1	10	1.11	.447	1.1	.395	-.0119
Children in household	.117	.438	0	4	.104	.41	.13	.464	.026
Car owner	.264	.441	0	1	.268	.443	.259	.438	-.00862
Commuting distance (km)	11.8	21.6	0	300	11.5	20.3	12.1	22.9	.539
Diet									
Mixed	.793	.405	0	1	.791	.406	.795	.404	.00374
Vegan	.0324	.177	0	1	.032	.176	.0329	.178	.000882
Vegetarian	.0794	.27	0	1	.0819	.274	.0768	.266	-.00505
Vegfish	.095	.293	0	1	.0948	.293	.0952	.294	.000428
Pre-treatment days available	329	88	63	365	330	86.9	328	89.2	-2.08
Post-treatment days available	146	73.3	0	231	146	72.8	147	73.7	.338
Pre-treatment monthly mean									
Total footprint (kg CO2e)	429	373	58	13482	429	438	429	295	-.155
Food	124	72	.95	830	122	70.5	126	73.3	4.1
Housing	51.3	78.6	.076	1394	49.3	76.8	53.3	80.3	3.98
Miscellaneous	153	264	4.5	13252	160	356	147	112	-13.6
Transport	100	167	0	3711	97.7	150	103	183	5.35
Total spending (SEK)	54103	70778	5831	1500515	53066	70220	55133	71332	2067
Food	6118	2986	69	26114	6079	2996	6158	2977	79.2
Housing	10746	12068	13	298461	10439	12027	11050	12105	611
Miscellaneous	35076	64922	1231	1470965	34412	64153	35734	65687	1322
Transport	2164	4044	0	167771	2136	3154	2191	4766	55.1
Observations	3579				1783		1796		3579

TABLE 4
SUMMARY STATISTICS: PRE-TREATMENT SURVEY

	Full sample				Treatment		Control		Difference (3)-(2)
	(1)				(2)		(3)		(4)
	Mean/b	Sd	Min	Max	Mean/b	Sd	Mean/b	Sd	Mean/b
Started pre-treatment survey	.98	.139	0	1	.978	.146	.982	.132	.00406
Passed attention check	.755	.43	0	1	.755	.43	.755	.43	-.0000585
Number of questions answered	94.9	6.96	2	109	94.7	7.05	95.1	6.88	.402
Consistent answers on political self-identity	.979	.143	0	1	.982	.134	.977	.151	-.00489
Consistent answers on environmental self-identity	.987	.115	0	1	.987	.114	.986	.116	-.000417
Passed checks for attention and consistency	.732	.443	0	1	.732	.443	.732	.443	.000202
Considers climate change a problem (1-10)	8.38	1.93	1	10	8.4	1.89	8.35	1.97	-.0439
Considers climate change a problem ($\geq$7)	.845	.362	0	1	.848	.359	.841	.366	-.00728
Pro-environmental self-identity (1-7)	4.37	1.28	1	7	4.35	1.28	4.4	1.29	.0467
Wish to live more sustainably ($\geq$5)	.372	.483	0	1	.359	.48	.384	.486	.0243
Wish to live more sustainbly (1-7)	5.22	1.5	1	7	5.23	1.49	5.21	1.51	-.0206
Wish to live more sustainably ($\geq$5)	.708	.455	0	1	.715	.452	.701	.458	-.0144
Green preferences (0/1)	.308	.462	0	1	.304	.46	.313	.464	.00927
Pull lever in trolley dilemma (0/1)	.859	.348	0	1	.859	.348	.858	.349	-.00134
Plan to vote									
No	.0565	.231	0	1	.0609	.239	.0522	.223	-.00864
Undecided	.155	.362	0	1	.148	.355	.161	.368	.0131
Yes	.789	.408	0	1	.791	.407	.786	.41	-.00444
Sure of party to vote for (0/1)	.421	.494	0	1	.437	.496	.405	.491	-.032
Voting intention (greenness score)									
Green Party (100)	.201	.401	0	1	.193	.395	.208	.406	.0153
Left Party (85)	.197	.398	0	1	.2	.4	.194	.395	-.00646
Social Democrats (61)	.205	.404	0	1	.218	.413	.193	.394	-.025
Centre Party (55)	.0726	.26	0	1	.0701	.255	.0752	.264	.00506
Liberals (36)	.0562	.23	0	1	.0477	.213	.0646	.246	.0169*
Moderates (17)	.115	.319	0	1	.122	.327	.109	.311	-.0131
Christian Democrats (15)	.0201	.14	0	1	.0168	.129	.0234	.151	.00656
Sweden Democrats (0)	.0548	.228	0	1	.0544	.227	.0551	.228	.00072
Other	.0338	.181	0	1	.0325	.177	.0351	.184	.00255
Missing	.0447	.207	0	1	.046	.21	.0434	.204	-.00256
Observations	3579				1783		1796		3579

