**Does Climate Change Policy Have Regressive or Progressive Distributional Effects? Insights From a Priority Evaluator Experiment**

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**1 Abstract**

Controversies about climate policies’ potentially regressive distributional effects hamper efforts to implement such policies. “Regressive” means that such policies burden lower-income citizens and consumers disproportionately – both in terms of financial as well as behavioural cost. We study this issue bottom-up by exploring how individuals across different income groups and initial carbon footprints are likely to respond when tasked with reducing their personal carbon emissions to a level that is compatible with net-zero goals as a result of stringent climate policy. We do so by combining a carbon calculator that estimates individualized emissions and a novel priority evaluation-based methodology, which are implemented in an online survey amongst a population-representative sample in Switzerland (N=3’456). This priority evaluation approach is a highly individualized and interactive choice task that allows respondents to develop a set of behavioural responses and mitigation pathways to reach a personalized emission reduction target. We expect important insights into the policy costs individuals with different carbon footprints and differing income levels are likely to face, and whether, overall or for what subgroups of the population, regressive distributional effects are likely to exist. Such insights, in turn, could inform the design of compensatory measures that may be needed to achieve majority support for climate policy.

Keywords: climate policy, inequality, priority evaluator

Word count: target: 6’000

**2 Intro (1000)**

**Current challenge of climate policies**

The adoption and implementation of climate policies has been delayed in most countries due to the increased politicization of their distributional effects and more particularly their alleged regressive distributional effects on households (Aklin and Mildenberger, 2020; COLANTONE et al., 2023; Schaffer, 2023; Stokes, 2016). A distributional impact of a policy is considered regressive when lower income households are disproportionately burdened, and progressive when higher income households are disproportionately burdened. Importantly, “burdened” is understood in terms of both financial and behavioral costs.

**Why is it important to avoid regressive climate policies:**

***Political feasibility (fairness perceptions):***

Avoiding regressive climate policies is important: climate policies that are perceived as distributing costs and benefits in a fair way have a higher chance of political success. This is because distributional fairness concerns are amongst the most important determinants of climate policy support – next to perceptions about effectiveness and policy costs (Bergquist et al., 2022; Dechezleprêtre et al., 2022; Drews and van den Bergh, 2016). Popular support of climate policies in turn has been proven essential in democratic systems for the successful adoption and implementation of climate policy (Anderson et al., 2017; Schaffer et al., 2021).

**Puzzle/RQ: Climate policies and their distributive effects**

However, to what extent climate policies are regressive or progressive as defined above, and to what extent they’re also perceived as such by the public, has been of part of a longstanding debate in the literature:

**Policy design**

***Policies and their distributive effects***

Generally, climate policies tend to be regressive in the sense that they place a disproportionate *financial* burden on low-income households. This is because climate policies increase the relative price of carbon intensive goods (Vona, 2023), and low-income households spend a higher share of their income on these goods compared to high-income households (Grainger and Kolstad, 2010). Regressive effects have been most commonly established for carbon taxes (e.g. Callan et al., 2009; Douenne, 2020; Hassett et al., 2007), but also other climate policy instruments such as subsidies (e.g. Hardman et al., 2017; Ju et al., 2020; Lekavičius et al., 2020; Sovacool et al., 2019) or standards (e.g. Bruegge et al., 2019; Davis and Knittel, 2019; Levinson, 2019).

***Policy design to overcome repressiveness & counter public concerns***

As a result, scholars usually suggest to counter regressive effects of these climate policies in the hope of swaying public opinion in their favor by for example redistributing revenues of carbon pricing in the form of lump-sum rebates to all citizens (Horowitz et al., 2017; Metcalf, 1999) or tailor subsidies to target low-income households (Carley and Konisky, 2020; Muehlegger and Rapson, 2022). Other climate policies that also bear distributive effects (e.g. bans) can be combined with ancillary measures (e.g. making public transport more attractive in the case of low emission vehicle zones, see Thaller et al., 2021), or linked to more general economic and social reforms with the goal to simultaneously reduce economic and social inequalities that created unequal impacts of climate policy in the first place (so-called Green New Deals, see Green, 2024).

