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HOW TO AVOID ANOTHER YELLOW VESTS MOVEMENT? ASSESSING PUBLIC PREFERENCE FOR A CARBON TAX WITH A DISCRETE CHOICE EXPERIMENT

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Abstract

An ambitious climate policy can trigger tensions in societies with low trust and deep social divisions. We examine public preferences for policies to achieve energy security and climate change mitigation goals in the context of the energy crisis caused by Russia's invasion of Ukraine. We conducted a discrete choice experiment, using a willingness-to-pay approach, on a representative sample of 10,000 people in Poland, a country heavily reliant on fossil fuels in transport and domestic heating. We found a strong aversion to a carbon tax among citizens, which is only slightly mitigated by redistribution policies. Income and age shape preferences for climate and energy policies. People with lower incomes (bottom quartile) place lower value on achieving climate change mitigation (15%) and energy security (10%) goals than the general population (17% and 14% willingness to pay, respectively). Younger individuals (aged 18-34) are willing to forego a greater share of their income to mitigate climate change than those aged 55 or older (28% vs. 12%) but a lower share (11% vs. 16%) to reduce fuel imports from Russia. Finally, we quantify the heterogeneity of preferences regarding redistribution measures and evaluate their efficiency. Households with low incomes prefer cash transfers as a redistribution measure, while people with high incomes prefer subsidies for green technology investments. Given the strong aversion of people with low incomes to a carbon tax, policymakers should prioritise efficient redistribution measures for them.

Keywords: carbon tax, redistribution, climate change, discrete choice experiment, willingness to pay

JEL: H23, D74, Q41, Q54

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1. Introduction

Climate policy can spark social conflicts in countries with high rates of social distrust, scepticism towards climate change, and a lack of political representation. Instruments such as carbon taxes, often perceived as the most efficient climate policies, can destabilise mitigation efforts (McCright et al., 2016) as they directly affect household budgets. This tension is embodied by the "end of the month" vs. "end of the world" dilemma (Martin and Islar, 2021), whereby the elites prioritise climate change mitigation over the needs of financially struggling social groups. Reinforced by class divisions, it can fuel radical political movements, anti-elitist, and anti-climate discourse.

Carbon taxes remain politically controversial, with a considerable portion of the population opposing them more strongly than other climate policies (Carattini et al., 2018). This opposition is amplified by low levels of political trust (Levi, 2021), which restricts decisionmakers from considering this instrument (Umit and Schaffer, 2020). Acceptance of carbon taxes is higher among well-educated or more affluent people and lower among those with high energy costs (Sommer et al., 2022). In this context, it is important to understand how carbon taxes impact social groups that prioritise short-term financial stability over concerns about global warming in politically-risky institutional settings. To this aim, we must answer two questions: (1) What is the value attached to the energy and climate policy goals? (2) Which redistributive measures can mitigate carbon tax aversion among groups most exposed to energy price spikes?

This paper aims to answer these questions by assessing individuals' willingness to support climate change mitigation and energy security measures. We also estimate the threshold of aversion and acceptance of two redistributive policies: unconditional cash transfers and full subsidies for green investments. Importantly, we address these questions within the context of the energy crisis caused by the ongoing war in Ukraine, which may make the public more reluctant to support new policies or taxes. We conducted a discrete choice experiment to estimate preferences for climate change mitigation and improved energy security in Poland, an emblematic Central and Eastern European nation struggling with low trust, deep social divisions, highly exposed to the effects of a new carbon tax.[1] The introduction of the Emission Trading System for residential buildings and individual transport (ETS-II) in the late 2020s may lead to widespread social discontent as it will directly impact society through higher energy prices.

