# Prices vs. Quantities from a Citizen's Perspective

**Franziska Funke[*,†], Théo Konc[*,†,‡], Linus Mattauch[*,†,§,¶,‖] Michael Pahle[*], Antonia Schwarz[*], Stephan Sommer[**,††]**

February 18, 2026

**Abstract**

We propose a theory of public appraisal and employ it to explain divergent public opinion on similar economic policy instruments. In a survey-based policy design experiment with 13,665 respondents from seven European countries, we study how policy perceptions and support rates differ across carbon pricing designed as "carbon taxation" and "emissions trading". While there is considerable cross-country variation in the appraisal of both instruments, the emissions trading design reduces opposition in all countries except Germany. We find that the treatment effects of instrument design on policy perceptions are substantial: carbon taxes are consistently more often perceived as increasing the state budget, harming the economy, and increasing costs of living and production. Using causal mediation analysis, we ascertain that lower opposition to emissions trading is partly due to its perception as less costly. Overall, our results suggest that the public consistently perceives taxes as a "tougher" measure, and that emissions trading appeals more to European constituencies not already supportive of climate policy.

***JEL codes:*** Q54, Q58, D78, H23, P48
***Keywords:*** political economy, climate change, cap-and-trade, carbon tax, perceptions,

[*]Potsdam Institute for Climate Impact Research - Member of the Leibniz Association
[†]Technical University Berlin
[‡]Wageningen University
[§]University of Oxford
[¶]Berlin School of Economics
[‖]**Correspondence:** linus.mattauch@tu-berlin.de
[**]Bochum University of Applied Sciences
[††]RWI-Leibniz Institute for Economic Research

support, attitudes, survey

**Acknowledgements:** We would like to thank Julie Muhlke for her input in the early stages of the project and Luka Fischer and Anna Wiese for research assistance. We are grateful to Till Armbruster, Alkis Blanz, Viola Helmers, Cameron Hepburn, Martin Huber, Stefania Innocenti, Patrick Klösel, Christian List, Karolina Rütten, Thomas Sterner and seminar audiences at Columbia, Oxford, St. Gallen, Utrecht, ZEW Mannheim and at EAERE, EEA, IIPF and LAGV for valuable feedback. We gratefully acknowledge financial support by the German Federal Ministry of Research, Technology and Space (BMFTR) in the framework of the Kopernikus project Ariadne (grant FKZ 03SFK5A0-2). Funke acknowledges funding from the German Academic Scholarship Foundation and Mattauch from the Robert Bosch Foundation.

**Preregistration:** The survey-based experiment in this study was pre-registered in the AEA RCT Registry (AEARCTR-0010441).

# 1 Introduction

The design of economic policies is often constrained by a need to make the measure politically feasible and counter a common conundrum: while there is broad societal consensus on many political objectives, the policies that economists and policymakers deem most fitting to achieve a specific objective are not supported by a majority of the public. However, a general understanding of how it is exactly that citizens appraise policies is still lacking. Do they correctly and consistently assess the economic properties of policies, independently of how they are presented? Is valuation solely based on perceived economic properties and consistent across policy instruments? Or is public appraisal partially detached from specific policy properties, and instead rests on a more intuitive and contextual affinity for a specific design?

One marked example of this conundrum is climate policy. A large share of the public supports the objective of climate change mitigation (Andre et al., 2024). Yet carbon pricing – the policy option heralded by most economists as a necessary component for achieving the climate goals in a cost-effective way – is often opposed. A large body of research has investigated conditions and design tweaks that render carbon pricing more palatable (Dechezleprêtre et al., 2025; Klenert et al., 2018; Maestre-Andrés et al., 2019). We investigate the above questions in the context of a core design choice of carbon pricing: regulation by means of either carbon taxation or emissions trading. To yield general insights on understanding citizens' evaluations of policy, we exploit that the two forms of carbon pricing have largely similar economic properties, while we hypothesize that their broader connotations will markedly differ in citizens' minds.

To be clear, since Weitzman's (1974) seminal article 'Prices vs. Quantities', the comparative merit of these two options is a classical question in environmental economics and hinges on efficiency under uncertainty, perfect competition and political economy considerations (Cherry et al., 2017; Hepburn, 2006; Nesje et al., 2024; Pizer, 1999; Pizer & Prest, 2020; Stavins, 2022). Yet, sophisticated economic reasoning on such features of policy instruments may not be what laypeople apply when coming across public debates on climate policy. It remains unclear whether the instruments may be perceived as markedly different by the public.

We conducted a policy design experiment with 13,665 citizens across seven European countries (France, Germany, Greece, Italy, Poland, Spain and the United Kingdom) to gain a better understanding of how the public appraises carbon taxes and emissions trading. Specifically, we assign respondents to randomized treatments that convey standardized information on either carbon taxes or emissions trading. That means we analyse how designating carbon pricing as emissions trading, as opposed to carbon taxation, affects public support – we do not intend to measure the effect of information provision on policy sup-

port, as this was the focus of earlier research.

We then elicit people's support and opposition levels, their views on the policy's objective, and their perception of core economic properties, including cost implications, environmental effectiveness and revenue-raising potential. Identifying variation in the appraisal of carbon taxation and emissions trading – as two instruments that in principle share the same economic function and mechanism – allows us to develop a novel analytical framework of how citizens evaluate policies.

The major empirical findings of our analysis are as follows: we document substantial differences in the evaluation of the two instruments. Compared to carbon taxes, the emissions trading design reduces public opposition by 8 percentage points (%pt.) across countries. Notably, the emissions trading design leads to an increase in "neutral" responses, rather than reducing or increasing support across the sample. Furthermore, we find substantial cross-country variation on support levels, with emissions trading more popular in Italy and Spain, and carbon taxation more popular in Germany and the UK. We also find a relative preference for carbon taxes among traditionally pro-climate leaning constituencies, such as highly-educated respondents and those who believe that current climate policies are not ambitious enough, while emissions trading appeals to more cost-conscious constituencies.

In addition, we shed light on the origins of differences in evaluation by proposing a theoretical framework of public appraisal. This framework offers two reasons why materially equivalent policies may be appraised differently. First, citizens may diverge in their *perception* of the policies' properties, leading to epistemic disagreement. Second, they may diverge in their *valuation* of those properties when deciding whether to support or oppose a policy, giving rise to evaluative disagreements. This includes the extent to which such evaluation relies on specific properties to begin with. We apply these theoretical insights to the case of carbon taxes vs. emissions trading systems.

We find evidence both in favour of divergent perception and divergent valuation of carbon pricing designs. On the one hand, there are systematic variations in the perception of core economic policy properties across the whole sample. Specifically, we find that citizens associate carbon taxes more strongly with an increase in living costs, production costs, negative effects on the economy and an increased state budget, while emissions trading systems are overall perceived as easier to evade. Using causal mediation analysis, we ascertain that these effects matter for appraisal: the perception of emissions trading as less "costly" accounts for around 30% of the difference in opposition. On the other hand, we find that cost perceptions have a slightly stronger effect on appraisal under the carbon tax design than the emissions trading design, indicating divergent valuation. Moreover, while perceptions of the here surveyed properties matter, 70% of the effect on opposition remains unaccounted for, pointing to other appraisal channels. In sum, the public disagrees on car-

bon taxes and emissions trading systems both on epistemic and on evaluative grounds.

This article contributes to a growing literature using surveys for unveiling the perceptions and reasoning behind citizens' stated preferences about economic policies (Dechezleprêtre et al., 2025; Stantcheva, 2023) and builds on a substantive body of research on public support of carbon taxation (for meta studies see Maestre-Andrés et al. (2019) and Mohammadzadeh Valencia et al. (2024)). In addition, we cast a new light on the comparative merit of carbon taxation and emissions trading in environmental economics. In identifying those properties of carbon taxes and emissions trading that are potentially relevant to citizens' perceptions and opinion of carbon pricing policies, we extend previous contributions on support for instruments. Earlier research has repeatedly shown that citizens care about three broader criteria when appraising a climate policy: (1) costs to self, (2) fairness concerns, and (3) environmental effectiveness (Drews & van den Bergh, 2016; Maestre-Andrés et al., 2019; Sommer et al., 2022). In our survey, we elicit people's perceptions of related criteria that appear important to the specific context of emissions trading systems. Amongst other factors, our analysis casts light on previously under-examined dimensions of fairness concerns, by investigating how the cost burden of carbon taxes and emissions trading is perceived to be distributed between consumers and companies (Andor et al., 2022). By quantifying the extent to which differences in support arise from divergent perceptions of economic properties, we also contribute to a body of literature on the causal analysis of public support (Carattini et al., 2024).

We specifically build on three strands of research findings. First, research has shown that citizens care strongly about the emission reduction effect of climate policies but tend to have biased perceptions of the environmental effectiveness of carbon pricing (Baranzini & Carattini, 2017; Douenne & Fabre, 2022; Kallbekken et al., 2011). Second, pessimistic beliefs about the costs and effectiveness of pricing carbon have proven resistant to information-based interventions, suggesting that aversion towards carbon taxes may have deeper roots than a mere lack of information (Douenne & Fabre, 2022). Indeed, consumers show more support for carbon taxes when they are designed under a different name, e.g., "climate contribution" (Baranzini & Carattini, 2017), and designed to be levied further upstream, rather than directly at the consumer level (Hardisty et al., 2019). This evidence points to the possibility that there could be significant differences between how carbon taxes and emissions trading systems are perceived in terms of their cost implications, mitigation effect, and the distribution of burden between consumers and companies. A study by Lachapelle (2017) on political communication suggests that the communication of carbon taxation and emissions trading must be sensitive to the different "frames" that these designs evoke in people. Kotchen et al. (2013) demonstrate that citizens' willingness to pay for climate protection does not differ across the labels "carbon tax" and "cap-and-trade". Yet, these studies provide no systematic evidence on how the public perceives key policy properties across these two instruments. Third, a number of attitudinal characteristics and

political preferences has been linked with support of carbon taxes and other environmental regulation (Anderson et al., 2023), including trust in government (Fairbrother, 2016; Hammar & Jagers, 2006; Rafaty, 2018), pro-environmental attitudes and concern about climate change. Cherry et al. (2017) show in a lab experiment that people's cultural worldviews explain their opposition to environmental policies, with different attitudes toward Pigouvian taxes and quantity regulations depending on their worldview. We assess to what extent these variables are also linked to support of emissions trading relative to carbon taxes, across multiple European countries.

Our research investigates where there is disagreement about the anticipated outcomes of carbon taxes and emissions trading, and brings analytical precision to debates on political feasibility of environmental policy: Understanding recurrent patterns in misperceptions about carbon taxes and emissions trading will allow policy makers to target information better or tweak the design or carbon pricing in ways that appeal to critical constituencies in society, thereby strengthening public support.

The remainder of the article is structured as follows: In Section 2, we introduce a simple model of public appraisal, link it to prior work of public appraisal and describe its implications for the empirical design of our study. Section 3 introduces the survey design and describes the data. The presentation of results is structured as follows: Section 4 examines differences in appraisal (i.e., support and opposition levels) of carbon taxes vs. emissions trading systems. Section 5 assesses differences in perceptions of the policies' core economic properties. Finally, Section 6 brings together both appraisal and policy perceptions, analysing the extent to which differences in opposition levels between carbon taxes and emissions trading systems can be attributed to changes in perceptions of core economic properties. Section 7 discusses policy implications and concludes.

# 2 Theoretical framework

How do citizens evaluate policy instruments? The specific divergence in appraisal of carbon taxes vs. emissions trading systems offers itself as a test case of public appraisal because of two opposed stylised facts. First, at a fundamental level, both instruments fulfil the same function and mechanism of a broad cross-sectoral price incentive on greenhouse gas reduction, and can be designed to entail roughly equivalent economic outcomes. While the specific impacts are highly sensitive to design choices (such as revenue recycling), the many ways in which carbon pricing schemes – in either form – can be designed ultimately blur the distinction between carbon taxation or emissions trading (Stavins, 2011). Second, in contrast, the political economy of implementing carbon taxes and emissions trading is markedly different, and many economists and political actors have demonstrated a clear preference for one design option over the other (Nesje et al., 2024). By confronting sur-

vey respondents with short and standardized information that 'switches off' any economic design differences between carbon taxes and emissions trading, we can assess where the equivalence between both options breaks in the eye of the public.

In this section, we introduce a general framework, centring around support as a function of perceived policy properties. We distinguish between disagreement based on epistemic grounds (i.e., divergent perception of policy properties) and evaluative grounds (i.e, divergent valuation functions). We further specify how different measures aimed at increasing support can be understood within our appraisal framework. Finally, we lay out our empirical strategy for identifying to what extent switching from a "carbon tax" to an "emissions trading" design of carbon pricing changes appraisal and perceived policy properties.

## 2.1 General model of public appraisal

Define policy appraisal $Y_i$ for a single agent $i$. For two economic instruments, one a tax $T$ and one a quantity instrument $Q$, there is a finite list of properties of these instruments $X_1(P), \ldots, X_k(P)$, for $P \in [T, Q]$. For now, assume that this list is limited to properties about the instrument's economic effects, such as its anticipated costs or distributional outcomes. We further assume citizen $i$ can perceive these properties inaccurately. For example, Douenne and Fabre (2022) show that French citizens overestimate the cost of a carbon tax, wrongly think a "fee and dividend" scheme is regressive and underestimate how many emissions such a tax would reduce. We label the perceived properties as $X^*$. For a citizen $i$ support for a certain policy $P$ depends both on agent-specific valuation function $f_i$ and agent-specific perception of properties $X_i^*$ :

$$Y_i(P) = f_i(P, X_{i,1}^*(P), \ldots . X_{i,k}^*(P)). \tag{1}$$

As a consequence, citizens could have both epistemic and evaluative disagreements about policy. That is, two citizens $i$ and $j$ can have an epistemic disagreement about the effects of a policy, such that $X_{i,l}^*(P) \neq X_{j,l}^*(P)$ for some property $l$. Moreover, assuming citizens agree on the specific properties of a policy, they may still assign different degrees of importance to them, such that $f_i^P \neq f_j^P$, an evaluative disagreement. It is evidently reasonable to assume that different citizens with different political leanings will have evaluative disagreements about policy. For instance, some might put a stronger emphasis on distributional effects, and others on personal costs.

Our article lays out two theoretical claims. First, disagreement on two policies with equal properties is either epistemic, evaluative, or both. Second, measures for enhancing support can be distinguished based on whether they act on properties directly, the perception of properties, or the valuation function that binds them together.

### Epistemic and evaluative disagreement on policy

Aside from disagreement *between agents* on the appraisal of the same policy, we are interested in disagreement *across policy designs* that are on the face of it very similar with respect to their material outcomes. Can we, for a citizen $i$, identify design-specific differences in policy support? For our purpose of comparing appraisal of different carbon pricing designs, we have assumed equivalent "material properties" for policy $T$ (i.e., carbon tax) and $Q$ (i.e., emissions trading):

$$X_1(T) = X_1(Q); X_2(T) = X_2(Q); ...; X_k(T) = X_k(Q) \tag{2}$$

Through the lens of citizens, the symmetry between $T$ and $Q$ can break in two ways. First, the difference in policy design can lead to differences in the perception of the properties of carbon taxes and emissions-trading systems, i.e., ***divergent perception*** for some property $l$ and citizen $i$:

$$X^*_{i,l}(T) \neq X^*_{i,l}(Q) \tag{3}$$

Second, even when holding the perceived policy properties stable across designs $T$ and $Q$ (i.e., assuming equation 2), the design difference may affect the valuation function. That is, citizens care differently about certain policy properties when the policy is presented as a tax or an emissions trading system. We call this ***divergent valuation***:

$$f_i(T, X_1(T), \ldots, X_k(T)) \neq f_i(Q, X_1(Q), \ldots, X_k(Q)) \tag{4}$$

In the remainder of the article we investigate empirically, whether a measure of designing a carbon pricing policy as an 'emissions trading system', as opposed to a 'carbon tax', breaks the symmetry in appraisal. We find evidence in favour of both divergent perceptions, as well as divergent valuation.

### The effects of an intervention on appraisal

Our general framework allows to classify prior work in political economy that advances specific claims about the public appraisal of economic policy instruments. A variation in policy $P$ could be any "support-enhancing measure" a policymaker could implement, including policy packaging, an information campaign, or a change of tone in political messaging. The effect of such a measure can be stated as a function both of changes in the perception of policy properties, as well as changes in the valuation function (i.e., what properties citizens care about). That is, for any agent, changes in support from a new measure can be expressed as:

$$\frac{\partial Y_i}{\partial P} = \underbrace{\sum_{l=1}^{k} \frac{\partial f_i}{\partial X^*_{i,l}} \times \frac{\partial X^*_{i,l}}{\partial P}}_{\text{indirect effect}} + \underbrace{\frac{\partial f_i}{\partial P}}_{\text{direct effect}} \tag{5}$$

In general, the measure can enhance support by acting on the perceived properties (i.e., indirect effect), but also on the evaluation function directly (i.e., direct effect). Below, our results on how citizens perceive properties of taxes and emissions trading differently can be understood as a measure to switch from one form of carbon pricing design to another. Our further analyses show that this switch acts on the perceived properties, but also directly on the evaluation.

There are at least four major established research strands examining public support that can be expressed as specific cases of our framework, as they restrict the set of properties and measures.

First, public choice theory classically takes the effect on individual payoffs as the only relevant property. Assuming that citizens perceive properties accurately, the only option $M$ is to readjust the *substantive* payoff (Besley & Persson, 2023). There are variants of this theory in which payoffs are not correctly perceived, for example when agents are loss-averse about the effects of carbon pricing on themselves (Fischer & Pizer, 2019). The theory also allows for incorporating non-standard preferences, such as fairness views (Sommer et al., 2022). In that case, the distribution of payoffs is another policy property of concern.

Second, empirical studies on public support examine the role of perceptions of policy properties (Baranzini & Carattini, 2017; Dechezleprêtre et al., 2025; Douenne & Fabre, 2022; Woerner et al., 2024). A general recommendation from this strand of research is that the inaccurate perceptions should be corrected: $M$ closes the gap between actual properties $X$ and perceived properties $X^*$ especially for environmental effectiveness. $M$ is understood as improving economic literacy of the population through education, media outreach or targeted information campaigns.

Third, certain theories from environmental social and moral psychology emphasise the role of political ideologies for attitudes on climate policies (Campbell & Kay, 2014; Chater, 2018; Konc et al., 2022). For example, assume that free market ideologues are less inclined to support a tax. A measure $M$ could then act both on the perception of properties and the evaluation function. For instance, a free-market ideologue may be predisposed, with respect to their valuation function, to care about properties that unleash market forces, rather than curtail them. In that context, the "tax" label may evoke perceptions of state regulation and growing public budgets. Hence, a support-enhancing measure $M$, such as re-framing or renaming carbon taxes in market-friendly terms as part of a communication campaign, could act primarily on changing perceptions and evoking more favourable properties such as 'budget neutrality' or a potential to spur entrepreneurial innovation. Moreover, especially in societies with an adversarial political culture, citizens may care about whether a policy reform will be regarded as a political win or loss for their respective ideological camp. Politicization of a policy along ideological lines may hence shift the

valuation function to an extent that support is primarily determined by the property of whether it is a perceived ideological "win" or "loss" (Anderson et al., 2023). A measure $M$ that brings about depoliticization and bipartisan endorsement can re-focus valuation on economic policy properties (Gustafson et al., 2022).

Fourth, studies in environmental political science have highlighted the important role of trust in government for support of carbon pricing (Fairbrother, 2016; Hammar & Jagers, 2006; Rafaty, 2018). Within the scope of this general theory, let us assume that distrust is an expression of the uncertainty over whether favourable properties that depend on governmental action are brought about, or whether unfavourable effects can be reined in. Hence, the perception of a policy's properties may be discounted (if positive), or inflated (if negative) in the valuation function, if a citizen is distrustful of the government. Importantly, distrust can result in diverging appraisals of similar policies, if those two policies evoke different perceived properties, and specifically differ on how dependent those properties are on executive promise-keeping.

The above approaches to enhance support rest on different premises about how accurate and amenable perceptions are, and what, if any, weight is given to policy properties in the valuation function. With this article we lend empirical support to the idea that each approach on its own delivers an incomplete characterization of policy appraisal. That is, our empirical analysis shows that the measure at hand, a switch from the 'carbon tax' design to an 'emissions trading' design of carbon pricing, changes support indirectly through the perception of economic policy properties, while also affecting policy appraisal more directly.

## 2.2 Econometric specification

Using insights from our theoretical framework, we conduct a survey-based experiment to explore three key questions: (1) Does designing a carbon price as an 'emissions trading system' rather than a 'carbon tax' influence appraisal levels? (2) Does the policy design intervention lead to differences in how policy properties are perceived (i.e., divergent perceptions)? (3) To what extent can changes in support or opposition levels be attributed to changes in policy perceptions?

First, we estimate Equation (6) to assess the effect of the policy design intervention $P$ (i.e., the switch from the 'carbon tax' to the 'emissions trading' design) on appraisal $Y_i$, given a vector of socio-demographic and attitudinal controls $Z_i$. In our analysis, appraisal $Y_i$ is elicited from a five-point Likert scale survey item, which we recode as a variable with three levels (i.e., "oppose", "neutral", and "support"). While many survey-based studies typically focus solely on support, tracking opposition may often be a more relevant metric for gauging the practical feasibility of policies. In our main specification, we hence report

marginal effects on both support, opposition, and neutral answers. For ease of interpretation, we use a binary variable of either "support"/"no support" or "opposition"/"no opposition" in later parts of the analysis.

$$Y_i = \alpha_1 + \alpha_2 P + \alpha_3 Z_i + \varepsilon_{1,i} \tag{6}$$

We further assess heterogeneous treatment effects on socio-economic and attitudinal sub-populations using estimation techniques based on random forests.

Second, we estimate Equation (7), where we regress policy properties $X_{l,i}$, as perceived by individual respondent $i$ on the treatment variable $T$ and the same vector of socio-demographic and attitudinal controls $Z_i$.

$$X_{l,i} = \beta_1 + \beta_2 P + \beta_3 Z_i + \varepsilon_{2,i} \tag{7}$$

A significant coefficient $\beta_2$ indicates divergent property perceptions across carbon taxes and emissions trading.

Third, we bring our analysis of the design effects on support outcomes and policy properties together, analysing the role that policy properties play for appraisal. We employ causal mediation analysis (Tingley et al., 2014) to assess the extent to which design-induced changes in appraisal can be attributed to changes in perception. This method has found wide application in experimental studies in the social and medical sciences (Imai, Keele, & Tingley, 2010; Imai, Keele, & Yamamoto, 2010), and has been previously applied in the context of survey-based design experiments eliciting public attitudes (Imai & Yamamoto, 2013; Jagers et al., 2021). In the context of our policy design experiment, probing into the relationship between perceptions and appraisal requires careful consideration of the fact that perceptions themselves are endogenous to the treatment intervention of designing the policy as a 'carbon tax' or an 'emissions trading system'. Causal mediation analysis allows us to account for this endogenous relationship and identify the indirect effect of the policy design intervention on appraisal $Y$ *through* the change in perceived policy properties. Specifically, we decompose the total effect of the treatment variable $t$ on appraisal $Y_i$ into direct effects of the policy design intervention and indirect effects via the perceived policy properties $X_{l,i}$.

Direct effects $\theta$ of the treatment on appraisal $Y$ and indirect effects $\delta$ mediated via perceptions of policy properties $X_{l,i}$ can be summarised in a potential outcomes notation in Equations 8-10 (Huber, 2019; Pearl, 2001; Tingley et al., 2014):

$$\theta(P) = Y_i(Q, X_{l,i}(t)) - Y_i(T, X_{l,i}(t)), \quad P \in \{Q, T\} \tag{8}$$

$$\delta(P) = Y_i(P, X_{l,i}(Q)) - Y_i(P, X_{l,i}(T)), \quad P \in \{Q, T\} \tag{9}$$

$$\Delta = Y_i(Q, X_{l,i}(Q)) - Y_i(T, X_{l,i}(T)) = \theta(Q) + \delta(T) = \theta(T) + \delta(Q) \tag{10}$$

For estimating direct and indirect effects we compare potential values for the binary outcome variable $Y_i$ across respondent units $i$ and treatment states $P \in \{T, Q\}$ (whereby $T$ refers to the carbon tax design, and $Q$ refers to the emissions trading design). For estimating direct effect $\theta(P)$, the direct channel through which the change in design affects the outcome is isolated by holding the mediator $X_l$ (i.e., perception of policy properties) constant at the value it would take at treatment state $P$, thereby 'switching off' any indirect effects through policy perceptions. The indirect effect $\delta(P)$ in turn is estimated by comparing outcomes under the same treatment state, while counterfactually varying the value the mediator would take under different treatment states (i.e., $X(P)$, for $P \in \{T, Q\}$ ). Statistically significant differences in indirect effects across treatment states (i.e., $\delta(Q) - \delta(T)$, corresponding to the treatment-mediator interaction effect) point towards variation in how much the indirect channel of a specific policy property matters for support. This allows for insights into whether a specific policy property matters more for appraisal under one carbon pricing design, as opposed to the other, pointing to *divergent valuation*. The average treatment effect $\Delta$ can be summarised as the sum of the direct and indirect effects under opposite treatment states. In our context, the estimates and their causal interpretation rely on two key assumptions: sequential ignorability (i.e., conditional on pretreatment observable covariates, the absence of confounding affecting both the mediator and outcome variable), as well assuming that there is no reverse causality, where the perception of policy properties is endogenous to respondents' support levels.