TABLE 5
SUMMARY STATISTICS: SNES SURVEY

	Full sample				Treatment		Control		Difference (3)-(2)
	(1)				(2)		(3)		(4)
	Mean/b	Sd	Min	Max	Mean/b	Sd	Mean/b	Sd	Mean/b
EFID started SNES survey	.775	.417	0	1	.774	.418	.777	.417	.00275
Number of questions answered	69.4	17	0	77	69.9	16.2	68.9	17.8	-.971
Passed quality check	.942	.233	0	1	.949	.22	.935	.246	-.0138
Party Environmental Reputation									
Left Party	5.68	1.23	1	7	5.7	1.21	5.67	1.25	-.0298
Social Democrats	4.52	1.08	1	7	4.53	1.06	4.5	1.09	-.0253
Centre Party	4.22	1.24	1	7	4.24	1.22	4.2	1.26	-.0431
Liberals	3.3	1.22	1	7	3.28	1.21	3.32	1.24	.0317
Moderates	2.39	1.27	1	7	2.39	1.26	2.39	1.28	-.000706
Christian Democrats	2.25	1.23	1	7	2.23	1.2	2.26	1.26	.0274
Green Party	6.41	1.16	1	7	6.4	1.15	6.42	1.17	.0146
Sweden Democrats	1.57	1.07	1	7	1.56	1.06	1.58	1.09	.0281
Voted	.657	.475	0	1	.66	.474	.654	.476	-.00589
Voted for: (greenness score)									
Green Party (100)	.265	.442	0	1	.272	.445	.258	.438	-.0136
Left Party (85)	.191	.393	0	1	.191	.393	.191	.393	-.000706
Social Democrats (61)	.128	.334	0	1	.138	.345	.118	.323	-.0197
Centre Party (55)	.0795	.271	0	1	.0764	.266	.0827	.276	.00637
Liberals (36)	.0477	.213	0	1	.0445	.206	.051	.22	.00648
Moderates (17)	.067	.25	0	1	.0586	.235	.0753	.264	.0168
Christian Democrats (15)	.0255	.158	0	1	.0245	.155	.0266	.161	.00213
Sweden Democrats (0)	.0337	.18	0	1	.0334	.18	.034	.181	.000615
Did not vote	.116	.32	0	1	.115	.319	.117	.322	.00253
Cannot remember	.00185	.043	0	1	.00148	.0385	.00222	.047	.000733
Don't want to answer	.0126	.111	0	1	.0119	.108	.0133	.115	.00143
Blank vote	.00925	.0957	0	1	.00964	.0977	.00886	.0938	-.000774
Other	.0226	.149	0	1	.0237	.152	.0214	.145	-.0023
Greenness of vote	70.1	30.3	0	100	70.9	30	69.3	30.6	-1.58
Climate Policy Index	.0117	.864	-2.6	3	.000465	.86	.0231	.869	.0226
Climate Policy: Ban	3.46	1.34	1	5	3.46	1.35	3.47	1.34	.0158
Climate Policy: Tax	3.58	1.26	1	5	3.56	1.26	3.6	1.27	.0404
Climate Policy: Nudge	4.25	.931	1	5	4.25	.924	4.25	.938	-.00176
Importance of climate in vote	4.42	.9	1	5	4.45	.894	4.4	.906	-.0433
Society's vs individuals' responsibility for consumptions' effect on climate	3.72	1.01	1	5	3.73	1.02	3.71	.996	-.0218
Observations	3579				1783		1796		3579