***Policy design perceptions (mixed evidence that smart policy design works, so maybe we don’t know enough about perceptions/ distribute effects apart from monetary costs)***

So far there is no conclusive evidence to whether policy designs that aim to correct regressive distributional effects can sufficiently increase climate policy support. While there are studies that suggest that the inclusion of revenue recycling (Beiser-McGrath and Bernauer, 2019; Dolšak et al., 2020), adding ancillary measures (Thaller et al., 2024) or linking climate policy to broader economic and social reforms (Bergquist et al., 2020) can increase support for climate policy , there are others that show that citizens are rather sceptic regarding the ability of such policies to redistribute revenues in a just way, lack understanding of how these mechanisms work (Beiser-McGrath and Bernauer, 2024; Douenne and Fabre, 2022; Maestre-Andrés et al., 2019).

Add literature about instrument perceptions:

* Poovitkina et al 2021
  + perceive carbon taxes to be unfair due to a diverse range of arguments, such as need, equality, and equity, lack of trust in government and whether the purpose of the tax is justified.
* Carattini et al 2018
  + Find that peole do not consider taxes to be an effective tool to change behaviour because they perceive demand elasticity to be close to zero for carbon intensive goods
* Douenne and fabre 2022
  + Evidence of misperception around distributional impacts of taxes
* Maestre andres 2019:
  + how that many people are sceptical that taxation will be effective in changing behavior and tend to perceive carbon taxes as a tool to generate public revenue rather than to change public behavior
* Beiser bernauer 2024
  + Evidence of misperception around distributional impacts of taxes

Some explanations:

Thus, another important reason why policies are (perceived to be) regressive despite is that lower-income households are much more strongly affected by climate policies in non-pecuniary ways. Demand-elasticity, i.e. the possibility or willingness to mitigate emissions by changing behaviors and lifestyles – is also substantively lower amongst lower income households (CITE, due to essential needs, residential location, etc.). This is usually not part of welfare-focused approaches, and also much harder to assess ex ante (Vona, 2023).

**Research gap/research questions: What we don’t know SUMMARY:**

The question that remains and we therefore aim to answer is:

**Are climate policies regressive or progressive when taking into account both their financial and behavioral costs across different income groups and different carbon footprints?**

By answering this question, we hope to get important insights into the policy costs (both behavioural and financial) individuals with different initial carbon footprints and differing income levels are likely to face, and whether, overall or for what subgroups of the population, regressive distributional effects are likely to exist. Such insights, in turn, could inform the design of more targeted compensatory measures that may be needed to achieve majority support for climate policy (GAIKWAD et al., 2022; Meckling et al., 2015).

**Our approach is therefore different, and this is what it is:**

We study these questions bottom-up by exploring how individuals across different income groups and initial carbon footprints are likely to respond when tasked with reducing their personal carbon emissions to a level that is compatible with net-zero goals as a result of stringent climate policy. We do so by combining a survey-embedded carbon calculator that estimates individualized emissions and a novel priority evaluation-based methodology: a highly individualized and interactive choice task that allows each respondent to develop a set of behavioural adaptations and mitigation pathways to reach a personalized carbon emission reduction target (Hoinville, 1971; Jäggi, 2015; Permain, 1989).

The personalized emission reduction target, which is set at 70% of one’s initial emissions, mimicks a XYZ. Add how we answer RQs exactly! The tool allows explicitly to reduce emissions either via behavioral adaptations, or investments in mitigation strategies (i.e. buying less carbon intensive, offset emissions by buying co2 certificates/paying a carbon price). We can then detect to what extent different income groups are able to reduce their emissions in order to assess distributive effects of both financial and behavioral implications of such a climate policy. Further, by identifying how income groups differ in the way they reduce their emissions, we can identify what policies are needed in order to support them making these changes.