The Yellow Vests[2] are one of the most well-known social movements that were triggered by climate policies. They believed that the French government's proposed tax disproportionately affected low-income individuals or those struggling financially, hurting the working class (Mehleb et al., 2021). The Yellow Vests' protests led to the withdrawal of a diesel tax by the French government through strikes and riots, illustrating agency against top-down carbon tax adoption, even societies supportive of climate policy (Douenne and Fabre, 2020). Social structures in

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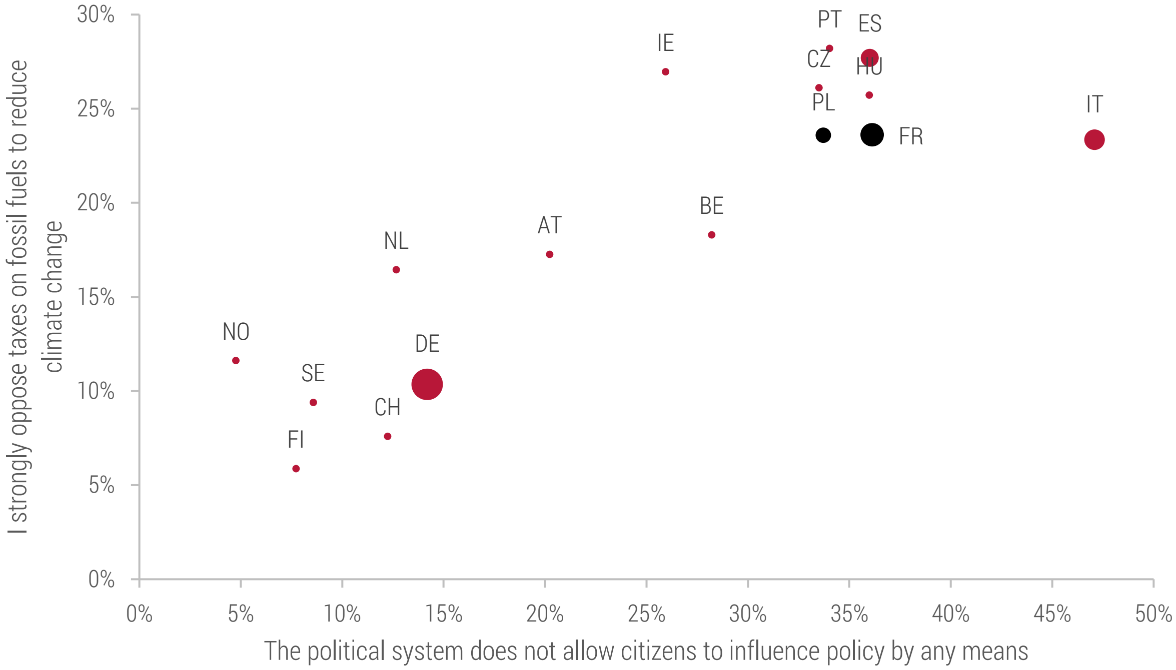
[1] Households in Poland are highly exposed to the effects of a new carbon tax (Antosiewicz et al., 2022a) as most people (56%) live in detached or semi-detached houses, rely on fossil fuels for household heating, and drive outdated cars. In 2018, 45% of households in Poland used coal to heat their homes. Almost two-thirds of Polish households own cars, with the average vehicle being 12 years old (GUS, 2019), making Poland one of Europe's largest and most obsolete car fleets.

[2] As a bottom-up, anti-systemic successor of the trade union movement, protests by the Yellow Vests sprouted up across France in 2018, constituted by growing sentiments of social injustice and demands for stronger citizen agency in political decisions (Grossman, 2019). The Yellow Vests protested the disrespect by the "ruling class" towards the "common people" (Kipfer, 2019; Lianos, 2019).

Poland and France share several similarities; both are politically divided, less trustful (both socially and politically), and more sceptical about climate change than the European Union average (Fairbrother et al., 2019). Similarly to France, people in Poland and other Central and Eastern European countries strongly oppose to carbon taxes and declare a widespread sense of political underrepresentation (Figure 1). In this regard, the example of Poland is essential for studying preferences regarding climate change, energy security, and the risks of social tensions caused by the introduction of a carbon tax.

Figure 1. Opposition to a carbon tax and feelings of political underrepresentation by nation (%)



Note: plot size is representative of a given country's relative population share in Europe.
Source: own elaboration based on European Social Survey 8, 2018.