7.2 Consumption outcomes

Our analysis of consumption outcomes is still in progress, as there are a number of checks that must be completed on the transactions data before running the final regressions described in our PAP.

7.3 Political outcomes

Does exposure to personal responsibility messaging crowd-in or crowd-out political action and engagement? To shed light on this question, we examine how the carbon footprint app treatment affects our outcomes for voting (participation in EU election, greenness of choice in EU election), revealed preference measures of climate action (donations to a climate cause in a charitable dictator game, signing a climate petition), and policy attitudes and preferences (support for climate policy, importance of climate to EU voting choice, and locus of responsibility for addressing climate change). More detailed descriptions of these outcomes are described in Table 6.

Results from our ANCOVA are presented in Tables 7, 8, and 9.[13] These tables present three specifications for each outcome, with outcomes denoted in the column headers. The first specification for each outcome analyzes the full sample; the other two specifications focus on a subsample of "green participants" (those with relatively strong environmental attitudes and conservation intentions), who we noted in our PAP as a subsample that would likely experience stronger treatment effects. The third specification differs from the second, as it includes an additional interaction term to estimate heterogeneous treatment effects between consequentialists and deontologists, in line with the approach described in our PAP.

Across outcomes and specifications, two notable patterns emerge. First, we find null or marginally significant average treatment effects (ATEs) when analyzing the full sample and when pooling consequentialists and deontologists in the subsample of green participants. Second, when we probe heterogeneity, we find positive coefficients for the base effect (Treatment) and negative coefficients for the treatment interacted with an indicator for consequentialists (Treatment $\times$ Consequentialist). This suggests that the treatment tends to crowd-in political attitudes and behaviors for deontologists, while there is a countervailing effect for consequentialists. These relative effects are consistent with the hypotheses stated in our PAP.

In Table 7, we see both of these patterns emerge for our two voting outcomes: whether

[13] The sample for analysis here is confined to users who passed quality checks for both the pre-treatment survey and the endline survey.

the subject participated in the EU election and the green score of the chosen party (higher values indicate more environmentally-friendly parties; details for calculating green scores are available in the Appendix). Here, we have insignificant ATEs in the first two specifications for each outcome, while we see significant positive coefficients for Treatment (5% level) and significant negative coefficients for Treatment $\times$ Consequentialist (10% level). In Table 8, the qualitative insights for our two revealed preference measures (donations to a climate cause, signing a climate petition) are similar, although the patterns of significance differ. Here, we see significant positive ATEs (10% level) for the donations outcome, as well as positive coefficients for Treatment and negative coefficients for Treatment $\times$ Consequentialist, although neither is significant. For the petition outcome, all of the signs of the treatment effects are consistent with the aforementioned trends, but none of the coefficients are significant; we attribute these null findings to ceiling effects, as willingness to sign the petition is very high throughout our sample, leaving little room for additional variation between treatments. In Table 9, we examine participants' policy preferences, with outcomes examining their support for climate change policy, the importance of climate change in their EU election choice, and their perceived locus of responsibility for addressing climate issues. We again see null ATEs for the full sample and the green subsample for all three outcomes, and positive coefficients for Treatment and negative coefficients for Treatment $\times$ Consequentialist. The heterogeneous treatment effects are both significant for the support for climate change policy outcome. For the importance of climate change in the EU election choice, the coefficient for Treatment is significant, but the one for Treatment $\times$ Consequentialist is not; for locus of responsibility, neither coefficient is significant.