# 3 Survey Design and Data

To assess how citizens appraise carbon taxes and emissions trading, we conducted an inter-European survey with a sample size of 13,665 across seven European countries, spanning some of the largest EU economies and the United Kingdom. The sample includes approximately 1,500 individuals per country in France, Greece, Italy, Poland, Spain, and the United Kingdom (totalling over 9,000 respondents), while in Germany, we surveyed 4,459 participants via the existing Ariadne panel (Frondel et al., 2023). The survey was administered in seven languages and fielded between 28 November and 22 December 2022 by survey implementation agencies *Forsa* (Germany) and *Bilendi* (other countries), after successful pre-testing and national soft launches. The median answering time in the Bilendi sample was around 17 minutes in both treatment groups. The data has been sampled to be representative at the country level along the dimensions age, gender and education.

The survey is structured as follows[1]: We first elicit a large suite of psychological and

[1]The UK version of the questionnaire is reproduced in Appendix F

political attitudes and environmental and climate-transition related beliefs [2]. We then employ a simple policy design experiment with an active control group design (Haaland et al., 2023). Respondents are randomised into two groups and presented with short information on either carbon taxation or emissions trading. We then elicit their support for the assigned instrument, and their perceptions of environmental, economic, and distributional effects and further policy characteristics. To avoid priming at an earlier stage, we subsequently inquire about respondents' familiarity with the European Union Emissions Trading System.

## 3.1 Policy design intervention

As European countries move to expand carbon pricing to decarbonise the economy, we wish to understand how designating the policy as either emissions trading or carbon taxes affects public perception. Both treatment arms have therefore been designed to be neutral and convey the same set of information about the mechanism and workings of carbon pricing (see Appendix for full-text version): (1) carbon taxes [emissions trading systems] increase the price of goods and services in proportion to how many emissions they produce (*relative price effect*); (2) carbon taxes [emissions trading certificates] are levied directly from industry (*upstream design*). Furthermore, respondents in the emissions trading group, were given additional information on the more complex aspects of emissions trading (i.e., emissions of the whole economy are capped, and companies need to purchase certificates for every ton emitted, either directly from the government, or from other regulated entities through the market). As a result, the word count in the ETS group was 30% higher compared to that of the tax group. The difference in length is due to the fact that, in any real-world setting, the more complex design of emissions trading requires a more detailed explanation compared to the straightforward design of a carbon tax. Generally, the information treatments were designed with a specific eye on the external validity for capturing spontaneous reactions in averagely informed citizens: What information would average citizens encounter when they heard about carbon taxes or emissions trading systems for the first time (e.g., as part of a news segment, or newspaper article)? By providing only sparse information about the respective carbon pricing policy to both treatment groups, we aim at assessing respondents' intuitive associations and evaluations.

In the absence of a plausible baseline climate policy, both groups act as each other's active control group (Haaland et al., 2023). As we do not elicit prior beliefs, we cannot disentangle the internal experimental effect of providing short information treatments from prior familiarity with the instrument. Yet in Section 5, we detail how evidence that Euro-

[2]This includes a novel survey items on respondents' beliefs about the role of different actors (i.e., government, citizens and businesses) in the net-zero transition. See Appendix C.7 for a more detailed description of results.

peans have so far faced higher cost implications from emissions trading than carbon taxes allows us to rule out that our below experimental results reflect accurate experience.

## 3.2 Data

The country datasets collected by Bilendi were sampled to be representative of the underlying populations across the dimensions age, education and gender (see Appendix A.2). Since the German dataset stems from a specific-purpose panel that was not representative of relevant socio-economic characteristics, we used post-stratification weights to correct for the over-sampling of male respondents, older age strata and highly-educated respondents. However, we cannot rule out the possibility that the resampled German data is non-representative in terms of certain attitudinal characteristics, as suggested by the disproportionately high share of respondents who support the Green Party. Due to different country sample sizes, notably the large sample size of German respondents, cross-country regression results on the whole sample were obtained using frequency weights to achieve results that are balanced across countries.

Table 1 depicts weighted summary statistics across the two treatment groups for socio-demographic characteristics, political attitudes, environmental attitudes, and respondents' statements on which factors matter for their support of climate policies. Using Wilcoxon tests, we find no significant differences (at the 5% level) in the means of socio-demographic and attitudinal co-variates, implying successful randomization across treatment groups (for country-specific summary statistics see Appendix D.1). We do, however, find a significant difference between treatment groups in the stated level of familiarity with the EU Emissions Trading System, which was elicited at a post-treatment stage to avoid priming participants. We hence exclude this as a control variable, but report descriptive statistics in Table 12.

Concerning socio-demographic characteristics, 18% of our sample lives in rural areas, 22% have a college degree, and 26% belong to the lower income tertile. Attitudinal variables were elicited with five-point Likert scales and were dichotomised for simple interpretation (e.g., 'trust in government' has been coded as '1' for values '4' and '5' on a five-point Likert scale ranging from "strongly distrust" to "strongly trust", and '0' otherwise, including 'Don't know' answers). Concerning political attitudes, on average 21% (20%) of respondents in our sample trust in government (businesses), and 32% of the sample feel that they can trust their fellow citizens. Our sample includes 15% of respondents leaning towards far-right parties, and 24% of the sample either declared to be a non-voter, or did not want to state their voting preferences. Concerning environmental attitudes, 57% of our sample are moderately or strongly concerned about climate change, and a similar share of respondents (55%) agrees that current climate policies are not ambitious enough. A large majority of the sample (78%) expressed concern about energy costs in the context of the European energy crisis in 2022. Differences in how important respondents believe the government,

Table 1: Summary Statistics

| Variables | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) |
|---|---|---|---|
| **Socio-demographic variables** | | | |
| 50+ | 0.396 | 0.400 | 0.645 |
| Female | 0.500 | 0.494 | 0.542 |
| Rural areas | 0.179 | 0.176 | 0.772 |
| College degree | 0.217 | 0.222 | 0.470 |
| Lower income tertile | 0.265 | 0.255 | 0.227 |
| **Political attitudes** | | | |
| Trust in government | 0.207 | 0.217 | 0.245 |
| Trust in businesses | 0.198 | 0.198 | 0.967 |
| Trust in citizens | 0.311 | 0.326 | 0.091 |
| Individualistic worldview | 0.408 | 0.417 | 0.348 |
| Hierarchical worldview | 0.458 | 0.452 | 0.537 |
| Green voting preference | 0.066 | 0.059 | 0.172 |
| Left voting preference | 0.190 | 0.186 | 0.535 |
| Liberal voting preference | 0.046 | 0.048 | 0.620 |
| Conservative voting preference | 0.162 | 0.162 | 0.960 |
| Extreme-right voting preference | 0.148 | 0.146 | 0.780 |
| **Environmental attitudes** | | | |
| Concerned about climate change | 0.569 | 0.571 | 0.865 |
| Worried about energy costs | 0.784 | 0.782 | 0.813 |
| Familiar with EU ETS | 0.474 | 0.441 | 0.001 |
| Climate policies not ambitious enough | 0.553 | 0.546 | 0.463 |
| Government is important for transition | 0.660 | 0.670 | 0.275 |
| Businesses are important for transition | 0.711 | 0.725 | 0.119 |
| Citizens are important for transition | 0.689 | 0.690 | 0.859 |
| **Support factors** | | | |
| Has to reduce emissions effectively | 0.406 | 0.407 | 0.962 |
| Has to keep personal costs low | 0.395 | 0.400 | 0.624 |
| Has to share the financial burden fairly | 0.500 | 0.493 | 0.491 |
| Has positive co-benefits | 0.421 | 0.412 | 0.343 |

**Note:** This table displays means for all control variables used in our estimations. Details on variable construction are listed in Appendix B. Summary statistics by country can be found in Appendix D.1.

businesses and citizens to be for achieving decarbonization goals are rather moderate, with the shares of respondents holding an actor to be important ranging between 66% and 73%. We further asked about how important the instrument's effectiveness, personal cost implications, fair burden-sharing and co-benefits are for their decision to support or reject a climate policy. While each of these factors is deemed important by between 40-50% of the respondents, it is remarkable that the share of respondents agreeing that the policy has to share the financial burden fairly across society (50%) is larger than the share of respondents agreeing that their personal costs should be kept low, or that the policy has to reduce emissions effectively (40%). This underscores the importance of fairness concerns (Maestre-Andrés et al., 2019; Sommer et al., 2022).

Regarding prior knowledge of carbon pricing, only 1172 respondents (i.e., less than 10%) indicated that their country currently had a national carbon price implemented *and* felt knowledgable about the current carbon price level. Moreover, around, or just above, 20% of the sample in France, Greece, Italy, Spain and the UK in both treatment groups indicate that they were aware of the European Union Emissions Trading System prior to the survey. Much greater familiarity with the system has been indicated in Germany and Poland, with 59% (52%) in the carbon tax (ETS) group in Germany indicating previous knowledge of the scheme. In Poland the share of respondents amounts to 46% (44%) respectively in the tax (ETS) groups (see Table 12).

# 4 Appraisal of carbon taxes vs. emissions trading

This section presents our main results on how the design switch from "carbon taxation" to "emissions trading" affects policy appraisal, based on estimating Equation 6. We then examine treatment effect heterogeneity across a range of socioeconomic and attitudinal characteristics. Overall, the tax design has a comparatively more polarizing effect on public appraisal, while switching to the emissions trading design makes respondents either feel comparatively indifferent or unsure about how to evaluate the emissions trading design.

## 4.1 Treatment effects of the design switch

We find that the effect of designing the policy instrument as an emissions trading system, as opposed to a carbon tax, varies substantially across appraisal levels.[3]

Table 2 reports findings at the cross-country level. Average support is similar for both instruments, with the emissions trading design only leading to a 1%pt. decrease in support from a baseline of 36%. At the same time, however, the emissions trading design strongly

[3]As both support, opposition, and neutrality provide distinct information about policy feasibility, our analysis reports marginal effects on all three response categories.

reduces opposition and increases neutral responses: the share of respondents opposing the policy falls by about 8.4%pt. from a baseline of 27%, with a corresponding increase of 9.3%pt. in neutral responses from a baseline of 37%. This indicates that emissions trading mainly shifts respondents from opposition to neutrality rather than reducing or increasing support.[4]

Figure 4.1 displays country-level results of the design switch on policy appraisal. We see substantial variation at the country level, both in baseline appraisal levels for carbon taxes, and in the treatment effect from switching towards the emissions trading design (see Figure 4.1 and Appendix D.2 for full statistics). In Italy and Spain, the design switch increases support by 7%pt. and 6%pt. respectively, whereas in Germany and the UK it reduces support by around 14%pt. and 6%pt., respectively. With respect to opposition, the strongest declines appear in France, Italy, and Spain (up to 17%pt.), and in Greece (around 9%pt.), while opposition-reducing effects in Poland and the UK are modest. Germany remains the exception: the emissions trading design increases opposition by 8%pt., relative to carbon taxation. The design switch towards emissions trading consistently increases neutral responses across all countries, with the smallest margin in Poland (5%pt.) and the largest margin in France (16%pt.).

Who is more likely to support or oppose carbon pricing? Correlates of appraisal are largely consistent with prior work on public support for carbon pricing (e.g., Sommer et al. (2022)). Average marginal effects of the control variables from the partial proportional odds model in Equation 6 show that support for carbon pricing is most strongly associated with concern about climate change, trust in government, and having obtained a college degree (see Table 9 in Appendix C). Among beliefs about the roles of societal actors, the view that government is essential to decarbonization efforts is most strongly associated with support. Opposition largely mirrors the patterns: individuals concerned about climate change or trusting in government are substantially less likely to oppose carbon pricing, while higher education plays less of a role. By contrast, neutrality is less common among women, the college-educated, those who trust citizens, and those who see businesses as important for achieving net-zero targets. Overall, climate concern, higher education, and trust in government stand out as the most consistent predictors of appraisal outcomes.

[4]In light of the strong effects on 'neutrality', we conduct further analysis on the "Don't know" answers in Appendix C.5. Across our sample, respondents who identify as female, have obtained a college degree and are from Germany are less likely to select "Don't know" in the key appraisal question item, while respondents from the UK and Italy are more likely to select a non-answer. There is also considerable correlation between "Don't know" responses in the outcome variable, and "Don't know" responses across other Likert-scale survey items eliciting attitudes. The 'emissions trading' treatment makes "Don't know" responses around 6.6%pt. more likely, compared to carbon taxation, confirming that respondents are simply more unsure about what to think of emissions trading.

Table 2: Average marginal effects by appraisal level

| Appraisal level | Control mean | Estimate (SE) |
|---|---|---|
| Oppose | 0.270 | -0.084 (0.003)*** |
| Neutral | 0.369 | 0.093 (0.003)*** |
| Support | 0.361 | -0.010 (0.003)*** |

**Note:** 'Support' ('Oppose') corresponds to '4' and '5' ('1' and '2') on the corresponding five-point Likert scale ranging from "strongly oppose" to "strongly support". 'Neutral' encompasses both the mid-point '3' and 'Don't Know' answers.

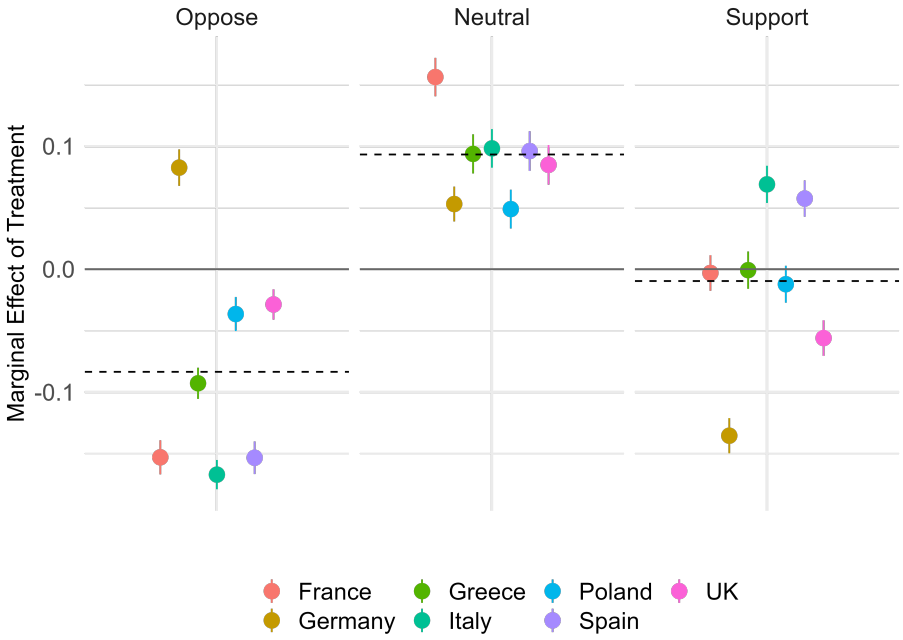



Figure 1: Country-specific average marginal treatment effects on appraisal

**Note:** Table 2 shows average marginal effects (AMTEs), obtained from a country-pooled partial proportional odds model, including socio-economic and attitudinal controls and non-parallel country effects. For average marginal effects across co-variates see Table 9. Robust standard errors (HC2) are shown in parentheses. Stars are based on q-values, adjusted for multiple hypothesis testing with the Benjamini-Hochberg correction. + $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$. Figure 4.1 depicts country-specific AMTEs, estimated with a partial proportional odds model allowing treatment-country interactions and non-parallel effects for all country dummies and control variables that violate the Brant test's proportional odds assumption. Error bars are based on robust standard errors (HC2). The dashed line shows the equal-country average of those AMTEs.

## 4.2 Heterogeneous treatment effects on support

Estimating across which socio-economic characteristics and attitudes the policy design intervention changes support can help identify for which groups in society the design choice between carbon taxes and emissions trading may have a polarizing effect. In sum, heterogeneous effects are largely country-specific, with few generalizable patterns across all sampled countries. Overall, the results suggest that the carbon tax design marginally increases support among constituencies already associated with higher climate policy support, while emissions trading appeals more to cost-conscious constituencies.

For estimating heterogeneous treatment effects, we leverage the advantages of combining flexible non-parametric estimation based on random forests with an easy-to-interpret linear regression model. Generalised random forests can be used for non-parametric treatment effect estimation and have several advantages, including their ability to handle complex, non-linear relationships between outcome, treatment and co-variates, variance reduction, and low risk of overfitting (Hastie et al., 2001). Using recursive partitioning, the algorithm builds a large set of decorrelated decision trees from a sampled subset of training data and a random subset of features (Athey et al., 2019; Wager & Athey, 2018). Conditional average treatment effects (i.e., counterfactual individualised treatment effects for each observation, conditional on individual co-variates) are obtained from averaging the predictions over all generated decision trees. For implementation, we utilise the generalised random forests algorithm implemented in the "grf" package in R by Athey et al. (2019).

The random-forest estimated average treatment effect on support from using the 'emissions trading' as opposed to the 'carbon tax' design is in line with the marginal effects from the partial proportional odds model model in Table 2 and stands at $-0.017(0.009)$ (i.e., 1.7%pt.). On average, across the entire sample, changing from the carbon tax to the emissions trading design has a small negative effect on support levels – largely confirming the results in Section 4. Figure 2 depicts marginal changes of the conditional average treatment effects for three groups of co-variates. Negative coefficients (shaded in light orange) denote a marginal decrease in support from designing the policy as an emissions trading system compared to a carbon tax, relative to the baseline average treatment effect of $-0.017$. Positive coefficients (shaded in light blue) denote a marginal increase in support from the emissions trading design relative to the baseline ATE.

Overall, we document a strong marginal increase in support for carbon taxes among college-educated respondents and those who view current climate policies as not ambitious enough. Conversely, emissions trading sees a marginal increase in support among respondents leaning towards individualistic worldviews (see Kahan et al., 2011) and those who trust businesses. Those concerned over energy costs amid the 2022/23 European energy crisis display an around 5%pt. marginal increase in support for emissions trading, relative

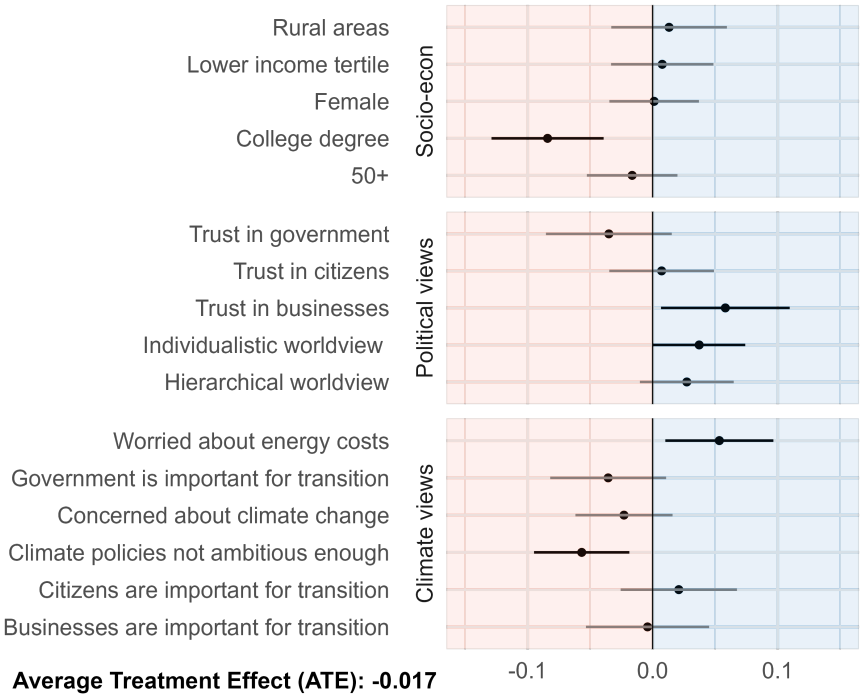



Figure 2: Conditional Average Treatment Effects (CATE) on policy support

**Note:** This plot depicts heterogeneities in the treatment effect on support across socio-economic co-variates, political views and climate views. Coefficients are obtained from the best linear projections of the random-forest estimated Conditional Average Treatment Effect (CATE), using robust standard errors (HC3) (Chernozhukov et al., 2018). The random-forest based estimation was conducted on the full weighted sample (n=13,665). Coefficients in the light-orange shaded area of the plots hint at a marginal preference for carbon taxation within the respective subsample (relative to the cross-sample ATE of $-0.017$), while coefficients in the light-blue shaded area imply a marginal preference for emissions trading relative to the baseline ATE. Support has been coded as '1' for values '4' and '5' on the corresponding five-point Likert scale.

to the -1.7%pt. baseline effect across the whole sample. Policy design has no discernibly different effect on support among respondents familiar with the EU Emissions Trading System (EU-ETS). This changes when considering *opposition* outcomes: the emissions trading design increases opposition by 5.5%pt. (relative to the -8%pt. baseline effect) among respondents that claim to have heard about the EU-ETS, bringing evaluations of carbon taxation and emissions trading closer together in this subgroup (see Figure 4).

Heterogeneous effects vary strongly by country context (see Appendix D.3). Among college-educated respondents, the tax design most strongly increases support in Italy and Poland — partially offsetting Italy's overall preference for emissions trading while reinforcing the tax preference in Poland. The positive marginal effect on tax support among those who view current climate policies as insufficiently ambitious is only significant in Poland when tested at the country level. Voting preferences further reveal distinct patterns: Italian conservatives are marginally less likely to support carbon taxes, while Greek and Spanish conservatives show a marginally stronger preference for emissions trading. While few results are generalizable across a majority of the sampled countries, the heterogeneous effects overall suggest that the intervention of designing the policy as an emissions trading system marginally decreases support among constituencies often associated with pro-climate and pro-regulation attitudes, while marginally increasing support among conservative and pro-market constituencies in most countries.

# 5 Perception of policy properties

Switching between carbon pricing designs may not only affect appraisal, but also the perception of the policy's properties. In this section, we estimate Equation 7 for a series of policy property perceptions, and document robust cross-country evidence in favour of *divergent perceptions* between carbon taxation and emissions trading, particularly with respect to cost perceptions.

Table 3 summarises average treatment effects of the design switch on perceptions of policy properties. Most noteworthy are the results on cost perceptions: around half of the sample agree that carbon taxes will markedly increase their living expenses, raise production costs and grow the government budget, and a third agrees that it will have negative impacts on the economy. In comparison, the 'emissions trading' treatment reduces these perceptions by between 6%pt. and 11%pt. on average. On the other hand, emissions trading is more often perceived as easy to evade. This perception increases under the ETS design by around 7%pt. from a baseline of 26%. The perceptions of the distributional properties and the positive effects of carbon pricing on emission reduction and innovation are not significantly different across carbon taxes and emissions trading designs. Our results further hint that the divergent cost perceptions are not due to differences in the

Table 3: Treatment effect on the perception of policy properties

| Dependent variable | Estim. mean (Tax) | Treatment effect (ETS) |
|---|---|---|
| **Policy objectives** | | |
| Increase in government revenues | 0.47 | -0.005 (0.009) |
| Incentives consumer change | 0.50 | 0.012 (0.009) |
| Incentives change in production | 0.57 | 0.007 (0.009) |
| **Policy properties: cost implication** | | |
| Increases costs of living | 0.57 | -0.099$^{***}$(0.009) |
| Increases production costs | 0.53 | -0.063$^{***}$(0.009) |
| Increases government budget | 0.51 | -0.109$^{***}$(0.009) |
| **Policy properties: effects** | | |
| Equitable burden-sharing | 0.25 | 0.017$^{+}$(0.008) |
| Reduces emissions effectively | 0.32 | -0.000 (0.009) |
| Positive effect on innovation | 0.36 | 0.018$^{+}$(0.009) |
| Negative effect on the economy | 0.37 | -0.073$^{***}$(0.009) |
| Easy to evade | 0.26 | 0.069$^{***}$(0.009) |
| Believes in Pigouvian effect | 0.32 | -0.007 (0.009) |

**Note:** This table shows the treatment coefficient of twelve separate OLS regressions of policy property perceptions. Treatment effect denotes the difference between being assigned in the "Carbon Tax" versus "ETS" group. Controls include socio-economic variables, political attitudes and climate-change related attitudes. Robust standard errors (HC2) are shown in parentheses. Stars are based on q-values, adjusted for multiple hypothesis testing with the Benjamini-Hochberg correction. $+$ $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$.
As a sensitivity analysis, we re-estimate the treatment effects on restricted samples excluding "Don't know" answers across all outcome variables. The results are largely confirmed, with modest differences in magnitudes (see Table 11).

perceived pass-through of carbon pricing. The emissions trading design causes respondents to perceive less cost increases both for consumers and producers, and does not change perceptions around the policy's incidence: respondents exposed to either policy design are in agreement that the burden of carbon pricing falls more strongly on businesses (63%) than consumers (20%), potentially reflecting information highlighting upstream design across both treatment arms.