Our paper makes three key contributions. First, we unveil preferences regarding climate change mitigation and improved energy security in the context of the Russian invasion of Ukraine. We evaluated the choices of more than 10,000 individuals regarding hypothetical carbon taxes that differed in redistribution mechanism (direct unconditional cash transfers against subsidies for green technologies) and their effects on the climate, energy security, and income. We identified a strong public aversion to carbon taxes unaffected by redistribution policies – when offered the same income with or without a climate policy, more than 50% of participants preferred no climate policy, regardless of the redistribution mechanism. However, for each level of income difference, a penalty considerably reduced preference for a carbon tax, while an equivalent premium did not increase this preference. Therefore, our results augment existing knowledge concerning the design (Carattini et al., 2018), perceptions (Drews et al., 2022), and preferences for revenue recycling revenues (Klenert et al., 2018) of a carbon tax. However, our study is the first to explore public preferences in the context of an ongoing war that has heavily impacted the region's energy market (Antosiewicz et al., 2022b) in the transitional period before the implementation of top-down carbon pricing mechanism taxing individual transport and energy consumption.

Second, we demonstrate an important heterogeneity in preferences towards climate change mitigation and energy security. Specifically, respondents place a higher value on climate change and air quality-related attributes than on energy security. On average, respondents are willing to forego 17-18% of their incomes towards mitigating climate change and improving air quality, and 11% to reduce reliance on Russian fuels. However, they would also require compensation equal to 14% of their incomes if their energy access and individual commuting are limited. Income and age shape preferences towards climate and energy policies. Respondents with lower incomes attach lower value to climate change mitigation and energy security compared to the general population (a WTP lower by 2-4 pp, on average). Younger respondents are more concerned about climate change than older respondents (a 28% willingness to pay, compared to 12%). Contrastingly, young respondents are willing to pay substantially less (11%) than older respondents (16%) to lower fossil fuel imports from Russia. Although our results align with the previous valuation of climate change mitigation in European countries (Ščasný et al., 2017) and air quality (Viscusi et al., 2008), we provide new knowledge by making respondents trade off between climate and energy-security-related attributes.

Third, our study suggests viable redistribution measures based on the results of a discrete choice experiment. We find that lower-income groups prefer cash transfers, which would help alleviate tensions arising from climate policies (Köppl and Schratzenstaller, 2022). Using preferences for the effects of carbon taxes (i.e. climate change mitigation, secure access to energy), we suggest implementing redistribution measures aimed at reducing the income-related burdens of the carbon tax, thereby potentially decreasing aversion to it. Our findings suggest that a targeted cash transfer at low-income households would be required from relatively low carbon tax rates (5%). Previous studies showed that allocating revenue from a carbon tax towards environmental initiatives can enhance public acceptance by improving environmental awareness and behaviour (Gevrek and Uyduranoglu, 2015; Kallbekken et al., 2011). However, the effects of climate rebates on carbon pricing popularity are limited (Mildenberger et al., 2022) and are associated with a small increase in acceptance of a carbon tax (Levi, 2021). Our contribution takes a different approach by using experimental methods to provide recommendations for redistribution policies in a more general sense, crucial in the context of highly politically-divided countries.

The remainder of this paper is structured as follows. Section two presents the data and descriptive statistics. Section three introduces the models used in the study, while section four presents the results. Section five concludes the paper.

2. Data and descriptive statistics

2.1. Experimental framework

In order to elicit the preferences toward climate and energy policies, we conducted a discrete choice survey experiment using vignettes based on four distinct attributes: (1) climate change mitigation; (2) improvements in air quality; (3) a limit on Russian fuel imports; (4) uninterrupted supply of electricity and transportation fuels (Table 1). Additionally, respondents decided if a new carbon tax should be introduced or not (status quo option) and how it should be redistributed. Two standard[3] revenue recycling schemes were offered: (i) a monthly cash benefit for all families; (ii) a subsidy to finance green investments in environmentally friendly technologies.

[3] These two categories have been previously applied in policy reviews to assess the distributional effects of climate policies (Vona, 2023), in energy-economy modelling (Bourgeois et al., 2021), and other experimental studies (Dechezleprêtre et al., 2022).