Overall, we take our preliminary results to mean that the carbon footprinting treatment crowded-in political actions and preferences for some participants. Green deontologists in the treatment group voted for greener candidates in the EU election and demonstrated greener policy preferences in our subsequent surveys, suggesting that private and political actions may be complements rather than substitutes. However, because of the countervailing coefficients, we do not find any effects for green consequentialists, indicating that the ethical worldview is a crucial moderator of treatment effects. The results thus far are preliminary. We will complete additional analysis in spring 2025, and updated results will be available by the time of the conference.

Dependent Variable	Description
Voted	A dummy variable equal to one if the individual voted in the 2024 European Parliament elections (including blank votes); and zero otherwise. It takes a value of one if the individual voted for any of the following parties: Vänsterpartiet (V); Socialdemokraterna (S); Centerpartiet (C); Liberalerna (L); Moderaterna (M); Kristdemokraterna (KD); Miljöpartiet (MP); Sverigedemokraterna (SD); another party (in which case the individual can specify); or voted blank.
Greenness of vote	This is a 0-100 normalized average environmental-friendliness score for each party, computed from survey respondents' ratings, with higher scores representing "greener" parties. Survey respondents answered the following question: "If you consider the parties' attitude towards investing in an environmentally friendly society, even if it means lowering the material standard of living, where would you place the parties on the following scale?" Responses range from 1, meaning that the party views this as a "very bad proposal," to 7, meaning that the party views this as a "very good proposal." The mean 1-7 score is then converted to a 0-100 scale, where the party with the lowest score is assigned 0 and the party with the highest score is assigned 100.
Donation	Indicates the donation amount (in SEK) that the individual is willing to donate for a climate change cause if the individual is (randomly) selected to receive SEK 500. The donation range is between SEK 0-500.
Petition	A dummy variable equal to one if the individual is willing to sign a petition supporting strong climate action to be sent to the Prime Minister's Office; and zero otherwise. Survey participants are informed that only aggregated results (percentage of participants willing to sign the petition) will be shared with the Prime Minister's Office, while individual responses will remain confidential.
CC Policy Support	The average of the Z-scores of three SNES survey variables that measure support for policies to counter climate change. Specifically, the index is constructed from responses to three questions, each assessing the extent of support (rated from 1 to 5, with 5 indicating the strongest support) for the following policies: (1) "Introduce a fossil fuel ban from 2030 that prohibits the use of fossil fuels in industry and all sales of fossil fuels"; (2) "Raise the carbon tax to reduce emissions, with an expected increase in spending for households and businesses in proportion to how much carbon dioxide they emit"; and (3) "Introduce mandatory climate labeling of products, so that the degree of climate impact from a product is always visible to the consumer". Each of these survey variables is converted into a Z-score, and the simple average of these Z-scores is calculated.
CC Importance for Vote	A variable from the SNES survey that measures the importance of climate considerations in party choice during the European Parliament elections. Specifically, it corresponds to responses to the following question (coded from 1 to 5, with 5 indicating the strongest importance of climate considerations): [Climate] How important were the following issues for your choice of party in the European Parliament elections?
Locus of Responsibility (Individual vs. Society)	A variable from the SNES survey that measures the extent to which the individuals feel climate change is of individual vs. societal responsibility. Specifically, it corresponds to responses to the following question (coded from 1 to 5, 1 indicating "mainly an individual responsibility" and 5 indicating "mainly a societal responsibility"): [Reducing the climate impact of consumption] In the political debate, it is sometimes discussed who has the main responsibility for achieving certain societal goals or minimizing the harmful effects of various activities; the individual or society at large?