Moreover, we have tested for people's beliefs concerning the objectives of the policy and the 'Pigouvian' mechanism of carbon pricing (Kallbekken et al., 2011). One hypothesis to explain opposition to carbon pricing and the comparative popularity of combining it with green spending is that people see carbon prices predominantly as a mechanism to raise government revenues, which are then to be spent on decarbonization measures. In our survey, respondents do not identify revenue generation as a dominant objective, at least in comparison to the other suggested objectives of *'incentivising changes in consumption behaviour'*, and *'incentivising a greening of production processes'*. On average, there are also no significant differences between how respondents ascribe policy objectives to carbon taxes and emissions trading. We further elicit beliefs in 'Pigouvian' principles by asking respondents whether they believe the effect of reducing emissions is maintained even when revenues are distributed back to consumers (i.e., they are not to be spent on additional mitigation measures). Notably, the share of respondents believing in the isolated effect of relative price changes is fairly low at 32%. The 'Pigouvian' beliefs are independent from the question of whether a carbon price is presented as a tax or an emissions trading system.

Splitting the sample per country highlights cross-country heterogeneities in how carbon taxes and emissions trading systems are perceived (see Appendix D.2). The decrease in cost perceptions induced by the emissions trading design can be consistently documented in all countries of our sample, except for Greece and Poland. Quantitatively, the effect on the perception of living costs is largest in France (at an effect size of around -20%pt.). The perception that emissions trading systems are easier to evade is strongest in Germany (at around 18%pt.). Respondents in Germany are on average noticeably more pessimistic about the emission reduction potential and fairness of both emissions trading systems and, to a lesser extent, carbon taxes, compared to respondents in other countries. Most notably, respondents in Poland see on average fewer differences between regulation by taxation and emissions trading, while in Greece the design switch has no effects on any of the elicited perceptions on policy properties.

One caveat to our study is that the similarity of tax and quantity instruments depends on their specific design. They *can* be made equivalent but are not *necessarily* so in practice. For instance, different permit allocation mechanisms or redistribution schemes will yield different distributive effects, and taxes and trading systems often differ in their sectoral coverage and stringency. In fact, citizens in four countries in our sample (France,

Poland, Spain and the United Kingdom) are exposed to both a national carbon tax and an emissions trading mechanism. The rest (Germany, Italy, Greece) are only exposed to emissions trading systems.[5] Thus, differences in policy perceptions could reflect different past experiences with national policy designs. In our study, the internal experimental effect from providing brief information cannot be disentangled from prior real-world experience with existing national carbon taxes, emissions trading systems, or the EU-ETS.

This raises the question: to what extent can we assume that treatment effects on policy perceptions imply epistemic disagreement about the general designs, rather than reflecting experience with national implementations?

First, our survey results suggest that citizens are often not aware of national schemes, with only 10% of respondents indicating knowledge of national carbon pricing levels. Moreover, just above 20% of respondents in most countries reported familiarity with the EU ETS, except in Germany and Poland, where knowledge is considerably higher at above 50% (see Table 12). Yet, even in Germany, where respondents have experienced both the EU ETS and a national emissions trading system on heating and transport fuels, the perception that emissions trading is significantly less costly persists.

Second, if respondents do draw on their perceptions of and experience with existing carbon pricing schemes, our results become even more surprising. Recent macro-economic evidence suggests that the economic costs of the EU-ETS are, if anything, larger than the costs of national taxes. Metcalf and Stock (2023) find small and insignificant effects of European national carbon taxes on GDP and employment, while Känzig (2023) reports larger economic costs of the European emissions trading system. Känzig and Konradt (2023) explicitly compare the effects of carbon taxes and emission trading in Europe and reaches the same conclusion: implemented carbon taxes seem to have a smaller negative effect on the economy compared to emission trading. It is therefore reasonable to assume that perceiving carbon taxes as more costly than emissions trading systems is not primarily due to past experiences with policies, but rather reflects epistemic disagreement about general policy effects across designs.

# 6 The role of policy properties for appraisal

So far, we have documented that switching from the 'carbon tax' to the 'emissions trading' design reduces opposition against the policy in cross-country comparison (Section 4), and entails significant changes in the perception of the policy's properties (Section 5). In particular, respondents less often anticipate substantial cost increases or negative economic

[5]Note that, in its implementation as a fixed-price system, the German national emissions trading system currently exhibits hybrid features that make it more similar to a tax in practice.

effects under the emissions trading design. To what extent, however, can the cross-country finding on lower opposition be causally attributed to the change in cost perceptions? In this section, we employ causal mediation analysis to assess in how far the differences in opposition can be interpreted to stem from changes in perceived properties, as opposed to other valuation channels.[6]

Causal mediation analysis allows to identify how much of the average treatment effect on opposition is *mediated* by design-induced changes in how respondents perceive the policy's properties, such as the perceived increase in consumer costs, accounting for the fact that these perceptions are themselves endogenous to the treatment (see Section 2.2). By leveraging Equations 8–10 to estimate counterfactual relationships between mediator $X$ (i.e., a specific policy property) and outcome $Y$ (i.e., opposition) under different treatment states, causal mediation also allows for identifying in how far the indirect effect of a specific perception on opposition may vary with the treatment state (i.e., treatment-mediator interaction effect). This indicates whether specific policy properties are more important for people's appraisal under one policy design as opposed to the other, potentially pointing to *divergent valuation* as stipulated in Section 2.1.

## 6.1 Mediating effects of cost perceptions on opposition

Table 4 summarises the cross-country results of separate mediation models for four central policy properties: 'increases costs of living', 'negative effects on the economy', 'reduces emissions effectively', and 'equitable burden-sharing', as well as an index of 'positive perceptions of policy properties' that combines all four aforementioned properties[7][8] Across the whole sample, the perceptions that emissions trading leads to a lesser increase in living costs and less negative effects on the wider economy each mediate around 16-18%, of the average treatment effect of -8%pt. on opposition. Perceptions around fairness matter considerably less, and changes in perceptions around reduced emissions show no mediating effect.[9]

[6]In light of the considerably stronger average treatment effect on opposition (-8%pt.), rather than support (-1.7%pt.), *at the cross-country level*, we decided to focus the mediation analysis on probing into the comparatively stronger result.

[7]This is the subset of assessed properties, for which we included a pre-treatment question in the survey (*'When evaluating a measure to tackle climate change, how important are the following aspects to you?'*, see Appendix F). Their relevance is supported by a broad empirical literature (Maestre-Andrés et al., 2019). Note that we assume that we measure the perceptions respondents have had at the moment of support elicitation (i.e., there is no reverse causality, where respondents adjust their perceptions based on the support level they indicated).

[8]This binarised index can be interpreted as having an above-average positive perception of the four respective policy properties (i.e., perceptions around "living costs" and "negative effect on the economy" have been reverse-coded).

[9]This result is anticipated, as there is on average no treatment effect from switching from the carbon tax to the emissions trading design on perceived emission reduction potential, and only a

Table 4: Mediation through policy perceptions: total, indirect and direct effects on opposition

| Mediator | | $\hat{\Delta}$ (ATE) | $\hat{\delta}$ (Tax) | $\hat{\delta}$ (ETS) | $\hat{\theta}$ (Tax) | $\hat{\theta}$ (ETS) | Share med. |
|---|---|---|---|---|---|---|---|
| **Raises living costs** | *effect* | -0.081 | -0.019 | -0.012 | -0.07 | -0.063 | 18.6% |
| | *CI lower* | (-0.096, | (-0.023, | (-0.015, | (-0.085, | (-0.077, | (14.5%, |
| | *CI upper* | -0.066) | -0.015) | -0.009) | -0.054) | -0.048) | 24.2%) |
| **Negative econ. effect** | *effect* | -0.082 | -0.018 | -0.01 | -0.072 | -0.064 | 16.7% |
| | *CI lower* | (-0.097, | (-0.022, | (-0.012, | (-0.088, | (-0.079, | (12.5%, |
| | *CI upper* | -0.066) | -0.013) | -0.007) | -0.056) | -0.048) | 22.4%) |
| **Reduces emissions** | *effect* | -0.081 | 0 | 0 | -0.08 | -0.08 | 0.2% |
| | *CI lower* | (-0.095, | (-0.003, | (-0.003, | (-0.094, | (-0.094, | (-4% |
| | *CI upper* | -0.066) | 0.003) | 0.003) | -0.066) | -0.066) | 3.7%) |
| **Fair burden-sharing** | *effect* | -0.081 | -0.003 | -0.002 | -0.079 | -0.078 | 3.3% |
| | *CI lower* | (-0.096, | (-0.006, | (-0.004, | (-0.094,) | (-0.092, | (0.7%, |
| | *CI upper* | -0.066) | -0.001) | 0) | -0.064) | -0.063) | 6.4%) |
| **Policy property index** | *effect* | -0.08 | -0.028 | -0.021 | -0.06 | -0.053 | 30.1% |
| | *CI lower* | (-0.096, | (-0.034, | (-0.025, | (-0.075, | (-0.067, | (23.6%, |
| | *CI upper* | -0.066) | -0.022) | -0.017) | -0.045) | -0.039) | 37.6%) |

**Note:** The average treatment effect (ATE) estimate $\hat{\Delta}$ is the sum of indirect effect $\hat{\delta}$ and direct effect $\hat{\theta}$ under different treatment states. 'Share med.' refers to the average share of the ATE mediated by $\hat{\delta}(t)$. We use the *mediation* package in *R* (Tingley et al., 2014). Mediation models include country-fixed, socio-demographic and attitudinal controls. Confidence intervals in parentheses have been computed using bootstrapping (number of simulations = 1000). We have tested the robustness of our results to (a) confounding by alternative mediators and (b) violations of the sequential ignorability assumption (i.e., omitted confounding of both the mediator and outcome variables). The results largely hold in a multi-mediator setting (using an index of alternative mediation channels). Our results on the mediating role of the policy property index and negative economic effects are moderately robust to common mediator-outcome confounding, while the results on living costs are more sensitive, especially under the emissions trading treatment state (see Appendix E).

When considering policy properties together, around 30% of the opposition-decreasing effect of emissions trading, compared to carbon taxes, can be attributed to the fact that respondents perceive the properties of emissions trading more positively (i.e., they have a more positive perception of the emission reduction potential and fairness of emissions

1.7%pt. effect on perceived fairness.

trading, and lesser perception of living cost increases and negative effects on the wider economy).

Table 5: Summary of treatment-mediator interaction effects

| Mediator | $\delta(ETS) - \delta(Tax)$ | 95% CI lower | 95% CI upper | p-value |
|---|---|---|---|---|
| **Raises living costs** | 0.007 | 0.004 | 0.10 | $< 0.001$ |
| **Negative economic effect** | 0.008 | 0.005 | 0.011 | $< 0.001$ |
| **Reduces emissions** | 0.000 | -0.001 | 0.001 | 0.93 |
| **Fair burden-sharing** | -0.001 | 0.0001 | 0.001 | 0.02 |
| **Policy property index** | 0.007 | 0.004 | 0.010 | $< 0.001$ |

**Note:** Treatment-mediator interaction effects are measured by the difference between indirect effects $\delta(t)$ between treatment states, and point towards heterogeneity in how much of the average treatment effect can be attributed to the respective mediator. Interaction effects and their significance were estimated using the built-in functions of the *mediation* package in *R* (Tingley et al., 2014).

Moreover, we find small differences between the indirect effect of cost perceptions under the carbon tax design ($\delta(Tax)$) and the emissions trading design ($\delta(ETS)$, see Table 4). Under the carbon tax design, the on average 10%pt. reduction in the perception that the policy leads to higher living costs (see Table 3) would (counterfactually) decrease opposition by 1.9%pt., while it decreases opposition against emissions trading by only 1.2%pt. We confirm the statistical significance of this treatment-mediator interaction effect in Table 5. Similar effects can be observed for the indirect effect of perceived costs on the economy. Even though the effect size is very small, such a differential consideration of cost implications hints at *divergent valuation*: the perception that costs are reduced plays a larger mediating role in easing opposition when taxes are considered.

## 6.2 Country-level indirect and direct effects

At a country level, we can confirm the indirect effect of the emissions trading design leading to less opposition through the perception that cost implications will be less. Perhaps unsurprisingly, the effect emerges most strongly in those countries with the largest *tax aversion* – France, Italy and Spain – if not in Greece, where we document tax aversion but no significant effects of the emissions trading design on policy perceptions (see Appendix D.4). Strikingly, the indirect effect also appears in the UK, where the emissions trading design has no direct effect on opposition levels. In Germany, the indirect effect even goes in the opposite direction of the direct effect: while the design as an emissions trading system as such increases opposition, this effect is slightly dampened by the perception that living

costs are less likely to increase under an emissions trading system. In Poland, we document neither a direct design effect on opposition, nor a mediated effect through policy properties.

### 6.3 Perceptions of properties play a robust but modest role

Overall, our results demonstrate that perceptions play a robust but modest mediating role in the appraisal of different carbon pricing designs: Around 30% of the -8%pt. difference in opposition between carbon tax and emissions trading can be attributed to *divergent perceptions* of their properties, and mainly to different perceptions of cost implications. Moreover, cost perceptions loom larger in the context of carbon taxation. Not only is carbon taxation perceived as costlier compared to emissions trading (i.e., *divergent perception*). Under the tax design, cost perceptions also *matter* more as a mediator in decreasing support and increasing opposition compared to the ETS context, pointing to *divergent valuation*.

What do these results imply for how appraisal of different carbon pricing designs works? On the one hand, the policy properties studied here play a robust role for the comparative evaluation of carbon taxes and emissions trading. Hence, trying to change perceptions around cost implications could be a valuable strategy for policymakers to reduce opposition, particularly against carbon taxes. On the other hand, our results indicate that differences in appraisal are not driven solely by divergent perceptions of economic impacts - around 70% of the effect in our mediation model remains unexplained. As a point of comparison, this pattern differs from a past study on revenue recycling options, where fairness perceptions mediate a much larger share of the differences in public support (Jagers et al., 2021). For securing public support of carbon taxes vs. emissions trading, there may be other - perhaps country-specific - channels, aside from perceptions of economic effects, to explain different appraisal.

## 7 Conclusion

Since Weitzman (1974) initiated the debate on regulating pollution by means of taxation or (tradeable) quantity limits, extensive research in public economics has clarified the conditions under which the regulatory symmetry between carbon taxes and emissions trading breaks down. Of the many hurdles to implementation, however, securing public support remains a key obstacle to enacting ambitious carbon pricing in any form.

In this article, we assess how carbon taxation and emissions trading compare in the eye of the public. We propose a theory how differences in support for two as closely related policies as carbon taxation and emissions trading can arise for two reasons. First, differences in the perceptions of the policy's properties and effects (*divergent perceptions*), and

second, differences in what it is that people value when appraising policies, including the weight they place on specific economic outcomes (*divergent valuation*).

Our analysis offers insights into the behavioural political economy of public appraisal. Taking account of people's perceptions of the detailed properties of a policy is important for bringing analytical precision to debates on political feasibility of instruments: Eliciting public opinion as such yields no indication *why* an individual rejects a policy proposal. Such opposition may be based on disagreement with a policy's objectives, including the desired level of mitigation ambition and the preferred form of burden-sharing. Alternatively, the public may question the policy's ability to deliver as planned, or fear negative side effects. For an informed societal debate about policy options, it is important to disentangle where there is *evaluative* disagreement about the objectives of policy instruments and where there is *epistemic* disagreement about the mechanism and expected real-world outcomes of climate policy.

To examine the two theoretical channels of policy appraisal empirically, we conducted a policy design interventions with 13,665 survey respondents across seven European countries, introducing variation by designating the carbon price either as an emissions trading system, or as a carbon tax. We document that differences in support and opposition levels results from both divergent perceptions of policy properties and divergent valuation.

Overall, we find that the emissions trading design reduces opposition by on average 8%pt. (from a baseline level of 27% in the carbon tax group). Importantly, this result stems from the fact that more respondents show a neutral attitude to emissions trading rather than supporting or opposing it. Moreover, we document strong variations across countries. Carbon taxes yield more support in Germany (+14%pt.) and the UK (+6%pt.), while the emissions trading design increases support in Italy (+7%pt.) and Spain (+6%pt.). Regarding opposition, designing the policy as an 'emissions trading system' reduces opposition most strongly in Southern Europe — by around 15-17%pt. in France, Italy, and Spain, and 9%pt. in Greece — but increases opposition in Germany by 8%pt., where the tax preference is strongest. Concerning heterogeneous effects, the tax design has a marginally stronger positive effect on support among college-educated respondents and climate-conscious individuals. Emissions trading, on the other hand, is marginally preferred by those with individualistic world-views and trust in businesses, and among individuals who worry about increasing energy costs. At the country level, we document country-specific variations with respect to political leanings. Consistent with past research, trust in government, climate concern, and higher education are associated with support for carbon pricing in either form.

Moreover, we find substantial treatment effects on the perception of policy properties, especially concerning cost perceptions: switching from a carbon tax to an emissions trading design makes respondents 10%pt. less likely to expect higher living costs, 11%pt. less likely

to expect an increase in and government revenues, and 6–7%pt. less likely to anticipate negative economic impacts or rising production costs. These effects are strongest in France (up to -20%pt.) and appear only partially in Greece and Poland. Emissions trading is also perceived as significantly easier to evade in all countries except Greece. In sum, taxes are being generally perceived as the 'tougher' (i.e., costlier) instrument. Considering the existing regulatory context, we can assume that treatment effects on policy perceptions imply epistemic disagreement about the *general* designs, rather than reflecting experience with national implementations. To begin with, we observe a general lack of familiarity with existing national carbon pricing schemes and the EU-ETS. Furthermore, the perception of emissions trading as less costly contradicts recent evidence that the costs and economic impacts of European emissions trading outweigh the costs from national carbon taxation (Känzig, 2023; Känzig & Konradt, 2023; Metcalf & Stock, 2023).

Crucially, we find that *divergent perceptions* of the policies' core economic properties mediate on average around 30% of the -8%pt. treatment effect on opposition across the whole sample, with the effect present in all countries except Greece and Poland. This suggests that lower opposition to emissions trading is partly due to its perception as less costly. Moreover, costs perceptions play a smaller mediating role under the emissions trading frame, aligning with the concept of *divergent valuation.*

Turning to policy implications, perhaps unsurprisingly, our finding that public perceptions of a policy are sensitive to the design of its mechanism weakens the case for viewing public support solely as a matter of adjusting substantive payouts to citizens. Specifically, the 'tax' design seems to highlight the regulatory 'toughness' and cost implications of the measure. Awareness of citizens' preconceptions around policy designs may help with choosing the right communication strategies to harness support. Policymakers should also consider, whether the properties highlighted by a specific design align with voter coalitions crucial for sustained public support. In that respect, our study suggests that the lens of 'cost perceptions' is the most important one for how the public evaluates carbon pricing. However, our results also show that differences in appraisal are *not solely* driven by perceptions of economic effects — around 70% of the effect remains unexplained, and may capture complex appraisal mechanisms beyond concerns about costs, effectiveness and fairness. This highlights the need to also consider broader contextual and psychological factors when designing carbon pricing policies.

For European climate policy, our findings shed new light on the predilection of the European Commission to drive decarbonisation by emissions trading, not carbon taxation. Our paper offers new insights into how the second European emissions trading system (ETS II), covering road transport and buildings from 2027, may be received by the public. With a large group of convinced climate policy supporters being in favour of ambitious regulation anyway, we overall expect emissions trading rather than carbon taxes to garner more sup-

port among those tending to be unconvinced by the steep emission reductions required by EU climate targets (Funke et al., 2024). However, with rising permit prices for heating and transport fuel under ETS II, it remains to be seen how perceptions of emissions trading, especially perceptions around cost implications, change.

To conclude, comparing pricing with command-and-control rather than tradeable quantities, Weitzman (1974) hypothesises that the public intuitively prefers (non-tradable) quantity-based regulation, due to lack of understanding of the Pigouvian logic:

*"I think it is a fair generalization to say that the average economist in the Western marginalist tradition has at least a vague preference toward indirect control by prices, just as the typical non-economist leans toward the direct regulation of quantities. That a person not versed in economics should think primarily in terms of direct controls is probably due to the fact that he does not comprehend the full subtlety and strength of the invisible hand argument."* (Weitzman, 1974)

Concerning perceptions of climate mitigation effectiveness, we document no such cross-country differences between carbon taxes and emissions trading. However, we document the inverse effect concerning the perception of cost implications. Specifically, it is the tax that is perceived as the tough instrument to citizens, whereas the "full subtlety and strength" of emissions trading as a quantity instrument is less clear.

# References


Anderson, S., Marinescu, I., & Shor, B. (2023). Can Pigou at the polls stop us melting the poles? *Journal of the Association of Environmental and Resource Economists*, *10*(4), 903–945.

Andor, M. A., Lange, A., & Sommer, S. (2022). Fairness and the support of redistributive environmental policies. *Journal of Environmental Economics and Management*, *114*, 102682.

Andre, P., Boneva, T., Chopra, F., & Falk, A. (2024). Globally representative evidence on the actual and perceived support for climate action. *Nature Climate Change*, *14*(3), 253–259.

Athey, S., Tibshirani, J., & Wager, S. (2019). Generalized random forests. *The Annals of Statistics*, *47*.

Baranzini, A., & Carattini, S. (2017). Effectiveness, earmarking and labeling: Testing the acceptability of carbon taxes with survey data. *Environmental Economics and Policy Studies*, *19*, 197–227.

Besley, T., & Persson, T. (2023). The political economics of green transitions. *The Quarterly Journal of Economics*, *138*, 1863–1906.

Campbell, T. H., & Kay, A. C. (2014). Solution aversion: On the relation between ideology and motivated disbelief. *Journal of Personality and Social Psychology*, *107*(5), 809–824.

Carattini, S., Dur, R., & List, J. (2024). Policy evaluation and the causal analysis of public support. *Science*, *386*(6721), 490–492.

Chater, N. (2018). *The mind is flat: The illusion of mental depth and the improvised mind.* Penguin UK.

Chernozhukov, V., Demirer, M., Duflo, E., & Fernandez-Val, I. (2018). *Generic machine learning inference on heterogeneous treatment effects in randomized experiments, with an application to immunization in india* (Working Paper No. 24678). National Bureau of Economic Research. https://www.nber.org/papers/w24678

Cherry, T. L., Kallbekken, S., & Kroll, S. (2017). Accepting market failure: Cultural worldviews and the opposition to corrective environmental policies. *Journal of Environmental Economics and Management*, *85*, 193–204.

Dechezleprêtre, A., Fabre, A., Kruse, T., Planterose, B., Chico, A. S., Stantcheva, S., & Zuerichberstrasse, A. F. E. Z. (2025). Fighting climate change: International attitudes toward climate policies. *American Economic Review*, *115*(4), 1258–1300.

Douenne, T., & Fabre, A. (2022). Yellow vests, carbon tax aversion and biased beliefs. *American Economic Journal: Economic Policy*, *14*, 81–110.

Drews, S., & van den Bergh, J. C. (2016). What explains public support for climate policies? a review of empirical and experimental studies. *Climate Policy*, *16*, 855–876.

Fairbrother, M. (2016). Trust and public support for environmental protection in diverse national contexts. *Sociological Science*, *3*, 359.

Fischer, C., & Pizer, W. A. (2019). Horizontal equity effects in energy regulation. *Journal of the Association of Environmental and Resource Economists*, *6*(S1), S209–S237.

Frondel, M., Gerster, A., Kaestner, K., Krieg, M., Pahle, M., Schwarz, A., Singhal, P., & Sommer, S. (2023, September). FDZ data description: The German Heating and Housing Panel (GHHP) – wave 1. https://www.econstor.eu/handle/10419/289429

Funke, F., Mattauch, L., Douenne, T., Fabre, A., & Stiglitz, J. E. (2024). Supporting carbon pricing when interest rates are higher. *Nature Climate Change*, *14*, 665–667.