Both carbon calculator and priority evaluator are implemented in an online survey amongst a population-representative sample in Switzerland in autumn 2022 (N=3’456).

[SUMMARY OF FINDINGS & WHAT THEY SUGGEST]

**Final paragraphs of intro**

Our article contributes to the existing literature in [INCLUDE NUMBER] ways.

* First, it provides evidence on the importance of considering behavioural costs for the design of fair climate policy. Specifically, we find xyz. Out results suggest that xyz.
* Second, our article contributes to the literature on preference elicitation methodology. We contribute by developing a tool simulates the ‘real-world’ trade-offs in behavioural and financial costs, and thus exceeds existing studies of behavioural adaptations towards reducing individual carbon emissions, which commonly rely upon simple survey questions (Lange and Dewitte, 2019).
* Third, our article speaks to ???

The remainder of the article is structured as followed. In the next section we outline our theoretical arguments and derive empirical expectations. We then describe our research design and present our results. The final section offers concluding thoughts.

**3 Theoretical argument and empirical expectations (1200)**

**Assumptions based on literature**

***Carbon inequality***

***Distribution of carbon emissions by sectors***

**Assumption based on policy design (relative 30% target)**

**Theoretical model**

***Ability to act (capabilities/capacities based on carbon footprint and household income)***

However, the availability of choices for behavioural adaptations and lifestyle changes are dependent on individual financial capabilities and constraints. While wealthier individuals are high emitters (Gössling and Humpe, 2023; Wiedmann et al., 2020) because they consume more as well as more energy intensive goods (Oswald et al., 2020), they also have a wider array of different options that are available to them in order to reduce emissions compared to less wealthy individuals. Additionally, wealthier individuals possess more financial capabilities to reduce their emissions.

***Willingness to act (attitude towards mitigation options based on climate attitudes/ideology)***

Further, behavioural choices can be expected to depend heavily on belief systems, norms, and attitudes of individuals (Ajzen, 1991; Stern et al., 1999). Respondents that that are environmentally concerned and have strong pro-environmental norms can be expected to show ex ante a higher willingness to engage in behaviours to reduce their carbon emissions. Further, they are also more willing to bear higher behavioural costs than others (Kaiser et al., 1999).

**Empirical expectations summarised**

***RQ1 Who reaches the target***

* + H1: Citizens with higher income levels are more likely to reach the emission reduction target
  + Hb: Citizens with higher income levels are more likely to reach the emission reduction target reached if they identify as politically left

***RQ2: How is target reached?***

***H3b: how is target reached across income levels***

* ***Formulate expectations with regards to availabilities (demand-elasticity argument)***
  + ***Car ownership/behaviour***
  + ***flying***
  + ***Diet***
  + ***House ownership***
* ***Formulate expectations with regards to financial capabilities***
  + ***Car ownership/behaviour***
  + ***flying***
  + ***Diet***
  + ***House ownership***
  + ***certificates***

***H3c: how is target reached across income levels and climate attitudes/political orientation?***

* ***Formulate expectations with regards to behavioral change***
* ***Formulate expectations with regards to certificates***

**4 Data and method (1000)**

**4.1 The priority evaluator**

We test these expectations by developing a priority evaluator-based methodology: a highly individualized and interactive choice task that allows each respondent to develop a set of behavioural adaptations and mitigation pathways to reach a personalized carbon emission reduction target (Jäggi, 2015). First, respondents are asked about their CO2-relevant behaviours and living conditions (carbon calculator). These responses are utilized to calculate each respondent’s CO2 emission and populate a list of realistic adaptation options. The dynamic nature of the digital application then allows citizens to compare the effectiveness of these different behavioural adaptations, while at the same time, weigh their choices against behavioural and financial cost implications. The respondents are tasked with developing a 30% reduction in their carbon emissions and are presented with the annual (over time) and one-time purchase costs or benefits of their behavioural changes (see Figure 1). Respondents can either reach their 30% reduction target or not. Lastly, respondents are asked to evaluate their cost and benefits perceptions of these changes.