TABLE 6
POLITICAL OUTCOME VARIABLES

TABLE 7
EFFECT ON VOTING

	(1) Voted	(2) Voted	(3) Voted	(4) Greenness of vote	(5) Greenness of vote	(6) Greenness of vote
Treatment	.027	.0285	.194**	.575	.649	9.71**
	(.0143)	(.021)	(.0727)	(.784)	(1.21)	(3.61)
Treatment × Consequentialist			-.189*			-10.2**
			(.0763)			(3.84)
Consequentialist			.168*			5.71
			(.0666)			(3.11)
Plan to vote or undecided (0/1)	.5***	.522***	.505***			
	(.0598)	(.106)	(.103)			
Control for pre-treatment voting intention	No	No	No	Yes	Yes	Yes
Observations	1947	669	667	1650	603	601
Mean dependent var.	.876	.909	.909	71.8	82.7	82.8
Sd. of dependent var.	.329	.288	.288	29.4	22.5	22.5

Notes: Consequentialists are classified based on responses to a trolley dilemma question (i.e., consequentialists are those who opted to pull the lever). Columns (1) and (4) analyze the full sample. Columns (2), (3), (5), and (6) analyze a subsample of green participants, i.e., those with "Considers climate change a problem" ≥ 7, "Pro-environmental self-identity" ≥ 5, and "Wish to live more sustainably" ≥ 5.
p-values: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 8
EFFECT ON CLIMATE DONATIONS AND PETITION SIGNING

	(1) Donation	(2) Donation	(3) Donation	(4) Petition	(5) Petition	(6) Petition
Treatment	22.7*	42.2*	65.8	.0276	-.00444	.0833
	(11.6)	(19)	(56.3)	(.0188)	(.0173)	(.0567)
Treatment × Consequentialist			-25.7			-.1
			(59.9)			(.0596)
Consequentialist			41.3			.0539
			(47.7)			(.0579)
Observations	1341	481	481	1341	481	481
Mean dependent var.	231	287	287	.863	.963	.963
Sd. of dependent var.	212	209	209	.344	.19	.19

Notes: Consequentialists are classified based on responses to a trolley dilemma question (i.e., consequentialists are those who opted to pull the lever). Columns (1) and (4) analyze the full sample. Columns (2), (3), (5), and (6) analyze a subsample of green participants, i.e., those with "Considers climate change a problem" ≥ 7, "Pro-environmental self-identity" ≥ 5, and "Wish to live more sustainably" ≥ 5.
p-values: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 9
EFFECT ON POLICY ATTITUDES AND PREFERENCES

	(1) CC Policy Support	(2) CC Policy Support	(3) CC Policy Support	(4) CC Importance for Vote	(5) CC Importance for Vote	(6) CC Importance for Vote	(7) Locus of Resp. Ind. vs Soc.	(8) Locus of Resp. Ind. vs Soc.	(9) Locus of Re Ind. vs So
Treatment	-.0257	-.0092	.281*	.00229	.0536	.206*	-.0126	-.046	-.161
	(.0392)	(.0494)	(.137)	(.0417)	(.0321)	(.0919)	(.0464)	(.0719)	(.206)
Treat. × Conseq.			-.337*			-.176			.133
			(.147)			(.0982)			(.22)
Consequentialist			.106			.0981			-.0367
			(.111)			(.087)			(.159)
Observations	1825	628	626	1690	608	606	1829	628	626
Mean dependent var.	.0624	.38	.381	4.48	4.84	4.84	3.79	3.86	3.86
Sd. of dependent var.	.837	.618	.619	.857	.395	.394	.992	.9	.901

Notes: Consequentialists are classified based on responses to a trolley dilemma question (i.e., consequentialists are those who opted to pull the lever). Columns (1), (4), and (7) analyze the full sample. Columns (2), (3), (5), (6), (8), and (9) analyze a subsample of green participants, i.e., those with "Considers climate change a problem" ≥ 7, "Pro-environmental self-identity" ≥ 5, and "Wish to live more sustainably" ≥ 5.
p-values: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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Appendix