Gustafson, A., Goldberg, M. H., Bergquist, P., Lacroix, K., Rosenthal, S. A., & Leiserowitz, A. (2022). The durable, bipartisan effects of emphasizing the cost savings of renewable energy. *Nature Energy*, *7*(11), 1023–1030.

Haaland, I., Roth, C., & Wohlfart, J. (2023). Designing information provision experiments. *Journal of economic literature*, *61*(1), 3–40.

Hammar, H., & Jagers, S. C. (2006). Can trust in politicians explain individuals' support for climate policy? The case of CO2 tax. *Climate Policy*, *5*(6), 613–625.

Hardisty, D. J., Beall, A. T., Lubowski, R., Petsonk, A., & Romero-Canyas, R. (2019). A carbon price by another name may seem sweeter: Consumers prefer upstream offsets to downstream taxes. *Journal of Environmental Psychology*, *66*, 101342.

Hastie, T., Friedman, J., & Tibshirani, R. (2001). *The elements of statistical learning*. Springer New York.

Hepburn, C. (2006). Regulation by prices, quantities, or both: A review of instrument choice. *Oxford Review of Economic Policy*, *22*, 226–247.

Huber, M. (2019). A review of causal mediation analysis for assessing direct and indirect treatment effects. *Working Papers SES, Faculté des sciences économiques et sociales et du management*, (500.I.2019). https://folia.unifr.ch/unifr/documents/307412

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological Methods*, *15*(4), 309–334.

Imai, K., Keele, L., & Yamamoto, T. (2010). Identification, inference, and sensitivity analysis for causal mediation effects. *Statistical Science*, *25*(1), 51–71.

Imai, K., & Yamamoto, T. (2013). Identification and sensitivity analysis for multiple causal mechanisms: Revisiting evidence from framing experiments. *Political Analysis*, *21*(2), 141–171.

Jagers, S. C., Lachapelle, E., Martinsson, J., & Matti, S. (2021). Bridging the ideological gap? how fairness perceptions mediate the effect of revenue recycling on public support for carbon taxes in the United States, Canada and Germany. *Review of Policy Research*, *38*(5), 529–554.

Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, *14*(2), 147–174.

Kallbekken, S., Kroll, S., & Cherry, T. L. (2011). Do you not like Pigou, or do you not understand him? Tax aversion and revenue recycling in the lab. *Journal of Environmental Economics and Management*, *62*, 53–64.

Känzig, D. R. (2023). *The unequal economic consequences of carbon pricing* (tech. rep.). National Bureau of Economic Research.

Känzig, D. R., & Konradt, M. (2023). *Climate policy and the economy: Evidence from europe's carbón pricing initiatives* (tech. rep.). National Bureau of Economic Research.

Klenert, D., Mattauch, L., Combet, E., Edenhofer, O., Hepburn, C., Rafaty, R., & Stern, N. (2018). Making carbon pricing work for citizens. *Nature Climate Change*, *8*, 669–677.

Konc, T., Drews, S., Savin, I., & Van Den Bergh, J. C. (2022). Co-dynamics of climate policy stringency and public support. *Global Environmental Change*, *74*, 102528.

Kotchen, M. J., Boyle, K. J., & Leiserowitz, A. A. (2013). Willingness-to-pay and policy-instrument choice for climate-change policy in the United States. *Energy Policy*, *55*, 617–625.

Lachapelle, E. (2017). *Communicating about carbon taxes and emissions trading programs*. Retrieved September 12, 2025, from https://oxfordre.com/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-431

Maestre-Andrés, S., Drews, S., & van den Bergh, J. (2019). Perceived fairness and public acceptability of carbon pricing: A review of the literature. *Climate Policy*, *19*, 1186–1204.

Metcalf, G. E., & Stock, J. H. (2023). The macroeconomic impact of europe's carbon taxes. *American Economic Journal: Macroeconomics*, *15*(3), 265–286.

Mohammadzadeh Valencia, F., Mohren, C., Ramakrishnan, A., Merchert, M., Minx, J. C., & Steckel, J. C. (2024). Public support for carbon pricing policies and revenue recycling options: A systematic review and meta-analysis of the survey literature. *npj Climate Action*, *3*(1), 74.

Nesje, F., Schmidt, R. C., & Drupp, M. A. (2024). Designing carbon pricing policies across the globe.

Pearl, J. (2001). Direct and indirect effects. *Proceedings of the 17th Conference on Uncertainty in Artificial Intelligence*, 411–420.

Pizer, W. A. (1999). The optimal choice of climate change policy in the presence of uncertainty. *Resource and Energy Economics*, *21*, 255–287.

Pizer, W. A., & Prest, B. C. (2020). Prices versus quantities with policy updating. *Journal of the Association of Environmental and Resource Economists*, *7*, 483–518.

Rafaty, R. (2018). Perceptions of corruption, political distrust, and the weakening of climate policy. *Global Environmental Politics*, *18*(3), 106–129.

Sommer, S., Mattauch, L., & Pahle, M. (2022). Supporting carbon taxes: The role of fairness. *Ecological Economics*, *195*, 107359.

Stantcheva, S. (2023). How to run surveys: A guide to creating your own identifying variation and revealing the invisible. *Annual Review of Economics*, *15*, 205–234.

Stavins, R. N. (2011). The problem of the commons: Still unsettled after 100 years. *American Economic Review*, *101*(1), 81–108.

Stavins, R. N. (2022). The relative merits of carbon pricing instruments: Taxes versus trading. *Review of Environmental Economics and Policy*, *16*(1), 62–82.

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). mediation: R package for causal mediation analysis. *Journal of Statistical Software*, *59*(5), 1–38.

Wager, S., & Athey, S. (2018). Estimation and inference of heterogeneous treatment effects using random forests. *Journal of the American Statistical Association*, *113*, 1228–1242.

Weitzman, M. L. (1974). Prices vs. quantities. *The Review of Economic Studies*, *41*, 477.

Woerner, A., Imai, T., Pace, D. D., & Schmidt, K. M. (2024). How to increase public support for carbon pricing with revenue recycling. *Nature Sustainability*, 1–9.

# Supplementary Information

## Contents

# A Data and survey information

## A.1 Data collection

The survey was implemented by Bilendi, with the exception of the German sample, which was collected by Forsa as part of the Ariadne panel (Frondel et al., 2023). The field times for the Bilendi surveys were in November and December 2022.

## A.2 Representativeness

The country datasets collected by Bilendi were sampled to be representative of the underlying populations across the dimensions age (within the age group 18-69), education and gender. Since the German dataset stems from a specific-purpose panel within the Ariadne project, the data is not representative along several socio-demographic characteristics and over-represents male, older age strata and high-educated respondents. Hence, for the German sample, we use sampling weights correcting along age, education, gender and degree of urbanisation throughout the analysis. Furthermore, Bilendi has sampled a restricted age group between 18-69 years. For cross-country comparisons in the main part of the survey, we hence use a restricted sample for Germany that excludes respondents above the age of 69 ($n = 4459$). Tables 6 and 7 compare national population statistics with sample characteristics.

Table 6: Sample representativeness - 1

| | Germany | | | France | | Greece | |
|---|---|---|---|---|---|---|---|
| Variable | Population | Sample | Weighted sample | Population | Sample | Population | Sample |
| **Age** | | | | | | | |
| 18-29 | 0.20 | 0.03 | 0.19 | 0.22 | 0.21 | 0.18 | 0.16 |
| 30-39 | 0.19 | 0.12 | 0.19 | 0.19 | 0.19 | 0.18 | 0.20 |
| 40-49 | 0.18 | 0.22 | 0.18 | 0.20 | 0.20 | 0.23 | 0.24 |
| 50-59 | 0.23 | 0.32 | 0.24 | 0.21 | 0.21 | 0.22 | 0.22 |
| 60-69 | 0.20 | 0.32 | 0.20 | 0.19 | 0.19 | 0.19 | 0.18 |
| **Gender** | | | | | | | |
| female | 0.51 | 0.42 | 0.50 | 0.52 | 0.50 | 0.51 | 0.52 |
| male | 0.49 | 0.58 | 0.50 | 0.48 | 0.50 | 0.49 | 0.48 |
| **Education (25-64)** | | | | | | | |
| Lower secondary and below | 0.16 | 0.03 | 0.11 | 0.42 | 0.24 | 0.20 | 0.17 |
| Upper secondary | 0.51 | 0.54 | 0.53 | 0.42 | 0.53 | 0.45 | 0.68 |
| Tertiary (Bachelor +) | 0.32 | 0.43 | 0.36 | 0.27 | 0.22 | 0.35 | 0.15 |
| **Place of living** | | | | | | | |
| Cities | 0.39 | 0.42 | 0.40 | 0.36 | 0.44 | 0.40 | 0.65 |
| Towns and suburbs | 0.41 | 0.39 | 0.40 | 0.30 | 0.19 | 0.31 | 0.17 |
| Rural areas | 0.20 | 0.19 | 0.20 | 0.34 | 0.37 | 0.29 | 0.18 |
| **Employment status** | | | | | | | |
| Employed | 0.81 | 0.84 | 0.80 | 0.74 | 0.70 | 0.66 | 0.63 |
| **Voting preferences** | | | | | | | |
| Left | 0.31 | 0.20 | 0.19 | 0.26 | 0.26 | 0.48 | 0.38 |
| Green | 0.15 | 0.36 | 0.36 | 0.00 | 0.11 | 0.00 | 0.00 |
| Liberal | 0.12 | 0.06 | 0.06 | 0.25 | 0.12 | 0.00 | 0.00 |
| Conservative | 0.24 | 0.21 | 0.17 | 0.06 | 0.06 | 0.40 | 0.45 |
| Right and far right | 0.10 | 0.07 | 0.07 | 0.37 | 0.43 | 0.04 | 0.10 |
| Others | 0.00 | 0.06 | 0.09 | 0.00 | 0.03 | 0.00 | 0.07 |

**Note:** This table presents sample characteristics for the full sample (n=13665) alongside representative population statistics. Population frequencies for demographic characteristics were sourced from Eurostat, employment rates from Eurostat and the UK Office for National Statistics, educational outcomes from the OECD, and voting results from Politico's "Poll of Polls" (detailed data sheet available upon request). Age groups were constructed to consider only the sampled cohort aged between 18-69 years. Educational outcomes are considered for the age group of 25-64 year-olds and track ISCED scales. Employment quotas consider age groups 20-64 years-olds (18-64 in the UK). Sample statistics on the degree of urbanisation (DEGURBA) are computed from the subsample with observations for which identifying post-codes were available (n=12608). Voting preferences are computed from a subsample excluding non-voters.

Table 7: Sample representativeness - 2

| | Italy | | Poland | | Spain | | UK | |
|---|---|---|---|---|---|---|---|---|
| Variable | Population | Sample | Population | Sample | Population | Sample | Population | Sample |
| **Age** | | | | | | | | |
| 18-29 | 0.18 | 0.18 | 0.19 | 0.20 | 0.18 | 0.18 | 0.23 | 0.24 |
| 30-39 | 0.17 | 0.17 | 0.22 | 0.23 | 0.18 | 0.19 | 0.20 | 0.20 |
| 40-49 | 0.22 | 0.23 | 0.22 | 0.21 | 0.24 | 0.24 | 0.19 | 0.20 |
| 50-59 | 0.24 | 0.24 | 0.17 | 0.17 | 0.22 | 0.22 | 0.21 | 0.21 |
| 60-69 | 0.19 | 0.18 | 0.19 | 0.19 | 0.17 | 0.17 | 0.16 | 0.16 |
| **Gender** | | | | | | | | |
| female | 0.51 | 0.49 | 0.52 | 0.49 | 0.51 | 0.49 | 0.51 | 0.50 |
| male | 0.49 | 0.51 | 0.48 | 0.51 | 0.49 | 0.51 | 0.49 | 0.50 |
| **Education (25-64)** | | | | | | | | |
| Lower secondary and below | 0.37 | 0.10 | 0.07 | 0.10 | 0.36 | 0.11 | 0.19 | 0.09 |
| Upper secondary | 0.43 | 0.70 | 0.60 | 0.70 | 0.23 | 0.76 | 0.30 | 0.58 |
| Tertiary (Bachelor +) | 0.20 | 0.20 | 0.34 | 0.20 | 0.28 | 0.14 | 0.42 | 0.32 |
| **Place of living** | | | | | | | | |
| Cities | 0.35 | 0.39 | 0.34 | 0.39 | 0.54 | 0.61 | 0.59 | 0.64 |
| Towns and suburbs | 0.46 | 0.50 | 0.28 | 0.28 | 0.32 | 0.28 | 0.29 | 0.30 |
| Rural areas | 0.19 | 0.11 | 0.38 | 0.33 | 0.13 | 0.11 | 0.12 | 0.05 |
| **Employment status** | | | | | | | | |
| Employed | 0.65 | 0.50 | 0.77 | 0.67 | 0.69 | 0.62 | 0.75 | 0.64 |
| **Voting preferences** | | | | | | | | |
| Left | 0.19 | 0.14 | 0.13 | 0.08 | 0.41 | 0.42 | 0.37 | 0.46 |
| Green | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 |
| Liberal | 0.08 | 0.05 | 0.00 | 0.12 | 0.08 | 0.05 | 0.12 | 0.09 |
| Conservative | 0.08 | 0.06 | 0.36 | 0.34 | 0.21 | 0.23 | 0.44 | 0.31 |
| Right and far right | 0.35 | 0.40 | 0.50 | 0.41 | 0.15 | 0.16 | 0.00 | 0.00 |
| Others | 0.22 | 0.30 | 0.01 | 0.05 | 0.13 | 0.10 | 0.01 | 0.12 |

**Note:** This table presents sample characteristics for the full sample (n=13665) alongside representative population statistics. Population frequencies for demographic characteristics were sourced from Eurostat, employment rates from Eurostat and the UK Office for National Statistics, educational outcomes from the OECD, and voting results from Politico's "Poll of Polls" (detailed data sheet available upon request). Age groups were constructed to consider only the sampled cohort aged between 18-69 years. Educational outcomes are considered for the age group of 25-64 year-olds and track ISCED scales. Employment quotas consider age groups 20-64 years-olds (18-64 in the UK). Sample statistics on the degree of urbanisation (DEGURBA) are computed from the subsample with observations for which identifying post-codes were available (n=12608). Voting preferences are computed from a subsample excluding non-voters.

# B Variable construction

## Outcome variables

All outcome variables were elicited through five-point Likert scales. For the main part of the analysis, Likert-scale variables were dichotomized as 'strong positives', i.e. '4' and '5' (respectively "somewhat agree" and "fully agree") coded towards '1' and all other replies (including 'Don't Know') coded towards '0'. We conduct a sensitivity check exclusively for the subset of clear responses (excluding 'Don't Know' answers) for the key outcome variable.

**Appraisal:** Variable with three ordinal levels. 'Support' corresponds to '4' and '5' on a five-point Likert scale ranging from "strongly oppose" to "strongly support". 'Oppose' includes '1' and '2' on the corresponding Likert scale. 'Neutral' encompasses both the mid-point '3' and 'Don't Know' answers.

**Support:** Binary, coded as '1' if $> 3$ on a five-point Likert scale (1 = "strongly oppose", 5 ="strongly support"), else coded as '0' (including *"Don't Know"*).

**Opposition:** Binary, coded as '1' if $< 3$ on a five-point Likert scale (1 = "strongly oppose", 5 = "strongly support"), else coded as '0' (including *"Don't Know"*).

**Beliefs about policy objectives:** *("Increase in government revenues", "Incentives for consumers towards greener consumption", and "Incentives for businesses to decarbonize production")*: Respondents were asked about how important they felt specific objectives were for their suggested policy instrument. In the main analysis, these values have been coded as binary, taking the value '1' if $> 3$ on a five-point Likert scale (1 = "not at all important", 5 = "very important").

**Perceptions of policy effects:** *("increases costs of living", "increases businesses' production costs", "increases government budget", "equitable burden-sharing", "reduces emissions effectively", "positive effect on innovation", "negative effect on the economy", "easy to evade", and "believes in Pigouvian effect")*: Perceptions were elicited asking respondents whether they agree or disagreed with specific statements about the suggested policy. In the main analysis, these values have been coded as binary, taking the value '1' if $> 3$ on a five-point Likert scale (1 = "strongly disagree", 5 = "strongly agree").

**Incidence between businesses and consumers** : Respondents were provided with a continuous slider (from $0 - 100$) to estimate to which share respectively businesses vs. consumers were affected by the climate policy. *"Businesses most burdened"* [*"Consumers*

*most burdened"*] was coded as "1" if the incidence on businesses [consumers] was indicated as larger than 66% [smaller than 33%].

## Socio-economic variables

**Degree of urbanisation:** We use the EU's degree of urbanisation (DEGURBA) classification to assign postcodes to geographic areas and construct three categories ("rural areas", "suburbs and towns", "cities").

**Income variable:** Respondents were asked to specify their income level on a scale comprising 13 categories. These categories were country-specific, with the fifth category set at the median national equivalised income, the first category capped at 35 percent of that median income, and the remaining categories to linearly cover the rest of the income spectrum. For our analysis, we used income tertiles.

## Political and climate-related attitudes

All attitudinal variables were elicited through five-point or seven-point Likert scales and binarized when used as control variables. For the construction of indices (e.g., worldviews, pro-environmental attitude) we follow Dechezleprêtre et al. (2025) and first transform the component variables of the respective indices into z-scores (i.e., setting the values relative to the mean). We then take the average of all z-scores and standardize that average by dividing it through its standard deviation.

**Political preferences:** For comparability of voting preferences across countries, we assign national political parties in accordance with the group that they choose to caucus with in the European Parliament. Where national parties are not or no longer represented in the EP, the decision of how to assign them was informed by national political context.

**Worldviews:** Z-score of six (partially reverse-coded) question items per worldview spectrum (i.e., "individualist-communitarian" and "hierarchical-egalitarian") based on Kahan et al. (2011), and also used in Cherry et al. (2017).

**Beliefs about climate change** : *"Believes in the existence of climate change"* is a binary measure of agreement with the statement that climate change exists. *"Concerned about climate change"* has been elicited on a seven-point Likert-scale, with responses $> 6$ coded towards concerned. *"Believes in the anthropological origin of climate change"* has been combined out of" Concerned about climate change" ($> 6$) and "Cause of climate change" (at least "partially human driven").

# C Supplementary results

## C.1 Raw data on appraisal

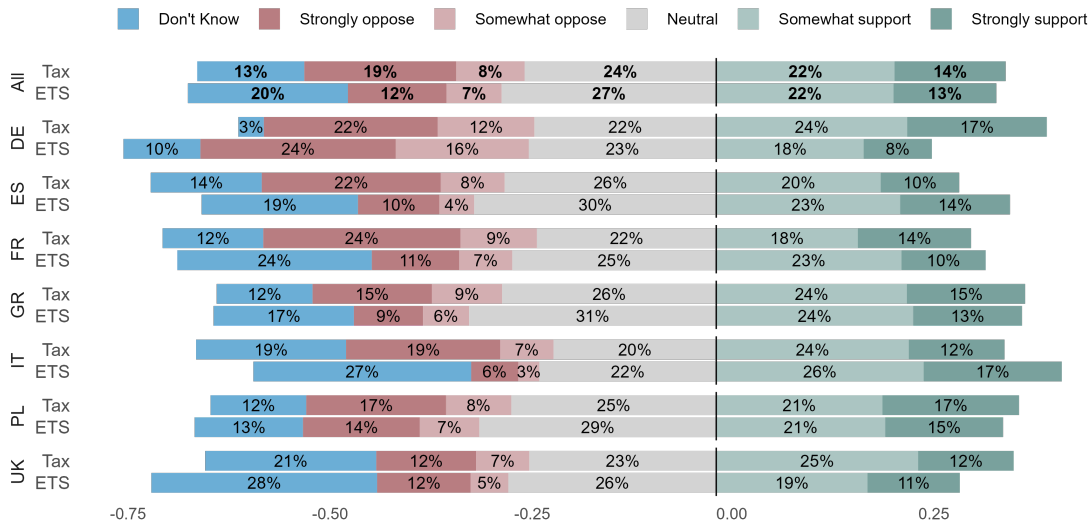



Figure 3: Support for carbon taxes vs. ETS by country (full Likert scale)

## C.2 Country-level AMTEs

Table 8: Average marginal effects by appraisal level and country

| Country | Appraisal level | Control mean | Estimate (SE) |
|---|---|---|---|
| France | Oppose | 0.339 | -0.153 (0.007)*** |
| | Neutral | 0.346 | 0.156 (0.008)*** |
| | Support | 0.315 | -0.003 (0.007) |
| Germany | Oppose | 0.317 | 0.083 (0.008)*** |
| | Neutral | 0.255 | 0.053 (0.007)*** |
| | Support | 0.428 | -0.135 (0.007)*** |
| Greece | Oppose | 0.235 | -0.093 (0.006)*** |
| | Neutral | 0.383 | 0.094 (0.008)*** |
| | Support | 0.382 | -0.001 (0.008) |
| Italy | Oppose | 0.257 | -0.167 (0.006)*** |
| | Neutral | 0.387 | 0.098 (0.008)*** |
| | Support | 0.357 | 0.069 (0.008)*** |
| Poland | Oppose | 0.254 | -0.037 (0.007)*** |
| | Neutral | 0.372 | 0.049 (0.008)*** |
| | Support | 0.375 | -0.012 (0.008) |
| Spain | Oppose | 0.301 | -0.153 (0.007)*** |
| | Neutral | 0.399 | 0.096 (0.008)*** |
| | Support | 0.301 | 0.057 (0.008)*** |
| UK | Oppose | 0.189 | -0.029 (0.006)*** |
| | Neutral | 0.443 | 0.085 (0.008)*** |
| | Support | 0.368 | -0.056 (0.007)*** |

**Note:** This table displays average marginal treatment effects alongside control group means across countries. Coefficients are obtained from a partial proportional odds model, where the outcome "Appraisal" (with levels "Oppose", "Neutral", "Support") has been regressed on the carbon pricing design treatment indicator, country dummies, country x treatment interaction effects, and a vector of socio-economic and attitudinal control variables. Robust standard errors (HC2) are reported in parentheses. Stars denote significance levels based on q-values, adjusted for multiple hypothesis testing using the Benjamini-Hochberg correction. + $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$.

## C.3 Correlates of appraisal

Table 9: Correlates of appraisal by level

| Variable | Oppose | Neutral | Support |
|---|---|---|---|
| Treatment | -0.084 (0.003)*** | 0.093 (0.003)*** | -0.010 (0.003)*** |
| **Socio-demographic variables** | | | |
| 50+ | 0.045 (0.003)*** | -0.010 (0.003)** | -0.036 (0.003)*** |
| Female | 0.044 (0.003)*** | -0.072 (0.003)*** | 0.027 (0.003)*** |
| Rural areas | 0.023 (0.003)*** | 0.003 (0.000)*** | -0.026 (0.003)*** |
| College degree | -0.007 (0.003)* | -0.056 (0.004)*** | 0.063 (0.004)*** |
| Lower income tertile | -0.015 (0.002)*** | -0.003 (0.001)*** | 0.018 (0.003)*** |
| **Political attitudes** | | | |
| Hierarchical worldview | 0.040 (0.002)*** | 0.006 (0.000)*** | -0.046 (0.003)*** |
| Individualistic worldview | -0.015 (0.003)*** | -0.026 (0.003)*** | 0.041 (0.003)*** |
| Trust in government | -0.120 (0.002)*** | -0.045 (0.002)*** | 0.166 (0.004)*** |
| Trust in businesses | -0.045 (0.003)*** | -0.011 (0.001)*** | 0.056 (0.004)*** |
| Trust in citizens | 0.009 (0.003)** | -0.056 (0.003)*** | 0.047 (0.003)*** |
| **Environmental attitudes** | | | |
| Concerned about climate change | -0.114 (0.003)*** | -0.030 (0.003)*** | 0.144 (0.003)*** |
| Climate policies not ambitious enough | 0.001 (0.003) | -0.034 (0.003)*** | 0.033 (0.003)*** |
| Businesses are important for transition | 0.028 (0.004)*** | -0.065 (0.004)*** | 0.037 (0.004)*** |
| Citizens are important for transition | -0.046 (0.003)*** | -0.006 (0.000)*** | 0.053 (0.003)*** |
| Government is important for transition | -0.047 (0.004)*** | -0.032 (0.004)*** | 0.079 (0.004)*** |

**Note:** This table displays coefficients for average marginal effects of all socio-economic and attitudinal co-variates from the partial proportional odds model used to obtain results in Table 2. Robust standard errors (HC2) are reported in parentheses. Stars denote significance levels based on q-values, adjusted for multiple hypothesis testing using the Benjamini–Hochberg correction. + $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$.