**Fig. 1. The Priority Evaluator (screenshot, annotations in red)**

A screenshot of a computer

Description automatically generated

The complete code as well as test versions (based on hypothetical input values to the carbon calculator can be accessed online on [Github](https://github.com/DeSciL/SmpPriorityEvaluator).[[1]](#footnote-1)

**4.2 Data**

The survey was administered to existing panelists who take part in the Swiss Mobility Panel (SMP), a longitudinal panel drawn from a nationally representative sample of adult (18–80 years) residents of Switzerland (i.e. the population register of the Federal Statistical Office BFS/SRPH of Switzerland). The BFS sample mirrors, besides random error, the Swiss resident population. The survey was fielded in the third wave of the SMP between 29/04/2022 and 21/07/2022. Respondents were recruited via mailed invitation letters, and the survey was administered online. The invited sample comprises 9’088 respondents from the existing panelists. The final sample consists of 5’941 respondents. The choice task on which this study is based was randomly allocated to 3’456 respondents of the final sample. A description of the sample and a comparison of socio–demographic characteristics with the Swiss resident population can be found in the appendix (see appendix). The survey could be completed in German, French, Italian, or English.

**4.3 Operationalization**

DV

* Emission reduction target (binary/continuous)
* Mitigation strategy (choice/continuous)

IV

* Income (income brackets)
* Political orientation/ climate attitudes

Controls

* List controls and refer to appendix

**4.4 Analytic approach**

1. *Descriptive: Carbon emissions (illustrating what we know from the literature/thus supporting the assumptions on which our expectations are built))*
2. *RQ1: Emission reduction target and distributive effects (INCOME)*
3. *RQ2: How do people reach the target*

**4.5 Robustness checks**

**5 Results (2000)**

**5.1 Descriptives carbon calculator: Carbon emissions (illustrating what we know from the literature/thus supporting the assumptions on which our expectations are built))**

**Fig. 3. The Priority Evaluator (screenshot, annotations in red)**

A graph of a graph of income

Description automatically generated with medium confidence

* Finding 1: sectoral composition of carbon footprint on average
* Finding 2: distribution across income groups (and sectors)

**5.2 RQ1: Emission reduction target and distributive effects (INCOME)**

**Fig. 4. The Priority Evaluator (screenshot, annotations in red)**

A graph of a graph

Description automatically generatedA graph with numbers and lines

Description automatically generated with medium confidence

* Finding 1: sectoral composition of carbon footprint on average
* Finding 2: distribution across income groups

ADD: Model PE target reached as support of descriptive findings

* Effect of income on target status (binary/continuous)
* (effect of income on target status by ideology)

**5.3 RQ2: How do people reach the target**

A graph of different colored squares

Description automatically generated with medium confidence

A graph of a graph of a graph

Description automatically generated with medium confidence

* + - Descriptive measures used by income (binary)

A graph of different sizes and numbers

Description automatically generated with medium confidence

* + Model: availabilities/measures used by income
    - Model PE use MDCEV (Daniel)
    - LCA based on PE use MDCEV, by income groups (Daniel)

**6 Discussion (800)**

* Summary
* Theoretical implications
* Policy relevance
* Shortcomings and outlook

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The author reports that there are no competing interests to declare.

**Generative AI:**

During the preparation of this work we used Grammarly in order to help with reformulating some paragraphs. After using this tool, the authors reviewed and edited  
the content as needed and take full responsibility for the content of the publication.

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**8 Appendix**

**A Carbon Calculator**

**B Priority evaluator**

**C Sample description**

**D Additional results**

**E Robustness checks**

1. https://github.com/DeSciL/SmpPriorityEvaluator [↑](#footnote-ref-1)