Greenness of voting choice

One of our outcomes will be the greenness of the participant's voting choice in the EU election. We will construct green scores for each political party based on survey responses from our participant pool. In particular:

1. In the SNES survey, subjects rate how environmentally friendly each party is.
2. We will use subjects' ratings to construct two greenness rankings of each party: one for the average ranking among subjects voting for government coalition parties, and one made by those voting for opposition parties.
3. The greenness of our subjects' vote can now be measured continuously. For those voting left/opposition, we use the continuous measure from the left/opposition affiliated subjects only, and analogously for those affiliated to government coalition parties.

This approach constructs two separate rankings to account for the fact that partisanship may affect subjects' perceptions of the parties.

Based on this procedure, we produce the following greenness scores for each party. Higher scores represent "greener" parties. The ranked parties are Vänsterpartiet (V) [Left Party], Socialdemokraterna (S) [Social Democrats], Centerpartiet (C) [Centre Party], Liberalerna (L) [Liberals], Moderaterna (M) [Moderates], Kristdemokraterna (KD) [Christian Democrats], Miljöpartiet (MP) [Green Party], and Sverigedemokraterna (SD) [Sweden Democrats]. Survey respondents answered the following question: "If you consider the parties' attitude towards investing in an environmentally friendly society, even if it means lowering the material standard of living, where would you place the parties on the following scale?" Responses range from 1, meaning that the party views this as a "very bad proposal," to 7, meaning that the party views this as a "very good proposal." The graph reports the mean score for each party across all respondents, along with the 95% confidence interval for that estimate. Parties are sorted from lowest to highest on the y-axis, based on their mean score.

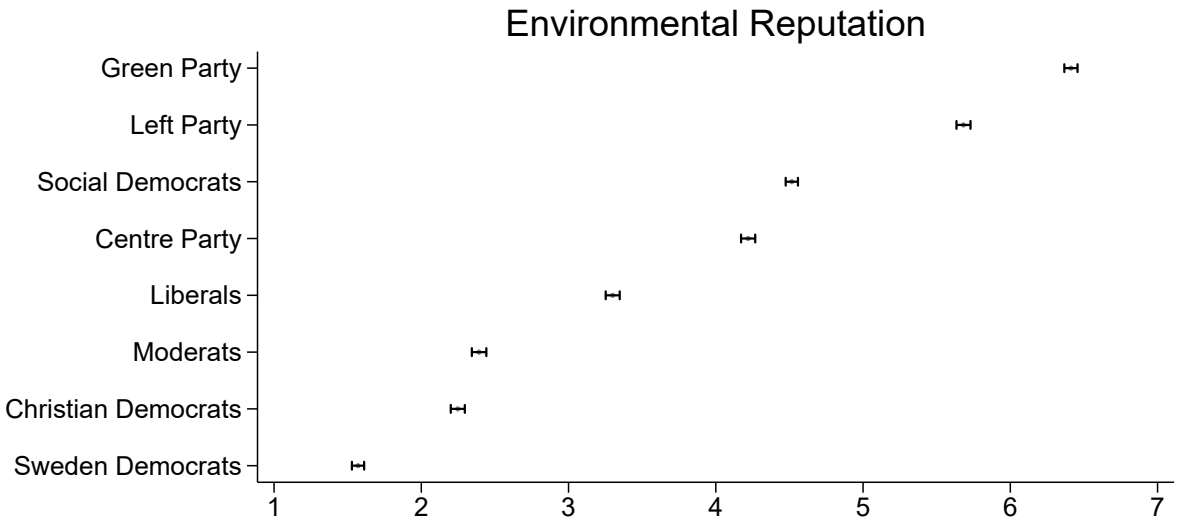


FIGURE 1
ENVIRONMENTAL-FRIENDLINESS SCORES, BASED ON SURVEY RESPONSES.