## C.4 Heterogenous effects on opposition outcomes

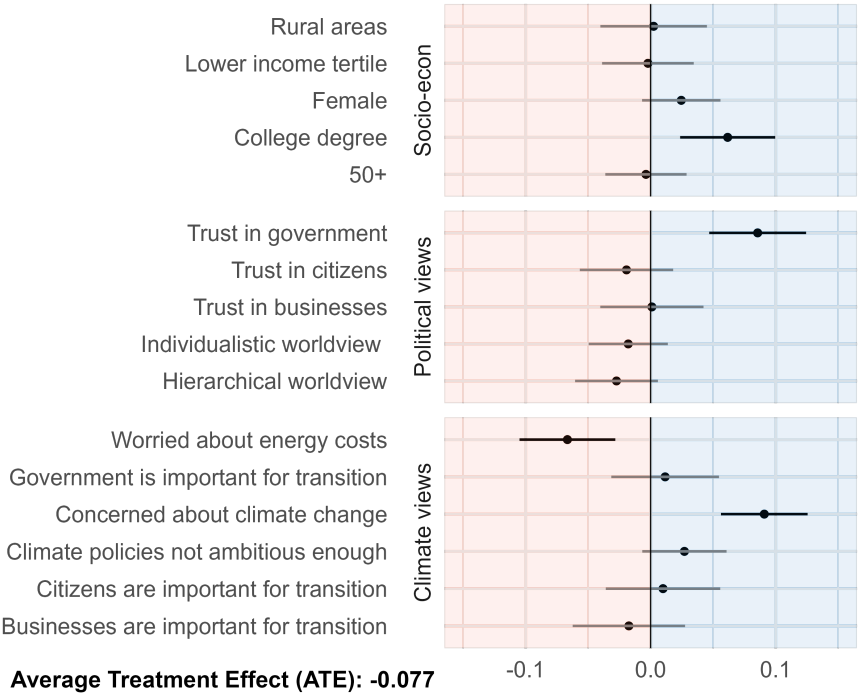



Figure 4: Heterogeneous treatment effects on opposition

**Note:** This plot depicts heterogeneities in treatment affects on opposition across socio-economic co-variates, political views and climate views. Coefficients are obtained from the best linear projections of the random-forest estimated Conditional Average Treatment Effect (CATE), using robust standard errors (HC3) (Chernozhukov et al., 2018). The random-forest based estimation was conducted on the full weighted sample (n=13,665). The random-forest estimated average treatment effect is -0.077(0.008) (i.e., -7.7%pt.). Coefficients in the light-orange shaded area of the plots hint at a marginal aversion against carbon taxation within the respective subsample (relative to the cross-sample ATE of $-0.077$), while coefficients in the light-blue shaded area imply a marginal aversion against emissions trading relative to the baseline ATE. Opposition has been coded as '1' and '2' on the corresponding five-point Likert scale.

## C.5 Analysis of "Don't Know" responses

Given that the emissions trading treatment shifts respondents towards "Neutral" responses, we analyse respondents tendency to select "Don't Know" responses to the appraisal survey item in further detail here. Table 10 summarizes correlates of selecting "Don't Know". Figure 5 summarizes in which socio-economic and attitudinal subgroups are more likely to be shifted to "Don't Know" by the emissions trading treatment. Finally, we test sensitivity of our results on policy perceptions to "Don't Know" responses in the outcome variables (Table 11). The results and magnitudes of effects are largely confirmed.

Table 10: Correlates of "Don't Know" responses

| | (1) | (2) | (3) |
|---|---|---|---|
| Variable | Model 1 | Model 2 | Model 3 |
| (Intercept) | 0.160 (0.011)*** | 0.244 (0.012)*** | 0.418 (0.017)*** |
| Treatment | 0.064 (0.007)*** | 0.065 (0.007)*** | 0.065 (0.007)*** |
| **Country** | | | |
| Germany | -0.063 (0.012)*** | -0.082 (0.012)*** | -0.093 (0.012)*** |
| France | 0.041 (0.013)** | 0.033 (0.013)* | 0.025 (0.013)+ |
| Italy | 0.081 (0.014)*** | 0.070 (0.014)*** | 0.062 (0.014)*** |
| Spain | 0.018 (0.013) | 0.014 (0.013) | 0.023 (0.013)+ |
| Poland | -0.018 (0.012) | -0.015 (0.012) | -0.033 (0.012)** |
| UK | 0.107 (0.014)*** | 0.112 (0.014)*** | 0.099 (0.014)*** |
| **Socio-demographic variables** | | | |
| 50+ | 0.007 (0.007) | 0.004 (0.007) | 0.016 (0.007)* |
| Female | -0.078 (0.007)*** | -0.061 (0.007)*** | -0.065 (0.007)*** |
| Rural areas | -0.012 (0.009) | -0.011 (0.009) | -0.010 (0.009) |
| College degree | -0.074 (0.008)*** | -0.067 (0.008)*** | -0.058 (0.008)*** |
| Lower income tertile | 0.022 (0.009)* | 0.021 (0.008)* | 0.014 (0.008)+ |
| **Political attitudes** | | | |
| Individualistic worldview | | -0.060 (0.007)*** | -0.063 (0.007)*** |
| Hierarchical worldview | | -0.077 (0.007)*** | -0.108 (0.008)*** |
| Trust in government | | -0.038 (0.008)*** | -0.039 (0.008)*** |
| Trust in businesses | | -0.028 (0.009)*** | -0.031 (0.009)*** |
| Trust in citizens | | -0.047 (0.008)*** | -0.035 (0.008)*** |
| **Environmental attitudes** | | | |
| Concerned about climate change | | | -0.024 (0.008)** |
| Worried about energy costs | | | -0.084 (0.009)*** |
| Government is important for transition | | | -0.033 (0.009)*** |
| Businesses are important for transition | | | -0.019 (0.009)* |
| Citizens are important for transition | | | -0.021 (0.009)* |
| Climate policies not ambitious enough | | | -0.051 (0.008)*** |
| Num.Obs. | 13665 | 13665 | 13665 |
| R2 | 0.049 | 0.082 | 0.110 |

**Note:** This table displays coefficients from three OLS models, where a outcome dummy for "Don't Know" responses in the appraisal variable has been regressed on the treatment indicator, country dummies, and a vector of socio-economic and attitudinal covariates. Robust standard errors (HC2) are reported in parentheses. Stars denote significance levels based on q-values, adjusted for multiple hypothesis testing using the Benjamini–Hochberg correction. + $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$.

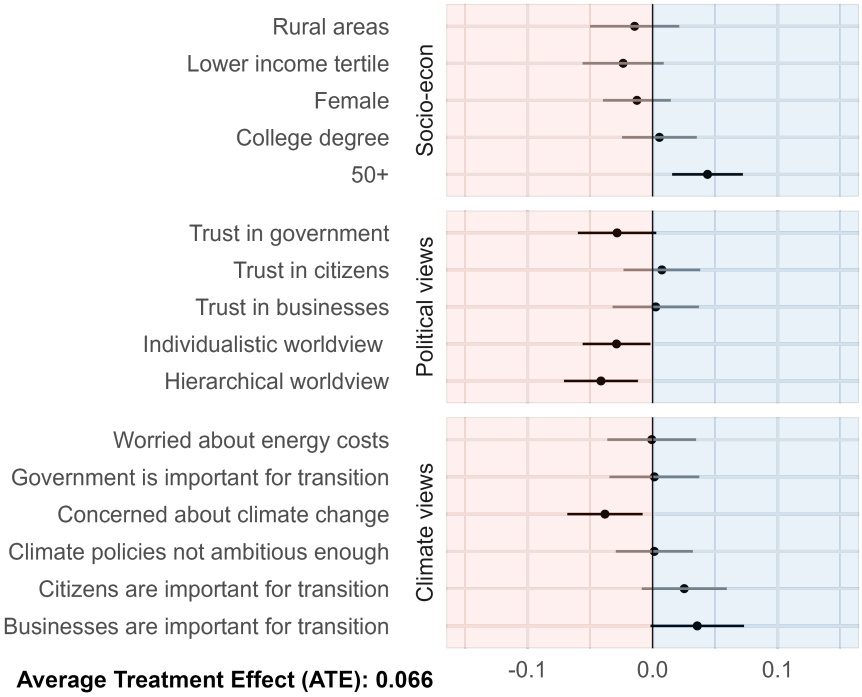



Figure 5: Heterogeneous treatment effects on "Don't Know" responses

**Note:** This plot depicts heterogeneities in how the treatment affects "Don't Know" responses across socio-economic co-variates, political views and climate views. Coefficients are obtained from the best linear projections of the random-forest estimated Conditional Average Treatment Effect (CATE), using robust standard errors (HC3) (Chernozhukov et al., 2018). The random-forest based estimation was conducted on the full weighted sample (n=13,665). The random-forest estimated average treatment effect is 0.065 (i.e., 6.5%pt.). Coefficients in the light-orange shaded area of the plots hint at a marginally higher likelihood to select "Don't Know" when confronted with the carbon taxation design (relative to the cross-sample ATE of 0.065), while coefficients in the light-blue shaded area imply a marginally higher likelihood to select "Don't Know" under the emissions trading design, relative to the baseline ATE.

Table 11: Treatment effect on the perception of policy properties (excluding "Don't Know" responses)

| Support & policy perceptions | Mean (Tax) | Treatment effect (ETS) | N |
|---|---|---|---|
| **Support** | | | |
| Support | 0.42 | 0.013 (0.009) | 11703 |
| Opposition | 0.31 | -0.073*** (0.008) | 11703 |
| **Policy objectives** | | | |
| Increase in government revenues | 0.54 | 0.005 (0.009) | 11913 |
| Incentives consumer change | 0.57 | 0.022* (0.009) | 12063 |
| Incentives change in production | 0.65 | 0.015 (0.008) | 12080 |
| **Policy properties: cost implication** | | | |
| Increases costs of living | 0.66 | -0.08*** (0.009) | 11741 |
| Increases production costs | 0.62 | -0.044*** (0.009) | 11666 |
| Increases government budget | 0.60 | -0.089*** (0.009) | 11330 |
| **Policy properties: distributional burden** | | | |
| Equitable burden-sharing | 0.30 | 0.035*** (0.008) | 11412 |
| Consumers most burdened | 0.22 | 0.001 (0.007) | 12825 |
| Businesses most burdened | 0.62 | -0.006 (0.008) | 12825 |
| **Policy properties: effects** | | | |
| Reduces emissions effectively | 0.38 | 0.022* (0.009) | 11612 |
| Positive effect on innovation | 0.42 | 0.038*** (0.009) | 11558 |
| Negative effect on the economy | 0.44 | -0.064*** (0.009) | 11393 |
| Easy to evade | 0.34 | 0.099*** (0.009) | 10615 |
| Believes in Pigouvian effect | 0.41 | -0.001 (0.009) | 10679 |

**Note:** This table shows the treatment coefficient for separate OLS regressions of policy property perceptions and other outcome variables, restricted to a dataset, where all 'Don't Know' answers to outcome questions were excluded (i.e., they have not been coded towards the '0' of the respective binary indicator). Treatment effect denotes the effect from being assigned in the "Emissions Trading" treatment group, relative to the predicted control-group mean in the "Carbon Tax" group. Controls include socio-economic variables, political attitudes and climate-change related attitudes. Robust standard errors (HC2) are shown in parentheses. Stars are based on q-values, adjusted for multiple hypothesis testing with the Benjamini-Hochberg correction. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

## C.6 Familiarity with the EU-ETS

Table 12: Prior familiarity with the European Union Emissions Trading System

| | **Familiar** | | **Not Familiar** | | **Don't Know** | |
|---|---|---|---|---|---|---|
| Country | Tax Group | ETS Group | Tax Group | ETS Group | Tax Group | ETS Group |
| France | 0.19 | 0.22 | 0.23 | 0.17 | 0.58 | 0.60 |
| Germany | 0.59 | 0.52 | 0.01 | 0.01 | 0.29 | 0.33 |
| Greece | 0.25 | 0.27 | 0.18 | 0.14 | 0.57 | 0.59 |
| Italy | 0.19 | 0.20 | 0.22 | 0.19 | 0.59 | 0.61 |
| Poland | 0.46 | 0.44 | 0.18 | 0.15 | 0.36 | 0.40 |
| Spain | 0.22 | 0.24 | 0.19 | 0.14 | 0.59 | 0.62 |
| UK | 0.23 | 0.22 | 0.18 | 0.18 | 0.59 | 0.60 |

**Note:** This table summarizes the share of respondents stating they have heard about the EU-ETS before (*'familiar'*), stating they have not heard about the EU-ETS before (*'not familiar'*), or stating they do not know (compare Questionnaire item C11). In order not to prime respondents to think of the EU-ETS when judging policy properties, the above results were elicited at a post-treatment stage after the key outcome variables.

## C.7 Transition-related beliefs

Designing carbon pricing as a 'carbon tax' or an 'emissions trading system' may evoke different beliefs about who and what the policy is targeting. We therefore elicited respondents' beliefs about how important they generally deemed different actors – citizens, businesses and the government – for achieving decarbonization goals (elicited prior to treatment), and which of these three actors they think the respective carbon pricing policy targets (elicited post treatment).

First, at a purely descriptive level (see Table 1), we cannot identify a dominating narrative as to whether one specific actor is generally deemed most important to bring about a full decarbonization of the economy. An equally broad majority of the sampled respondents, approximately 70%, support the statements that governments, citizens and businesses are important to achieve decarbonization. Moreover, respondents on average do not see large differences between carbon taxes and emissions trading as to which actor they target. There is moderate agreement with all three stated objectives of carbon pricing[10], with "incentivize change in production" somewhat dominating the other perceived objectives by a small margin (see Table 3). This provides some evidence against the notion that citizens see carbon pricing predominantly as a tool to raise government

[10]The stated objectives were (1) "increase government revenue for climate-friendly spending", (2) "incentivize consumer change", and (3) "incentivize changes in production".

revenues. Notably, the policy design treatment did not produce significant differences as to the perceived objective, except for Italy, where designing the policy as an emissions trading system increases the belief that the policy's objectives is "incentivizing changes in production" and "incentivizing consumer change" by 7%pt. and 5%pt. respectively (see Appendix D.2).

Second, we examined heterogenous treatment effects with respect to beliefs about 'transition roles' to test the hypothesis that carbon taxes are more popular with citizens who believe that governmental efforts and consumer-driven change play a primary role for decarbonising society. Meanwhile, we expected emissions trading to be more popular among respondents adhering to the idea that decarbonisation relies primarily on the action of companies. Indeed, we see that the policy design treatment has moderately differential effects with respect to whether respondents see an important role for governments, businesses or consumers. Among respondents who deem governmental action as important for the net-zero transition, the tax design marginally increases support by an additional 3%pt. in the cross-European sample (see Figure 2). In cross-country comparison this effect is present in Germany, France, Poland and the UK (see Appendix D.3). Heterogenous effects with regard to beliefs about the role of consumers and businesses do not follow a generalizable pattern across countries.

# D Country-specific results

## D.1 Summary statistics by country

## Table 13: Summary Statistics

| | Germany | | | France | | | Greece | | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) |
| **Socio-demographic variables** | | | | | | | | | |
| 50+ | 0.412 | 0.462 | 0.048 | 0.418 | 0.385 | 0.188 | 0.389 | 0.420 | 0.216 |
| Female | 0.496 | 0.504 | 0.780 | 0.477 | 0.524 | 0.067 | 0.520 | 0.514 | 0.809 |
| Rural areas | 0.195 | 0.203 | 0.685 | 0.379 | 0.344 | 0.151 | 0.158 | 0.159 | 0.948 |
| College degree | 0.337 | 0.332 | 0.828 | 0.218 | 0.218 | 0.985 | 0.161 | 0.154 | 0.723 |
| Lower income tertile | 0.443 | 0.388 | 0.052 | 0.291 | 0.292 | 0.944 | 0.248 | 0.234 | 0.545 |
| **Political attitudes** | | | | | | | | | |
| Trust in government | 0.269 | 0.292 | 0.384 | 0.150 | 0.207 | 0.004 | 0.221 | 0.219 | 0.909 |
| Trust in businesses | 0.089 | 0.094 | 0.710 | 0.209 | 0.211 | 0.914 | 0.203 | 0.192 | 0.583 |
| Trust in citizens | 0.196 | 0.204 | 0.712 | 0.318 | 0.411 | 0.000 | 0.379 | 0.348 | 0.208 |
| Individualistic worldview | 0.456 | 0.448 | 0.764 | 0.398 | 0.431 | 0.188 | 0.368 | 0.373 | 0.825 |
| Hierarchical worldview | 0.337 | 0.327 | 0.681 | 0.399 | 0.386 | 0.590 | 0.528 | 0.504 | 0.339 |
| Green voting preference | 0.351 | 0.306 | 0.085 | 0.065 | 0.059 | 0.645 | 0.000 | 0.000 | 0.317 |
| Left voting preference | 0.158 | 0.180 | 0.229 | 0.123 | 0.158 | 0.047 | 0.256 | 0.253 | 0.893 |
| Liberal voting preference | 0.056 | 0.049 | 0.579 | 0.061 | 0.067 | 0.632 | 0.000 | 0.000 | 0.317 |
| Conservative voting preference | 0.150 | 0.163 | 0.451 | 0.036 | 0.033 | 0.760 | 0.312 | 0.291 | 0.376 |
| Extreme-right voting preference | 0.061 | 0.065 | 0.781 | 0.248 | 0.224 | 0.270 | 0.057 | 0.079 | 0.082 |
| **Environmental attitudes** | | | | | | | | | |
| Concerned about climate change | 0.530 | 0.514 | 0.549 | 0.518 | 0.508 | 0.719 | 0.585 | 0.588 | 0.902 |
| Worried about energy costs | 0.682 | 0.706 | 0.363 | 0.826 | 0.824 | 0.896 | 0.814 | 0.788 | 0.191 |
| Familiar with EU ETS | 0.591 | 0.517 | 0.008 | 0.424 | 0.395 | 0.246 | 0.433 | 0.412 | 0.394 |
| Climate policies not ambitious enough | 0.661 | 0.637 | 0.312 | 0.576 | 0.597 | 0.395 | 0.563 | 0.556 | 0.786 |
| Government is important for transition | 0.669 | 0.700 | 0.217 | 0.588 | 0.632 | 0.074 | 0.730 | 0.737 | 0.752 |
| Businesses are important for transition | 0.831 | 0.848 | 0.392 | 0.694 | 0.707 | 0.587 | 0.723 | 0.731 | 0.750 |
| Citizens are important for transition | 0.681 | 0.692 | 0.686 | 0.647 | 0.695 | 0.045 | 0.727 | 0.723 | 0.845 |
| **Support factors** | | | | | | | | | |
| Has to reduce emissions effectively | 0.219 | 0.226 | 0.767 | 0.473 | 0.479 | 0.833 | 0.428 | 0.433 | 0.861 |
| Has to keep personal costs low | 0.263 | 0.245 | 0.440 | 0.457 | 0.481 | 0.329 | 0.416 | 0.395 | 0.397 |
| Has to share the financial burden fairly | 0.590 | 0.568 | 0.415 | 0.536 | 0.517 | 0.471 | 0.448 | 0.453 | 0.832 |
| Has positive co-benefits | 0.268 | 0.250 | 0.439 | 0.505 | 0.470 | 0.171 | 0.430 | 0.421 | 0.736 |

Table 14: Summary Statistics

| | Italy | | | Poland | | |
|---|---|---|---|---|---|---|
| Variables | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) |
| **Socio-demographic variables** | | | | | | |
| 50+ | 0.432 | 0.415 | 0.499 | 0.354 | 0.380 | 0.290 |
| Female | 0.497 | 0.482 | 0.544 | 0.489 | 0.490 | 0.963 |
| Rural areas | 0.101 | 0.102 | 0.948 | 0.272 | 0.290 | 0.418 |
| College degree | 0.179 | 0.187 | 0.701 | 0.179 | 0.196 | 0.413 |
| Lower income tertile | 0.217 | 0.231 | 0.527 | 0.224 | 0.227 | 0.864 |
| **Political attitudes** | | | | | | |
| Trust in government | 0.193 | 0.212 | 0.355 | 0.189 | 0.176 | 0.528 |
| Trust in businesses | 0.212 | 0.223 | 0.603 | 0.250 | 0.254 | 0.859 |
| Trust in citizens | 0.305 | 0.304 | 0.971 | 0.317 | 0.315 | 0.936 |
| Individualistic worldview | 0.395 | 0.416 | 0.401 | 0.347 | 0.373 | 0.290 |
| Hierarchical worldview | 0.371 | 0.394 | 0.360 | 0.601 | 0.580 | 0.398 |
| Green voting preference | 0.020 | 0.028 | 0.264 | 0.000 | 0.000 | 0.317 |
| Left voting preference | 0.093 | 0.089 | 0.784 | 0.068 | 0.051 | 0.176 |
| Liberal voting preference | 0.029 | 0.035 | 0.503 | 0.075 | 0.088 | 0.368 |
| Conservative voting preference | 0.045 | 0.035 | 0.329 | 0.244 | 0.233 | 0.586 |
| Extreme-right voting preference | 0.261 | 0.259 | 0.948 | 0.289 | 0.292 | 0.896 |
| **Environmental attitudes** | | | | | | |
| Concerned about climate change | 0.650 | 0.662 | 0.624 | 0.514 | 0.536 | 0.379 |
| Worried about energy costs | 0.784 | 0.784 | 0.980 | 0.740 | 0.735 | 0.812 |
| Familiar with EU ETS | 0.408 | 0.391 | 0.505 | 0.641 | 0.597 | 0.073 |
| Climate policies not ambitious enough | 0.550 | 0.521 | 0.251 | 0.460 | 0.480 | 0.450 |
| Government is important for transition | 0.670 | 0.646 | 0.335 | 0.550 | 0.564 | 0.591 |
| Businesses are important for transition | 0.700 | 0.706 | 0.799 | 0.594 | 0.616 | 0.379 |
| Citizens are important for transition | 0.692 | 0.690 | 0.943 | 0.648 | 0.633 | 0.562 |
| **Support factors** | | | | | | |
| Has to reduce emissions effectively | 0.403 | 0.415 | 0.637 | 0.527 | 0.505 | 0.388 |
| Has to keep personal costs low | 0.416 | 0.443 | 0.282 | 0.466 | 0.491 | 0.310 |
| Has to share the financial burden fairly | 0.474 | 0.492 | 0.468 | 0.551 | 0.541 | 0.695 |
| Has positive co-benefits | 0.428 | 0.431 | 0.883 | 0.518 | 0.503 | 0.577 |

Table 15: Summary Statistics

| | Spain | | | UK | | |
|---|---|---|---|---|---|---|
| Variables | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) | Mean (Tax) | Mean (ETS) | p-value (Wilcoxon) |
| **Socio-demographic variables** | | | | | | |
| 50+ | 0.432 | 0.415 | 0.499 | 0.354 | 0.380 | 0.290 |
| Female | 0.497 | 0.482 | 0.544 | 0.489 | 0.490 | 0.963 |
| Rural areas | 0.101 | 0.102 | 0.948 | 0.272 | 0.290 | 0.418 |
| College degree | 0.179 | 0.187 | 0.701 | 0.179 | 0.196 | 0.413 |
| Lower income tertile | 0.217 | 0.231 | 0.527 | 0.224 | 0.227 | 0.864 |
| **Political attitudes** | | | | | | |
| Trust in government | 0.193 | 0.212 | 0.355 | 0.189 | 0.176 | 0.528 |
| Trust in businesses | 0.212 | 0.223 | 0.603 | 0.250 | 0.254 | 0.859 |
| Trust in citizens | 0.305 | 0.304 | 0.971 | 0.317 | 0.315 | 0.936 |
| Individualistic worldview | 0.395 | 0.416 | 0.401 | 0.347 | 0.373 | 0.290 |
| Hierarchical worldview | 0.371 | 0.394 | 0.360 | 0.601 | 0.580 | 0.398 |
| Green voting preference | 0.020 | 0.028 | 0.264 | 0.000 | 0.000 | 0.317 |
| Left voting preference | 0.093 | 0.089 | 0.784 | 0.068 | 0.051 | 0.176 |
| Liberal voting preference | 0.029 | 0.035 | 0.503 | 0.075 | 0.088 | 0.368 |
| Conservative voting preference | 0.045 | 0.035 | 0.329 | 0.244 | 0.233 | 0.586 |
| Extreme-right voting preference | 0.261 | 0.259 | 0.948 | 0.289 | 0.292 | 0.896 |
| **Environmental attitudes** | | | | | | |
| Concerned about climate change | 0.650 | 0.662 | 0.624 | 0.514 | 0.536 | 0.379 |
| Worried about energy costs | 0.784 | 0.784 | 0.980 | 0.740 | 0.735 | 0.812 |
| Familiar with EU ETS | 0.408 | 0.391 | 0.505 | 0.641 | 0.597 | 0.073 |
| Climate policies not ambitious enough | 0.550 | 0.521 | 0.251 | 0.460 | 0.480 | 0.450 |
| Government is important for transition | 0.670 | 0.646 | 0.335 | 0.550 | 0.564 | 0.591 |
| Businesses are important for transition | 0.700 | 0.706 | 0.799 | 0.594 | 0.616 | 0.379 |
| Citizens are important for transition | 0.692 | 0.690 | 0.943 | 0.648 | 0.633 | 0.562 |
| **Support factors** | | | | | | |
| Has to reduce emissions effectively | 0.403 | 0.415 | 0.637 | 0.527 | 0.505 | 0.388 |
| Has to keep personal costs low | 0.416 | 0.443 | 0.282 | 0.466 | 0.491 | 0.310 |
| Has to share the financial burden fairly | 0.474 | 0.492 | 0.468 | 0.551 | 0.541 | 0.695 |
| Has positive co-benefits | 0.428 | 0.431 | 0.883 | 0.518 | 0.503 | 0.577 |

## D.2 Average treatment effects by country

Tables 16-19 depict country-specific results on the treatment coefficients of nine separate OLS regressions (per country) of policy property perceptions. Treatment effect denotes the difference between being assigned in the "Emissions Trading" group, relative to the "Carbon Tax" group. Due to the linear model interpretation, treatment effects can be interpreted as a %pt. change relative to the model-predicted mean in the carbon tax group. Controls include socio-economic variables, political attitudes and climate-change related attitudes. Robust standard errors are shown in parentheses. Stars are based on q-values, adjusted for multiple hypothesis testing with the Benjamini-Hochberg correction (at the country level). + $q < 0.10$, * $q < 0.05$, ** $q < 0.01$, *** $q < 0.001$.

Table 16: Treatment effect on the perception of policy properties (Germany)

| Dependent variable | Estim. mean (Tax) | Treatment effect (ETS) |
|---|---|---|
| **Policy objectives** | | |
| Increase in government revenues | 0.47 | -0.035 (0.024) |
| Incentives consumer change | 0.53 | -0.035 (0.024) |
| Incentives change in production | 0.66 | -0.017 (0.021) |
| **Policy properties: cost implication** | | |
| Increases costs of living | 0.62 | -0.101***(0.026) |
| Increases production costs | 0.58 | -0.062*(0.025) |
| Increases government budget | 0.51 | -0.178***(0.025) |
| **Policy properties: effects** | | |
| Equitable burden-sharing | 0.09 | -0.011 (0.016) |
| Reduces emissions effectively | 0.25 | -0.080***(0.021) |
| Positive effect on innovation | 0.41 | -0.073**(0.025) |
| Negative effect on the economy | 0.30 | -0.076***(0.019) |
| Easy to evade | 0.28 | 0.176***(0.024) |
| Believes in Pigouvian effect | 0.34 | -0.025 (0.025) |

Table 17: Treatment effect on the perception of policy properties (France and Greece)

| | France | | Greece | |
|---|---|---|---|---|
| Dependent variable | Estim. mean (Tax) | Treatment effect (ETS) | Estim. mean (Tax) | Treatment effect (ETS) |
| **Policy objectives** | | | | |
| Increase in government revenues | 0.43 | -0.034 (0.024) | 0.52 | 0.011 (0.024) |
| Incentives consumer change | 0.50 | -0.001 (0.023) | 0.54 | 0.024 (0.023) |
| Incentives change in production | 0.63 | -0.003 (0.021) | 0.58 | 0.020 (0.023) |
| **Policy properties: cost implication** | | | | |
| Increases costs of living | 0.60 | -0.199***(0.024) | 0.53 | -0.052 (0.025) |
| Increases production costs | 0.57 | -0.145***(0.025) | 0.51 | -0.016 (0.025) |
| Increases government budget | 0.54 | -0.183***(0.024) | 0.45 | -0.045 (0.025) |
| **Policy properties: effects** | | | | |
| Equitable burden-sharing | 0.21 | 0.038 (0.020) | 0.32 | -0.017 (0.023) |
| Reduces emissions effectively | 0.31 | 0.004 (0.022) | 0.35 | -0.022 (0.023) |
| Positive effect on innovation | 0.31 | 0.008 (0.023) | 0.35 | 0.018 (0.023) |
| Negative effect on the economy | 0.42 | -0.112***(0.024) | 0.32 | -0.009 (0.023) |
| Easy to evade | 0.26 | 0.061*(0.023) | 0.30 | -0.026 (0.023) |
| Believes in Pigouvian effect | 0.33 | -0.061*(0.023) | 0.26 | 0.003 (0.022) |

Table 18: Treatment effect on the perception of policy properties (Italy and Poland)

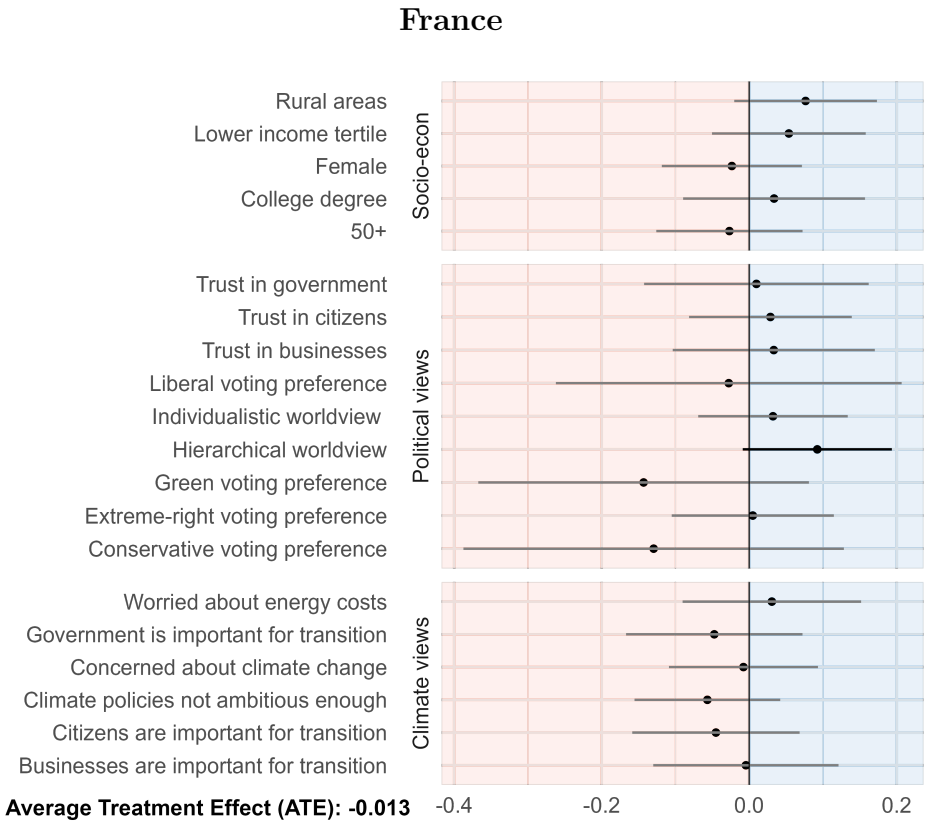
| | Italy | | Poland | |
|---|---|---|---|---|
| Dependent variable | Estim. mean (Tax) | Treatment effect (ETS) | Estim. mean (Tax) | Treatment effect (ETS) |
| **Policy objectives** | | | | |
| Increase in government revenues | 0.44 | 0.031 (0.023) | 0.45 | 0.024 (0.023) |
| Incentives consumer change | 0.49 | 0.054*(0.023) | 0.48 | -0.026 (0.023) |
| Incentives change in production | 0.51 | 0.074**(0.023) | 0.50 | -0.019 (0.023) |
| **Policy properties: cost implication** | | | | |
| Increases costs of living | 0.59 | -0.130***(0.025) | 0.56 | -0.031 (0.024) |
| Increases production costs | 0.55 | -0.094***(0.025) | 0.55 | -0.021 (0.024) |
| Increases government budget | 0.50 | -0.090***(0.024) | 0.54 | -0.111***(0.024) |
| **Policy properties: effects** | | | | |
| Equitable burden-sharing | 0.34 | 0.013 (0.023) | 0.25 | 0.050$^{+}$(0.022) |
| Reduces emissions effectively | 0.40 | -0.010 (0.023) | 0.30 | 0.043 (0.023) |
| Positive effect on innovation | 0.42 | 0.032 (0.023) | 0.36 | 0.001 (0.023) |
| Negative effect on the economy | 0.42 | -0.113***(0.024) | 0.33 | -0.007 (0.023) |
| Easy to evade | 0.32 | 0.059*(0.024) | 0.26 | 0.095***(0.023) |
| Believes in Pigouvian effect | 0.39 | 0.057*(0.024) | 0.34 | -0.023 (0.023) |

Table 19: Treatment effect on the perception of policy properties (UK and Spain)

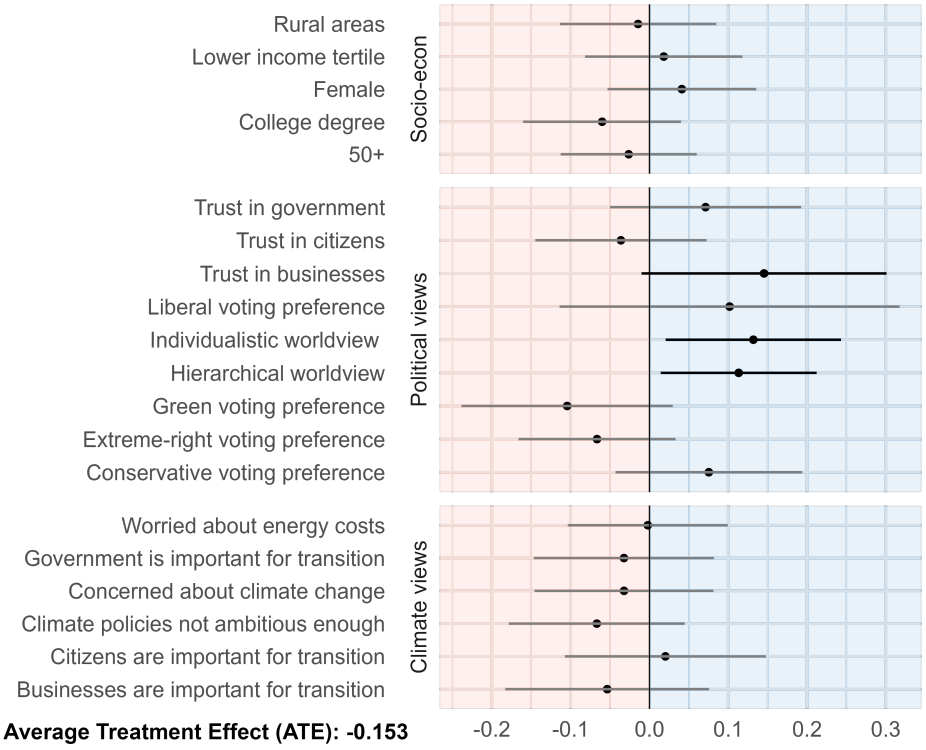
| | UK | | Spain | |
|---|---|---|---|---|
| Dependent variable | Estim. mean (Tax) | Treatment effect (ETS) | Estim. mean (Tax) | Treatment effect (ETS) |
| **Policy objectives** | | | | |
| Increase in government revenues | 0.49 | -0.045 (0.023) | 0.48 | 0.021 (0.024) |
| Incentives consumer change | 0.48 | 0.030 (0.023) | 0.47 | $0.050^{+}$(0.024) |
| Incentives change in production | 0.55 | -0.021 (0.022) | 0.54 | 0.028 (0.023) |
| **Policy properties: cost implication** | | | | |
| Increases costs of living | 0.50 | $-0.090^{**}$(0.024) | 0.59 | $-0.094^{***}$(0.025) |
| Increases production costs | 0.46 | $-0.070^{*}$(0.024) | 0.53 | -0.043 (0.025) |
| Increases government budget | 0.45 | $-0.058^{+}$(0.024) | 0.57 | $-0.101^{***}$(0.024) |
| **Policy properties: effects** | | | | |
| Equitable burden-sharing | 0.29 | -0.005 (0.022) | 0.25 | $0.074^{**}$(0.022) |
| Reduces emissions effectively | 0.32 | 0.006 (0.022) | 0.33 | $0.059^{*}$(0.023) |
| Positive effect on innovation | 0.32 | 0.037 (0.022) | 0.32 | $0.111^{***}$(0.023) |
| Negative effect on the economy | 0.33 | $-0.051^{+}$(0.023) | 0.47 | $-0.145^{***}$(0.024) |
| Easy to evade | 0.21 | $0.044^{+}$(0.020) | 0.20 | $0.088^{***}$(0.021) |
| Believes in Pigouvian effect | 0.27 | -0.003 (0.021) | 0.28 | 0.014 (0.022) |

## D.3 Heterogenous treatment effects by country

The following plots show country specific results for the heterogenous treatment effects on support (see Section 4). Coefficients are obtained from the best linear projections of the random-forest estimated Conditional Average Treatment Effect (CATE), using robust standard errors (HC3) (Chernozhukov et al., 2018). The random-forest based estimation was conducted on the full weighted country samples (covering 4,459 observations in Germany, and 1,500 observations in all other sampled countries). Coefficients in the light-orange shaded area of the plots hint at a marginal increase in support for carbon taxes, preference for carbon taxation within the respective subsample (relative to the cross-sample ATE of $-0.016$), while coefficients in the light-blue shaded area imply a marginal increase in support for emissions trading relative to the baseline ATE. Support has been coded as '1' for values '4' and '5' on the corresponding five-point Likert scale. Note that the here depicted marginal effects need to be interpreted in the context of country-specific average treatment effects (see Table 8).

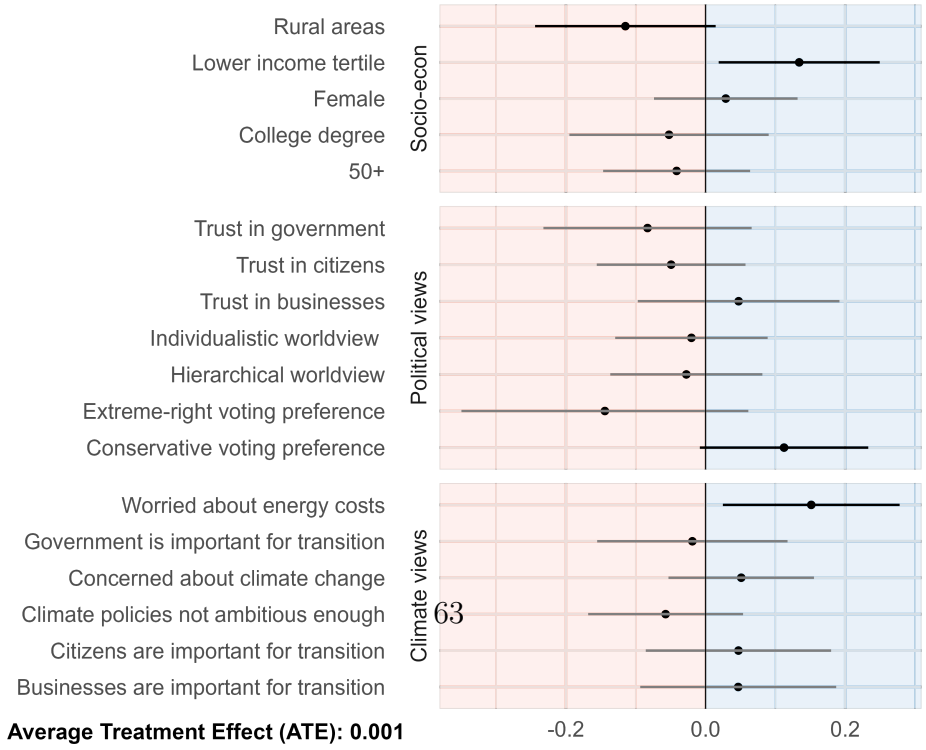


## Germany



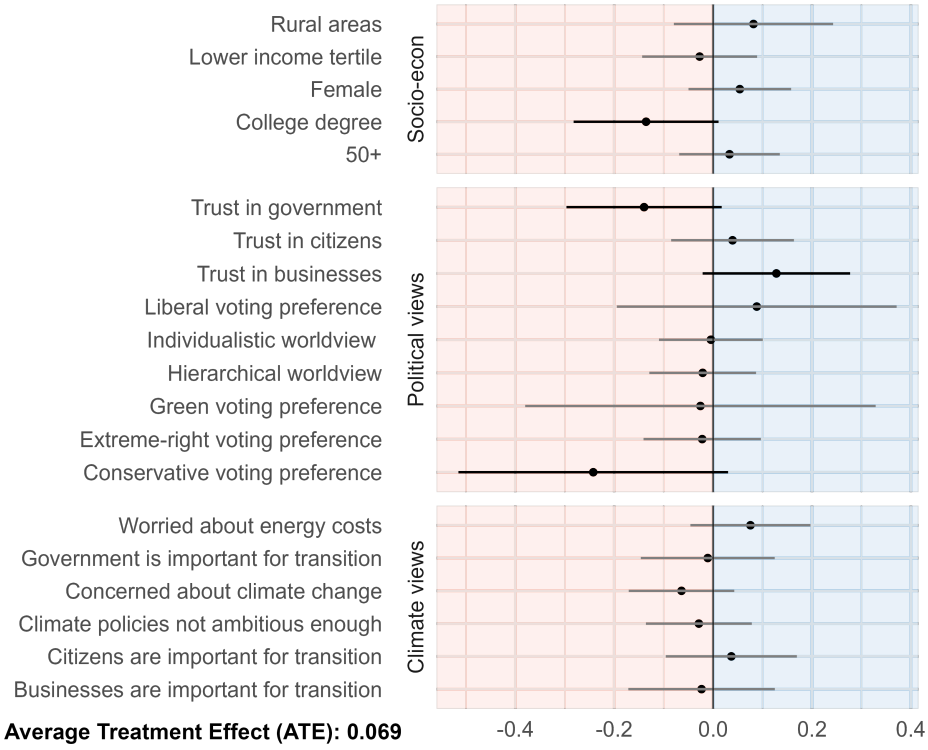

**Average Treatment Effect (ATE): -0.153**

## Greece



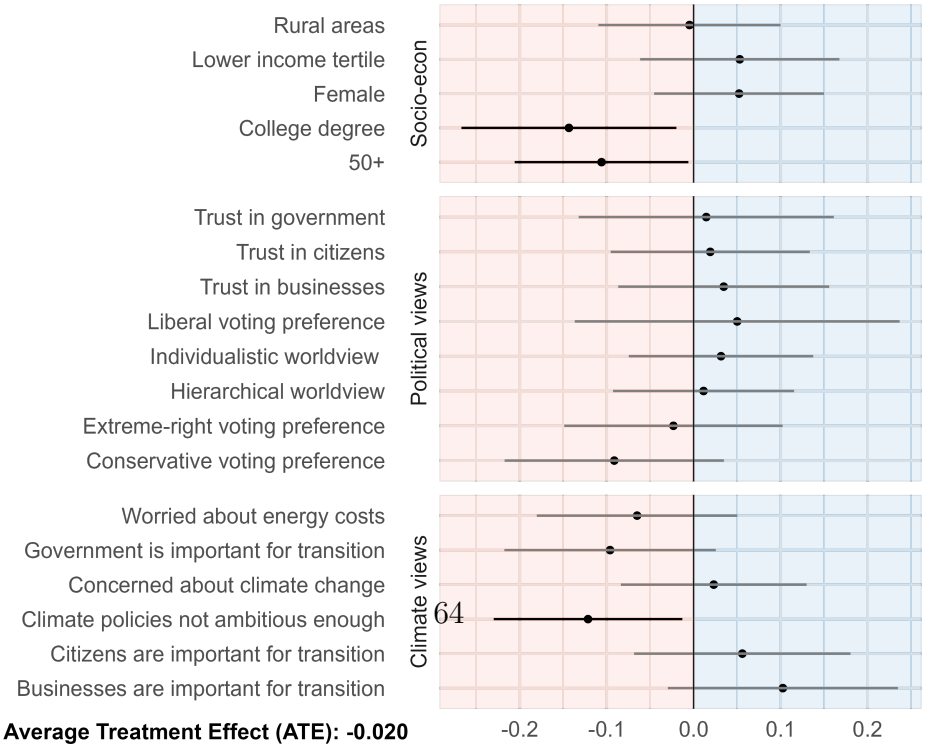

**Average Treatment Effect (ATE): 0.001**

## Italy



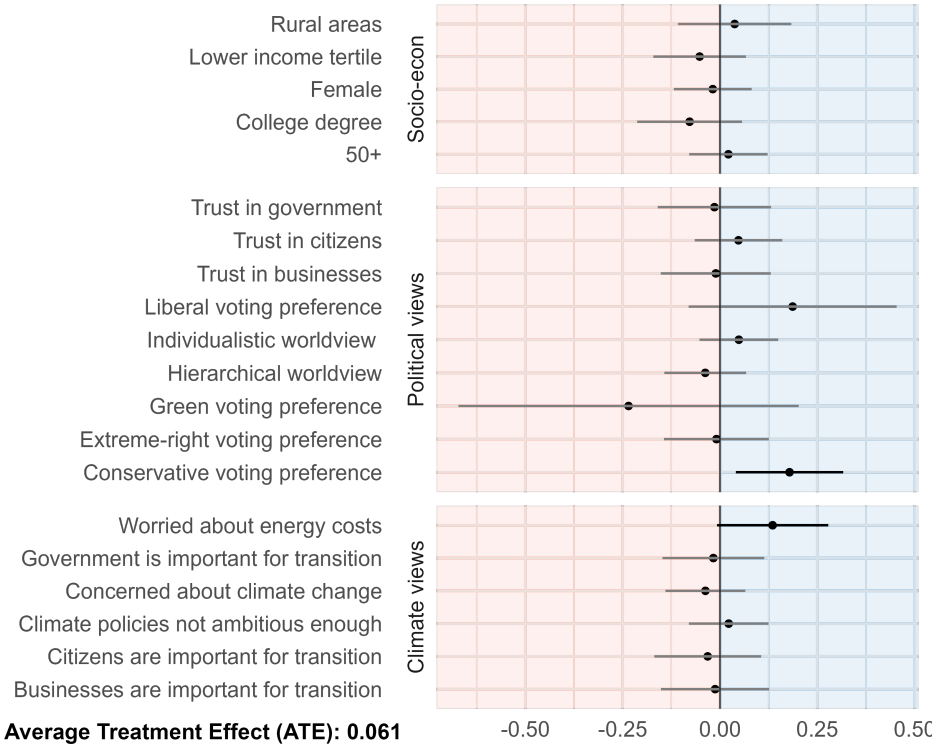

**Average Treatment Effect (ATE): 0.069**

## Poland



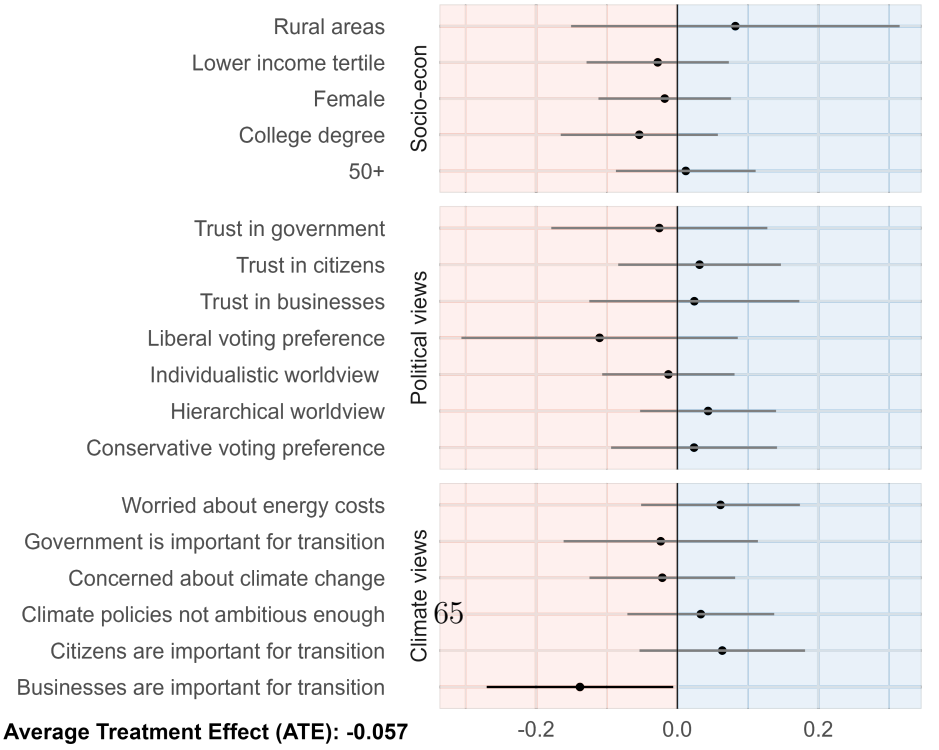

**Average Treatment Effect (ATE): -0.020**

## Spain




**Average Treatment Effect (ATE): 0.061**

## UK

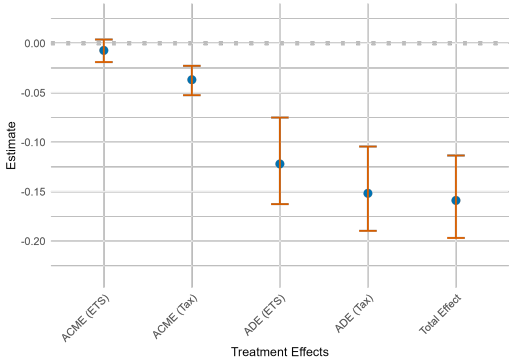



**Average Treatment Effect (ATE): -0.057**

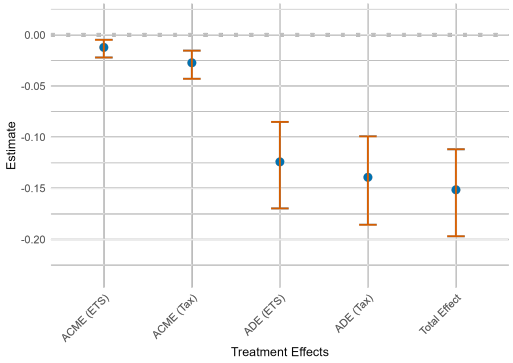
## D.4 Mediation analysis by country

The following plots summarise the country-specific results of the mediation analysis (see section 6). Each plot depicts average total, average direct (ADE) and average causal mediation effects (ACME) for a specific policy perception (mediator) and opposition outcomes. Both opposition and policy perceptions have been coded as binary variables from the corresponding five-point Likert scale. The underlying mediation models account for and display differences between the ACME and ADE under different treatment state (i.e., 'Tax' or 'ETS'). For example, in France, the perception of lower costs reduces opposition more strongly under the carbon tax design compared to the ETS design. The total effect is equal to the sum of the ACME and ADE under opposite treatment states.

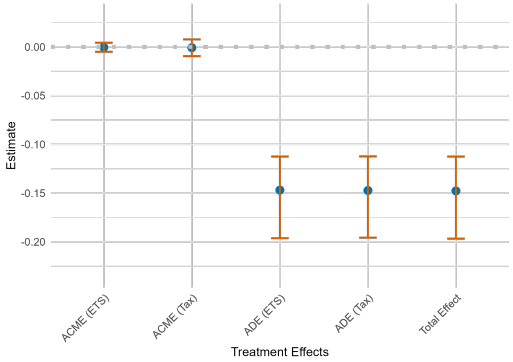
Figure 6: Mediation analysis on opposition outcomes: France



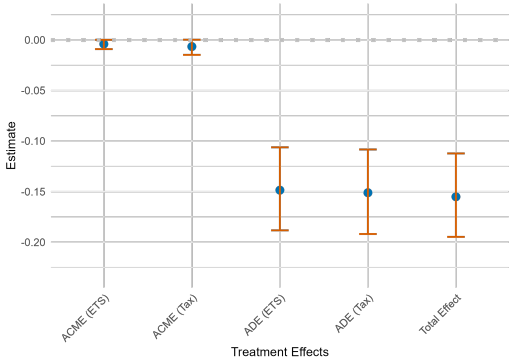

(a) Living costs



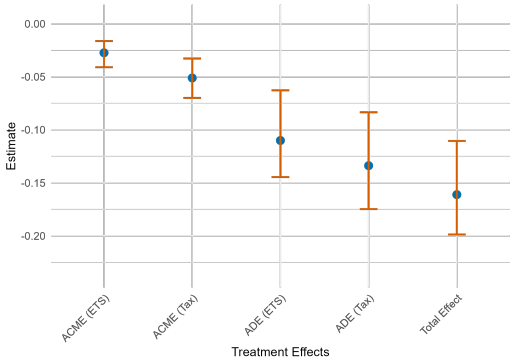

(b) Negative economic effects




(c) Mitigation

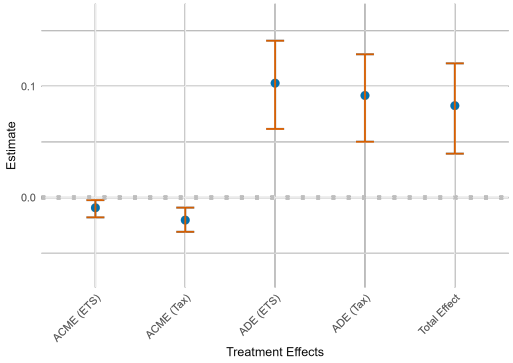



(d) Equity

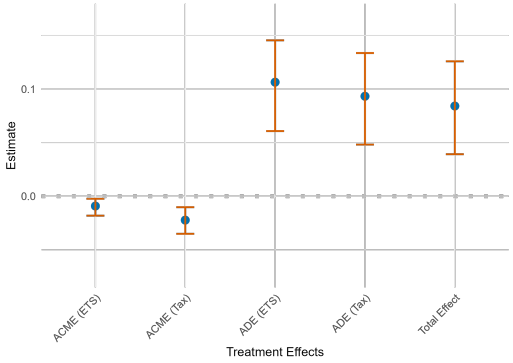



(e) Policy property index

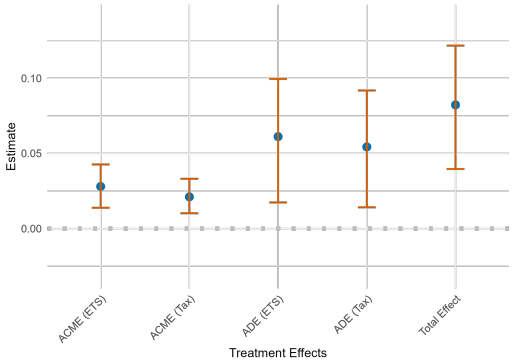
Figure 7: Mediation analysis on opposition outcomes: Germany



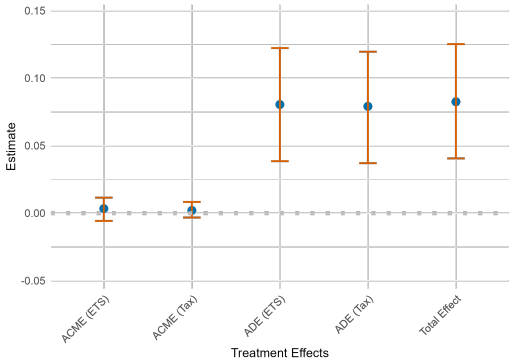

(a) Living costs



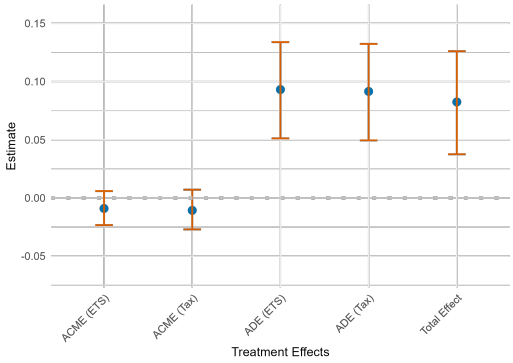

(b) Negative economic effects




(c) Mitigation

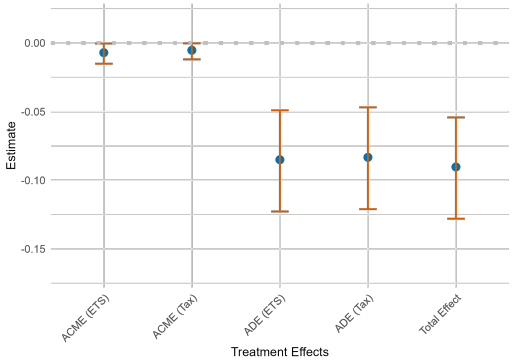



(d) Equity

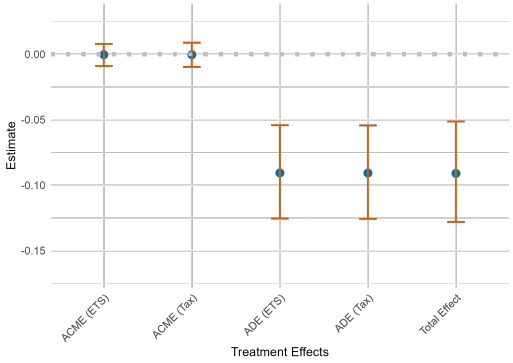



(e) Policy property index

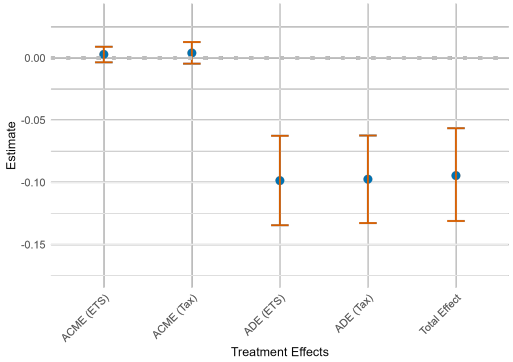
Figure 8: Mediation analysis on opposition outcomes: Greece



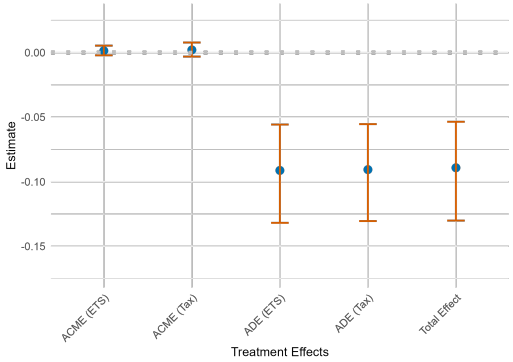

(a) Living costs



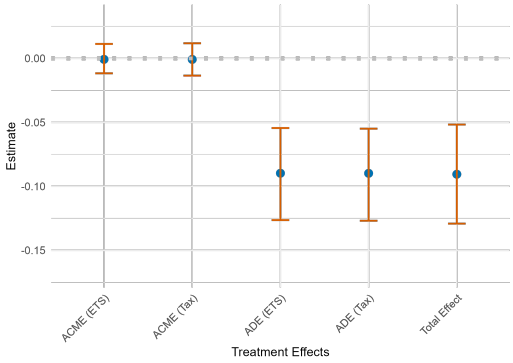

(b) Negative economic effects




(c) Mitigation

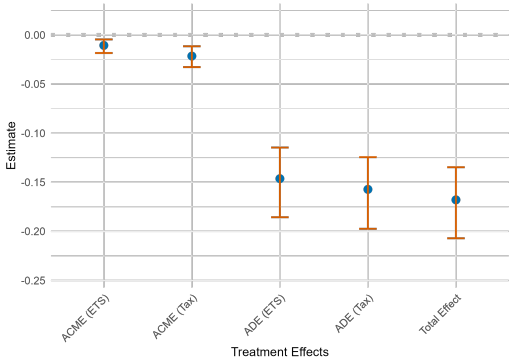



(d) Equity

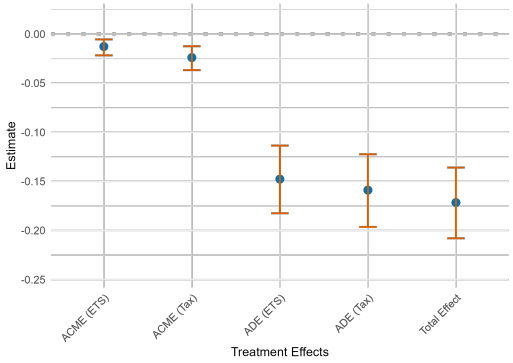



(e) Policy property index

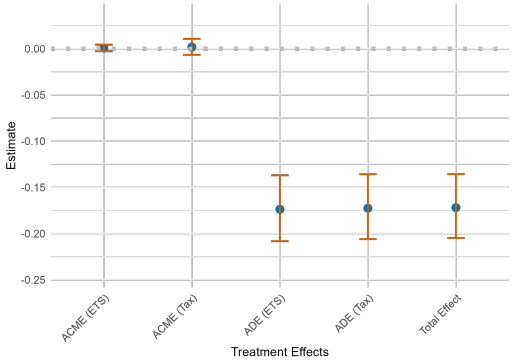
Figure 9: Mediation analysis on opposition outcomes: Italy



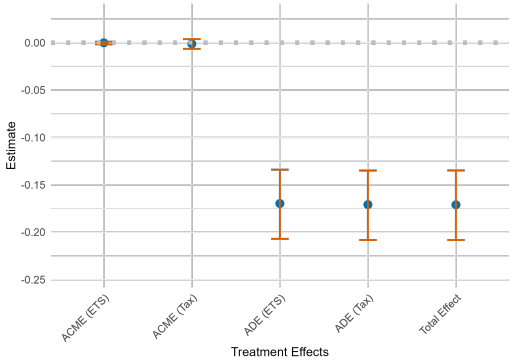

(a) Living costs



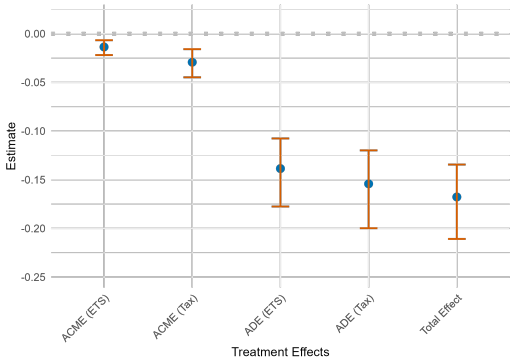

(b) Negative economic effects




(c) Mitigation

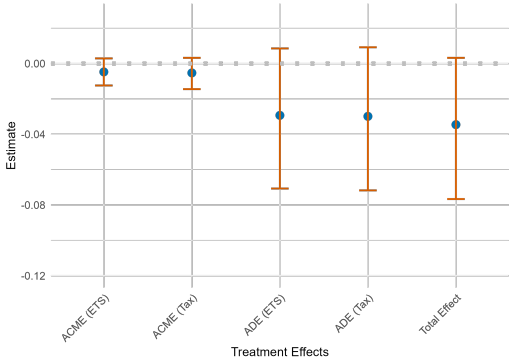



(d) Equity

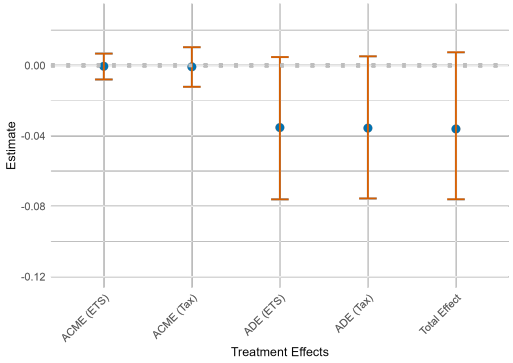



(e) Policy property index

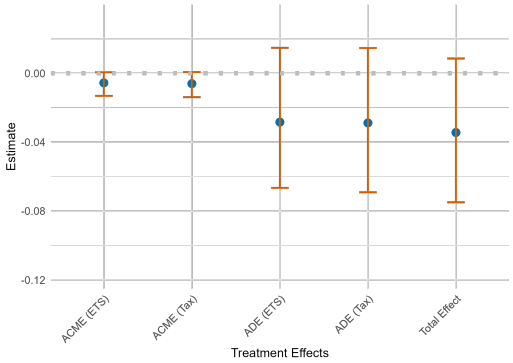
Figure 10: Mediation analysis on opposition outcomes: Poland



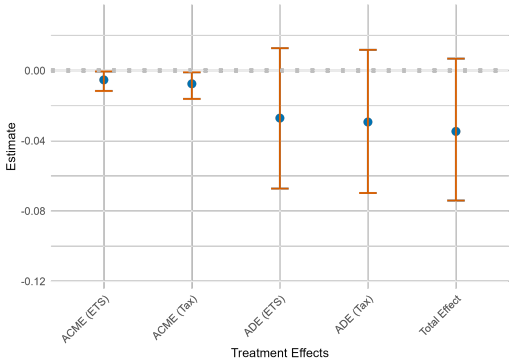

(a) Living costs



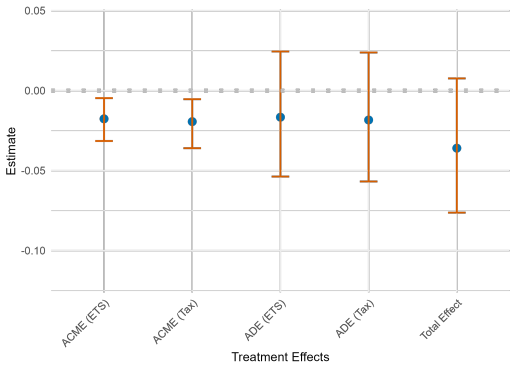

(b) Negative economic effects




(c) Mitigation

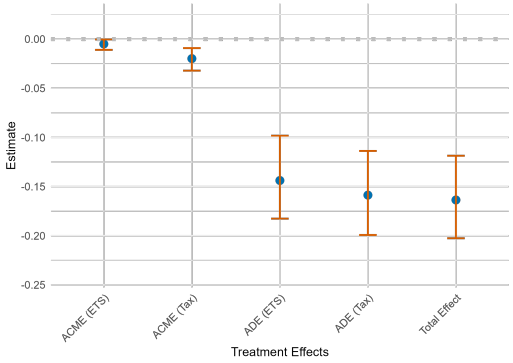



(d) Equity

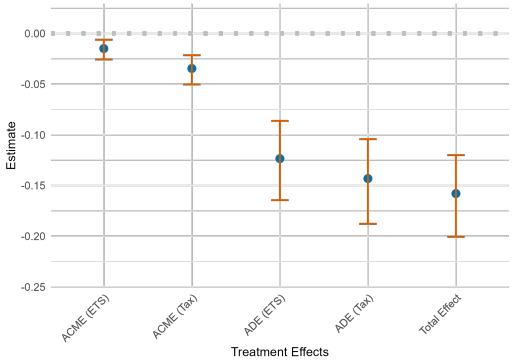



(e) Policy property index

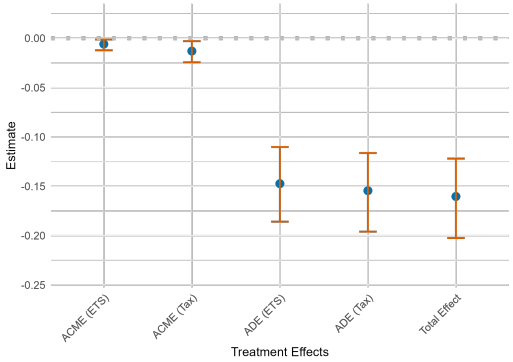
Figure 11: Mediation analysis on opposition outcomes: Spain



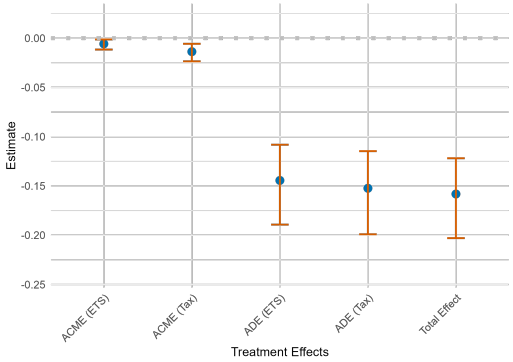

(a) Living costs



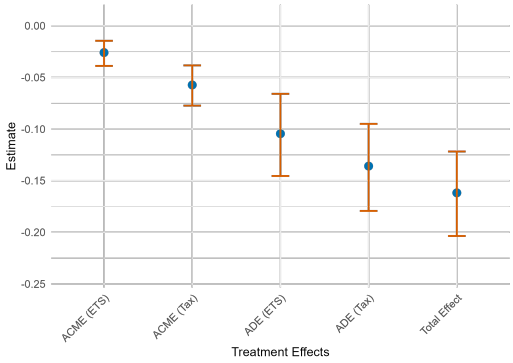

(b) Negative economic effects




(c) Mitigation

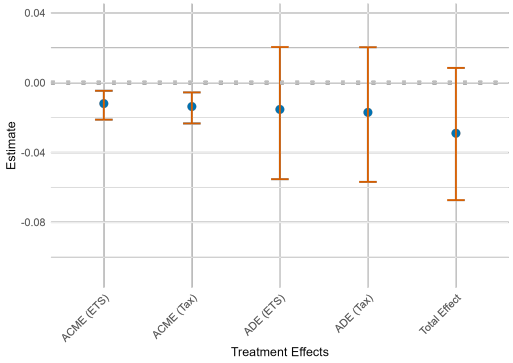



(d) Equity

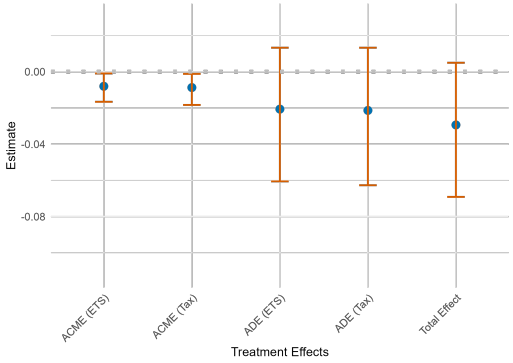



(e) Policy property index

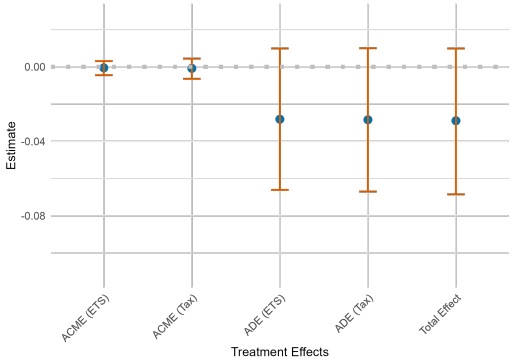
Figure 12: Mediation analysis on opposition outcomes: UK



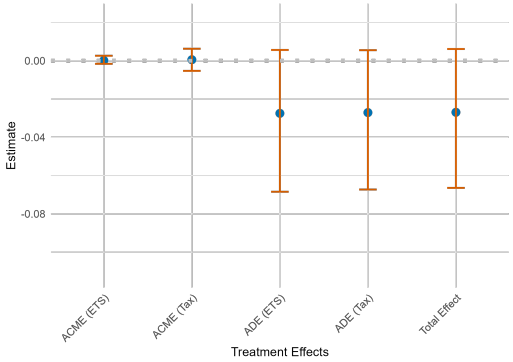

(a) Living costs



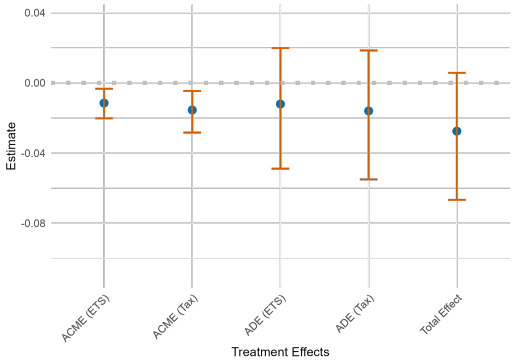

(b) Negative economic effects




(c) Mitigation




(d) Equity




(e) Policy property index

# E Sensitivity of the mediation analysis

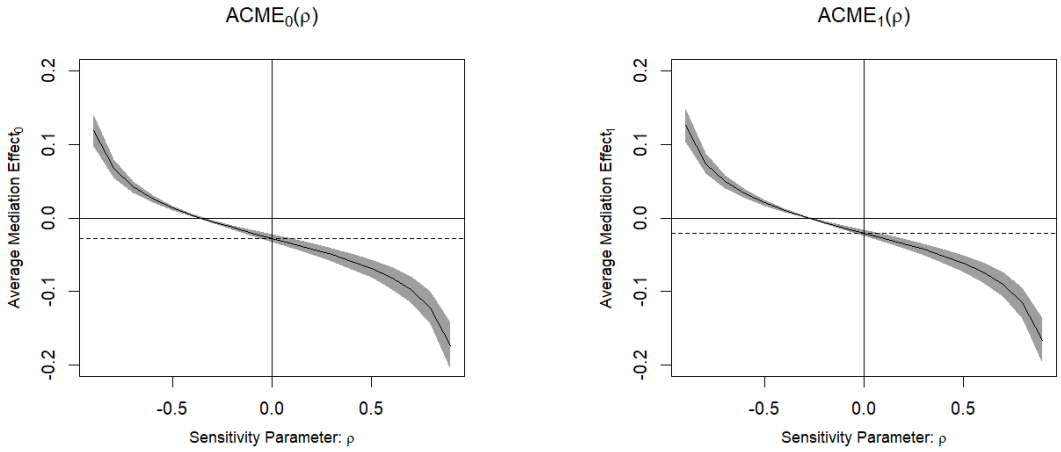
The direct and indirect effects estimated through causal mediation analysis rely on a sequential ignorability assumption. In this context, sequential ignorability assumes the absence of omitted confounders that affect both the mediator (i.e., perceptions of policy properties) and outcome variable (i.e., support). Since this is a strong assumption, we employ the inbuilt *medsens* function of the *mediation* R-package (Tingley et al., 2014) to test how robust our results are to violations of the sequential ignorability assumption. In Table 20 we report sensitivity of the indirect effect estimates for all five policy property measures considered in our mediation analyses. Sensitivity parameter $\rho$ denotes the correlation of error terms of the mediator and outcome models.

Table 20: Sensitivity analysis: parameters at which the indirect effects cross a zero-threshold

| Mediator | $\rho$-threshold (Tax) | $\rho$-threshold (ETS) | $R^2_M R^2_Y$-thrsh. (Tax) | $R^2_M R^2_Y - thrsh.(ETS)$ |
|---|---|---|---|---|
| **Raises living costs** | -0.2 | -0.1 | 0.0332 | 0.0083 |
| **Negative economic effect** | -0.3 | -0.2 | 0.0734 | 0.0326 |
| **Reduces emissions** | -0.2 | -0.3 | 0.0316 | 0.0316 |
| **Fair burden-sharing** | -0.2 | -0.1 | 0.0323 | 0.0081 |
| **Policy property index** | -0.4 | -0.3 | 0.1221 | 0.0687 |

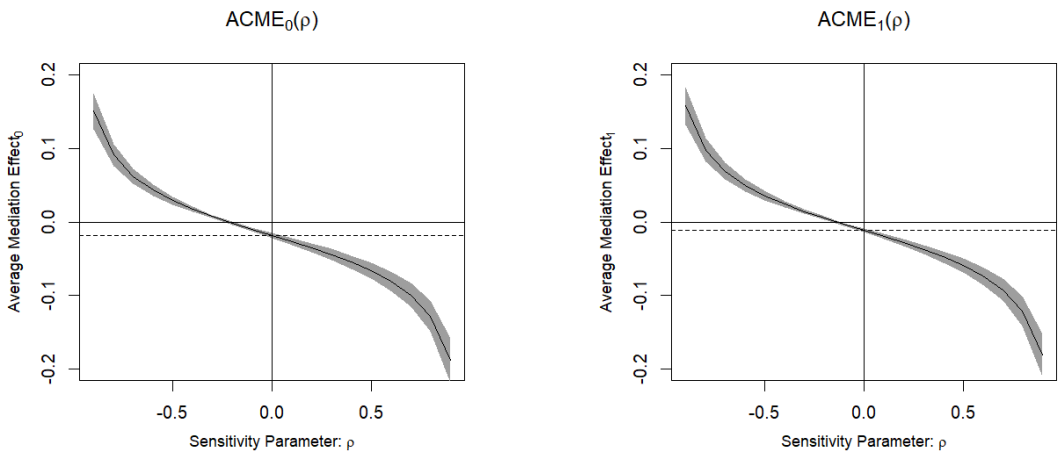
**Note:** The table summarizes results of sensitivity analyses for all mediation models. The sensitivity parameter $\rho$ denotes the correlation of the error terms of the outcome and mediator models, and $\rho$-threshold denotes that value of $\rho$, for which the indirect mediating effect crosses the value 0. Graphical illustration for each mediator and treatment state, including 95% confidence intervals are additionally reported in Figures 13a to 17a. As a second sensitivity measure, we report the product of the $R^2$-term of the mediator and outcome models explained by the omitted variable, with the $R^2_M R^2_Y$ threshold again denoting the value at which the indirect effect crosses 0. For example, a value of 0.0345 in the first row indicates that, under the tax design, the mediator model for the indirect mediating effect crosses 0 in cases such as when the $R^2$ of the mediator model attributable to the omitted variable takes the value 0.2 and the attributable $R^2$ in the outcome model takes the value 0.1725.

**Note:** The following plots depict the average mediation effect as a function of the sensitivity parameter $\rho$, indicating correlation between the error terms of the mediator and outcome models due to a common omitted confounding variable. Panel (a) depicts the average controlled mediation effect (ACME) under the 'Tax' treatment state, while (b) takes the 'ETS' design as a baseline. For example, the value of $\rho$, at which the average mediation effect crosses, taking -0.3 indicates moderate sensitivity of the mediation effect to confounding.



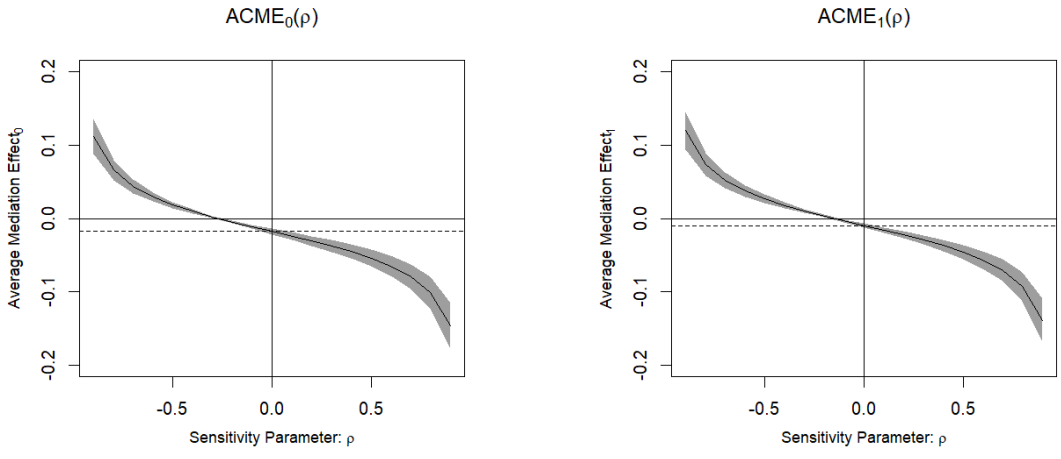

(a) (b)

Figure 13: Policy property index – sensitivity analysis of the indirect effect on opposition



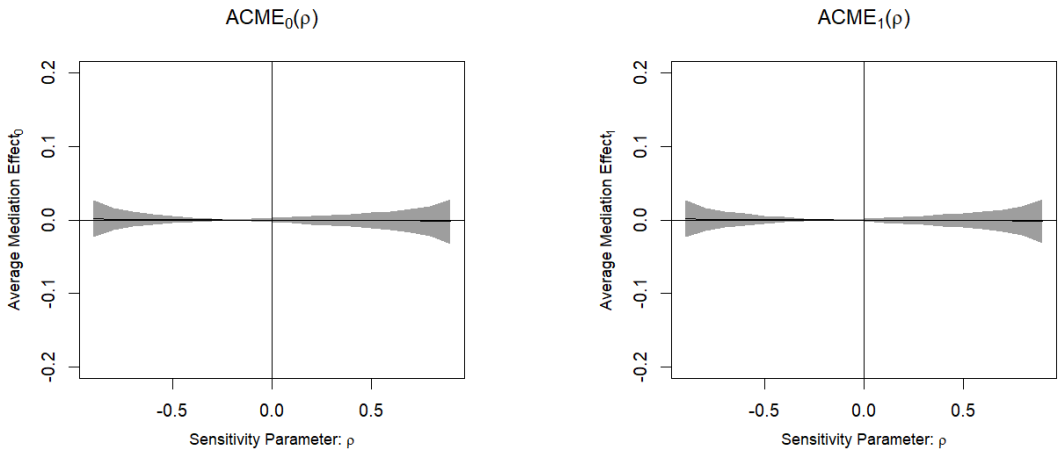

(a) (b)

Figure 14: Perceived increase in living costs – sensitivity analysis of the indirect effect



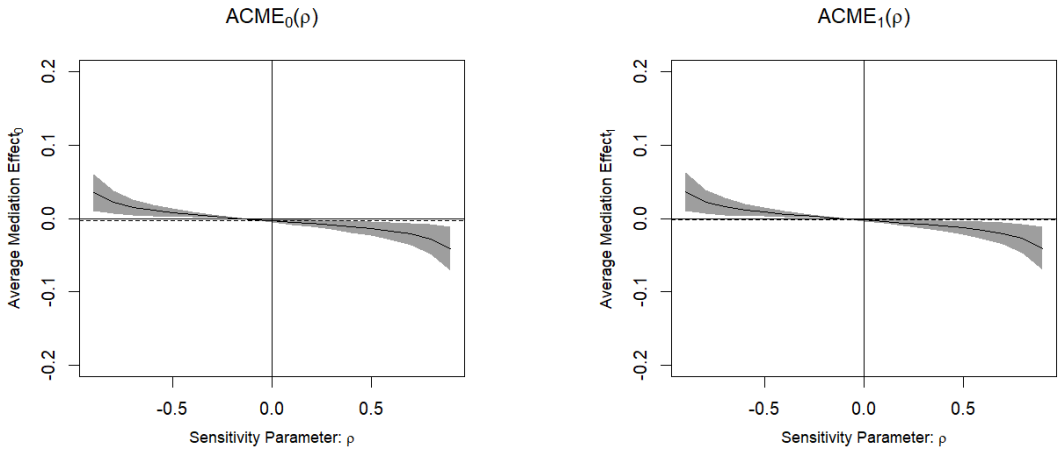

(a) (b)

Figure 15: Perceived negative economic effects – sensitivity analysis of the indirect effect




(a) (b)

Figure 16: Perceived mitigation effectiveness – sensitivity analysis of the indirect effect




(a) (b)

Figure 17: Perceived equity – sensitivity analysis of the indirect effect

# F Questionnaire (UK version)

## Introductory text

All information received in this survey is strictly confidential and will be dealt with in accordance with the Market Research Society Code of Conduct. The study you are about to participate in is for statistical purposes only. Nevertheless, for technical purposes some of your personal data such as your project unique identifier may be registered. We may need to contact you again in connection to this survey only. Please click Continue if you agree to the above terms. We appreciate your interest in our study and would like to thank you for taking part.

The transition to a greener economic policy is a heavily debated topic in the EU. Many of the existing and planned measures are aimed at changing our transport and mobility patterns. Against this backdrop, we are conducting a survey among participants from across Europe as part of the Ariadne project, which is being funded by the German Federal Ministry of Education and Research (BMBF). As a Kopernikus project, Ariadne is one of the key projects established to research the energy transition in Germany. Its aims include evaluating measures on an international level.

In this survey, we are particularly interested in finding out about your views and personal experiences concerning different modes of transport and mobility initiatives. We will additionally ask you about your opinion on carbon pricing.

The study is being conducted in accordance with data protection legislation. All data will be collected anonymously and will only be evaluated alongside the responses from other participants. It will not be possible to trace your responses back to you as an individual or your household.

We thank you for participating, and hope you enjoy completing the survey, which will take approximately 25 minutes.

Best wishes,
The respondi/Bilendi team, RWI and PIK.

## Introductory questions (Questionnaire Section A)[11]

### Postcode and rural areas

A1 - What is your postcode ?

A2 - Which of the following best describes where you live ?

- A city
- A town
- A suburb
- A rural area
- Don't know/no response

### Energy prices burden (Questionnaire Section K)

K1 - Do you feel a need to reduce expenditure in your everyday life due to rising or excessively high energy costs (e.g. electricity, petrol or heating)? *(No; Yes, occasionally; Yes, frequently, Don't know/no response)*

### Type of energy prices burden

K1b - Which energy costs are putting the biggest strain on your finances?

- Heating costs
- Electricity costs
- Fuel costs
- Don't know/no response

## Psychological and environmental attitudes (Questionnaire Section PE)

### Locus of control

PE1 - In this section, please use a scale of 1 (strongly disagree) to 7 (strongly agree) to indicate the extent to which you agree or disagree with the following statements. *(1 - strongly disagree; 7 - strongly agree; Don't know, no response)*

[11]Section headings and question subheadings are displayed for orientation, and are not featured in the original survey.

- I have little control over the things that happen to me
- There is no way I can solve some of the problems I have
- There is little I can do to change many of the important things in my life
- I often feel helpless in dealing with the problems of life
- Sometimes I feel that I'm being pushed around in life
- What happens to me in the future mostly depends on me
- I can do just about anything I really set my mind to do

### Belief in the existence of climate change

PE2_1 - To the best of your knowledge, do you believe that the world's climate is changing? *(Yes, I believe that the world's climate is changing; No, I don't believe that the world's climate is changing; Don't know/no response)*

### Belief about the cause of climate change

PE2_2 - In your opinion, who or what is responsible for climate change? *(Natural processes are mainly responsible; Humans are mainly responsible; Both natural processes and humans are responsible; Don't know/no response)*

### Level of concern about climate change

PE2_3 - How concerned are you about being personally affected by the consequences of climate change? *(1 - not at all concerned; 10 - very concerned; Don't know/no response)*

### Environmental attitudes

PE3 - To what extent do you agree or disagree with the following statements? *(1 - Strongly disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5 - Strongly agree; Don't know, no response)*

- Humans have the right to modify the natural environment to suit their needs
- The balance of nature is strong enough to cope with the impacts of modern industrial nations
- Plants and animals have as much right as humans to exist
- Humans are meant to rule over the rest of nature
- The balance of nature is very delicate and easily upset
- Humans are severely abusing the environment

## Political attitudes (Questionnaire Section PK)

We would now like to ask you a few questions about the government and politics.

### Voting preferences

PK1 - If there were an election today, which political party would you be most likely to support?[12]

- Conservative and Unionist Party
- Labour Party
- Scottish National Party
- Liberal Democrats
- Democratic Unionist Party
- Sinn Féin
- Another party
- No party
- Don't know/no response

### Individualist vs. Communitarian worldview

PK2_1 - In our society, there are often disagreements about the extent to which individuals should be allowed to make decisions for themselves. To what extent do you agree or disagree with the following statements? *(1 - Strongly disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5 - Strongly agree; Don't know, no response)*

- It's not the government's business to try to protect people from themselves.
- The government interferes far too much in our daily lives.
- The government should do more to advance society's goals, even if that means limiting the freedom and choice of individuals.
- Sometimes government needs to make laws that keep people from hurting themselves.
- The government should stop telling people how to live their lives.
- Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.

[12]For the other countries, political parties suggested in this question were adapted

### Hierarchical vs. Egalitarian worldview

PK2_2 - In our society, there are often disagreements about matters concerning equal opportunities and discrimination. To what extent do you agree or disagree with the following statements? *(1 - Strongly disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5 - Strongly agree; Don't know, no response)*

- We have gone too far in pushing equal rights in this country.
- Our society would be better off if the distribution of wealth was more equal.
- We need to dramatically reduce inequalities between the rich and the poor, whites and people of colour, and men and women.
- Discrimination against minorities still a very serious problem in our society.
- It seems like blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.
- Society as a whole has become too soft and feminine.

### Trust in political agents

PK3 - To what extent do you trust the following agents to do what is right for society?[13] *(1 - not at all; 5 - completely; Don't know/no response)*

- The government
- Citizens
- Businesses

### Climate transition role of political agents

PK4 - How big a role should the following agents play in the transition to a climate-friendly economy? *(1 - No role whatsoever; 5 - A very big role; Don't know/no response)*

- The government (e.g. by introducing more regulations or making more funding available)
- Citizens (e.g. by changing their consumer habits and leading more climate-friendly lifestyles)
- Businesses (e.g. by reducing emissions generated during their production processes and using climate-friendly technologies)
- International organisations (e.g. by setting new rules in international agreements)

[13]EU countries respondents were also asked about their trust towards the EU

### Policy satisfaction towards climate change

PK6 - How do you rate your country's political efforts to combat climate change? *(1 - Insufficient effort; 5 - Too much effort; Don't know/no response)*

## Carbon pricing (Questionnaire Section C)

The United Kingdom has set itself the goal of cutting emissions by 68 % by 2030[14] and for climate neutrality by 2050. Climate neutrality means that the amount of carbon dioxide emitted into the atmosphere does not exceed the amount being removed, e.g. as a result of reforestation, we need to drastically reduce our use of fossil fuels over the next ten years. We would now like to ask about a specific, cross-economy measure that could be used to help achieve our climate goals.

### Support factors towards an environmental policy

C1 - When evaluating a measure to tackle climate change, how important are the following aspects to you? *(1 - Not at all important; 5 - Very important; Don't know/no response)*

- The measure reduces emissions effectively.
- The measure has no negative consequences on the economy.
- The costs to me and my household are kept low.
- The financial burden is shared fairly.
- The measure has positive secondary effects on the environment, society and economy (e.g., better air quality, new economic opportunities).

One way of reducing carbon emissions is to put a price on them. This increases the cost of products that are harmful to the climate. We would now like to ask you a few questions about this measure.

### Presence of a carbon pricing policy

C2- Is there a national carbon pricing policy in your country and, if so, roughly how high is it?

- Yes, we have a national carbon tax of ...
- Yes, we have a national emissions trading scheme with a current price of ...

[14]For the EU countries in our sample, this information is replaced by the respective 2030 goal of cutting emissions by 55%.

### Policy design intervention (randomized)

**Carbon Tax (Baseline):** A carbon tax is a tax levied on the carbon content of fossil fuels (e.g. coal, gas and petrol). It is charged on the purchase price paid by industry for fossil fuels or added to the cost of end products that are made using fossil fuels. The more a product or activity is reliant on the use of fossil fuels and the more greenhouse gases it emits, the more expensive it will be as a result of the tax.

**Emissions Trading (Treatment):** Emissions trading schemes work in accordance with the "cap and trade" principle. The total amount of greenhouse gases that may be emitted in one year is limited ("capped") for the entire economy. Companies that produce carbon emissions must acquire emission allowances for each unit of carbon dioxide they emit by either obtaining them from the government or "trading" them with other companies. The price of these emission allowances depends on how "scarce" they are on the market. The more a product or activity is reliant on the use of fossil fuels, the more allowances are needed and the more expensive the product or activity becomes.

### Support to the carbon pricing policy

C3 - Do you support [a carbon tax / an emissions trading scheme] as a measure to tackle climate change? *(1 - Not at all; 5 - A lot; Don't know/no response)*

### Association of features

C4 - Which particular features do you immediately associate with [a carbon tax / an emissions trading scheme]? Please write up to three keywords: 1. ... 2. ... 3. ...

### Objectives of the carbon pricing policy

C5 - In your opinion, how important are the following objectives of [a carbon tax / an emissions trading scheme]? *(1 - Not at all important; 5 - Very important; Don't know/no response)*

- It increases **government** revenues, and this extra money can be used to make climate-friendly public investments (e.g. in infrastructure and the transition to using renewable sources of energy).
- It provides an incentive for **businesses** to use technologies and resources that emit less carbon dioxide and to make their production methods more climate friendly.
- It provides an incentive for **consumers** to purchase less carbon-intensive products and to lead a more climate-friendly lifestyle.

### Burden shared between businesses and consumers

C6 - Who do you think is most affected by [a carbon tax / an emissions trading scheme]? (*Slider between 1-100, with producers on one end and consumers on the other end*)

### Effects of the carbon pricing policy

C7_1 - To what extent do you agree or disagree with the following statements? *(1 - Strongly disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5 - Strongly agree; Don't know, no response)* [A carbon tax / an emissions trading scheme]:

- reduces emissions effectively.
- will increase my living costs significantly.
- will increase businesses' production costs significantly.
- shares the burden of combatting climate change fairly between households and businesses.
- will be easy to evade.
- will increase the government budget.
- will harm the economy.
- will drive forward innovation.

### Pigouvian ignorance

C8 - To what extent do you agree or disagree with the following statement? If the revenue generated from [a carbon tax / an emissions trading scheme] were redistributed to the population, carbon emissions would not be significantly reduced *(1 - Strongly disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5 - Strongly agree; Don't know, no response)*

If the respondent agrees: C8_1 - Why do you believe that carbon emissions would not be significantly reduced if the revenue generated from [a carbon tax / an emissions trading scheme] were redistributed to the population?

### Cost increases

C9 - If [a carbon tax of 85 £ per tonne were introduced/ carbon allowances were traded on the market for 85 £ per tonne], by how much do you believe your monthly expenses would increase?

### Knowledge about the carbon pricing policy's functioning

C10 - Are the following statements about [a carbon tax / an emissions trading scheme] correct? *(Yes; No; Don't know)*

- Participation in [a carbon tax / an emissions trading scheme] is voluntary for consumers and businesses.
- [A carbon tax / an emissions trading scheme] generates government revenues that can be used for climate-friendly public investments or redistributed to the population.
- [A carbon tax / an emissions trading scheme] gives us certainty about how much emissions will be reduced by in one year.
- [A carbon tax / an emissions trading scheme] gives us certainty about the price of a tonne of carbon dioxide.

### Knowledge about EU ETS

C11 - Before taking part in this survey, when did you first hear of the European Union Emissions Trading Scheme (EU ETS)? *(I had never heard of it before taking part in this survey; Last month; Last year; In the last five years; More than five years ago; Don't know/no response)*

### Worries about energy costs

C12 - Energy prices have increased in recent months as a result of Russia's war of aggression against Ukraine. Are you currently worried about rising energy costs? *(1 - Not at all worried; 5 - Very worried; Don't know/no response)*

## Socio-demographic variables (Questionnaire Section SO)

To conclude the survey, we would like to ask you a few questions about your personal circumstances.

### Children in household

HH1 - How many children below the age of 14 live in your household?

### Children

HH2 - Do you have any children (regardless of how old they are and whether they live with you)? *(Yes; No; Prefer not to say)*

### Gender

HH3 - What gender do you identify as? *(Male; Female; Non-binary; Prefer not to say)*

### Birth

HH4 - In what year were you born?

### Level of education/ College degree

SO1 - What is the highest level of education you have achieved? Please note: If you completed your education or training outside of the United Kingdom, please choose the option that best equates to your highest level of education.

- No schooling (ISCED 0)
- Primary education or lower secondary education (ISCED 1-2)
- Upper secondary (GCSEs or equivalent) or post-secondary non-tertiary education (A-Levels or equivalent) (ISCED 3-4)
- Higher/vocational education (HNC, HND, apprenticeship or equivalent) (ISCED 5)
- Bachelor's degree or equivalent (ISCED 6)
- Master's degree or equivalent (ISCED 7)
- PhD or equivalent (ISCED 8)
- Prefer not to say

### Employment status

SO3 - Which of the following best applies to you? Please choose only one option.

- I am employed or self-employed (incl. trainees, people on parental leave and the semi-retired)
- I am in school or studying at a university.
- I am retired/a pensioner
- I am a homemaker, stay-at-home parent and/or carer
- I receive benefits, Jobseeker's Allowance, Universal Credit or Pension Credit
- None of the above options apply to me
- Prefer not to say

### Employment type

SO4 - Employment or self-employment refers to any form of paid or income-generating work, regardless of how long you spend working. Are you...? *(In full-time employment; In part-time employment (at least 20 hours a week); In part-time employment or working on an hourly basis (under 20 hours a week); Prefer not to say)*

### Household income

SO6 - What is your household's total net monthly income?
By this, we mean everything your household earns through wages, salaries, self-employed work and pension payments after tax and National Insurance deductions. Please also include income from state benefits, rental and lease income, housing benefit, child benefit and other income.

*(Less than £900; £900 to less than £1,400; £1,400 to less than £1,900; £1,900 to less than £2,400; £2,400 to less than £2,900; £2,900 to less than £3,400; £3,400 to less than £3,900; £3,900 to less than £4,400; £4,400 to less than £4,900; £4,900 to less than £5,400; £5,400 to less than £5,900; £5,900 to less than £6,400; £6,400 or more; Prefer not to say)*

## Survey Feedback

Finally, please tell us briefly if you found any of the questions in this survey difficult to answer (e.g. because the question was hard to understand) or if you encountered any other problems. If this was the case, please describe the problem(s) briefly.