The participants viewed five screens with vignettes,[4] each with two policy options, and each option having four attributes (i.e. climate change, air quality, fuel imports, energy supply) with randomly drawn levels. One of the options (at random) was the "status quo", meaning that it did not include a new policy and redistribution scheme. The options differed between their "gains and losses"; a monetary attribute which represented changes in respondents' incomes due to the introduction of a new climate policy. The gains/losses were randomly drawn from a uniform distribution in the range of -0.24 to 0.24. We used emojis (pictograms), a universal and widespread mode of communication, to better visualise the choices on the vignettes.[5]

Table 1. The attributes used in the experiment

Attribute	Level		
	1	2	3
Climate change impacts	Major A major decline in crop yields, a significant threat to life due to catastrophic heatwaves, flooding, and droughts	Limited A moderate decline in crop yields, a moderate threat to life from catastrophic heatwaves, flooding, and droughts	Minimal No changes in crop yields, low risk to life from catastrophic climate events
Diseases caused by poor air quality	No change 50,000 deaths annually	Limited by half 25,000 deaths annually	Limited to minimum less than 5,000 deaths annually
Purchases of Russian fuels	No change imports of 10 billion m^3 of gas and 16 million tons of oil annually	Limited by half imports of 5 billion m^3 of gas and 8 million tons of oil annually	Limited to zero
Access to electricity and individual transport	No change	Interrupted access no electricity once a week for 1 hour and 2 Sundays a month without a car	Energy rationing no electricity every day for 1 hour and all Sundays of the year without a car
Policy options	No change	Carbon tax and new cash benefit Tax on coal, gas and oil consumption at home and a monthly cash benefit from the state budget for all families in Poland	Carbon tax and full investment subsidy Tax on coal, gas and oil consumption at home and one-off, full co-financing from the state budget for heat pumps, photovoltaic panels, thermal retrofitting, or an electric car
Net monthly income of your household in a given option	$\{-24\%, -20\%, -16\%, \ldots, 0, \ldots, 16\%, 20\%, 24\%\}$		
Monthly benefit/loss for your household	$\{-24\%, -20\%, -16\%, \ldots, 0, \ldots, 16\%, 20\%, 24\%\}$		

Source: own elaboration.

[4] Before seeing the vignettes, each participant was presented with information on interpreting each attribute (Appendix 1, Table A1).

[5] To our knowledge, this is the first such use of emoji in a vignette experiment related to environmental economics.

Our sample size (n = 10,281) was sufficient to investigate the main effect size among various subgroups. The projected sample size required to estimate the effect size of around 2 pp in the binary outcome (choosing a particular policy) was approximately 1,800 participants per subgroup (9,000 choices), with standard parameters of alpha (the significance level) equal to 0.05 and power equal to 0.8.

The experiment received ethical approval from the Rector's Committee for Ethics of Research with Human Participants at the University of Warsaw (Decision 156/2022). We also registered the experiment with the American Economic Association's registry for randomised controlled trials (RCT IDs: AEARCTR-0009482).

2.2. Data collection

The survey was conducted in August 2022 using a Computer-Assisted Web Interviewing (CAWI) technique and a nationwide research panel. This panel consists of 150,000 registered, active, and validated respondents and is an established research tool in Poland, widely used for various research studies, including on energy policy preferences (Aruga et al., 2021) or prejudice and hate speech (Bilewicz and Soral, 2022). To ensure a representative sample, we set quotas for key socio-demographic (gender, age, educational level) and geographical (municipality size and region) variables.

The survey consisted of three parts. In the first part, we collected information on a participant's socio-demographic characteristics, energy consumption, individual transportation patterns, and opinions on climate change and energy security. We introduced the discrete choice experiment in part two. In the third part, we asked about their political preferences and levels of trust (social and political) using standard questions and cafeterias from the European Social Survey (including the ESS8 with climate-related variables) to control the precision of our results.

In total, we collected 10,281 surveys from respondents and accounted for two critical sources of bias in the discrete choice experiment: (i) inattention (ii) hypothetical bias. To check for inattention, participants were asked about their favourite colour at a random moment during the survey, and had to select a predetermined one regardless of their preference. An incorrect answer would result in the survey's termination. Therefore, we conclude that participant inattention did not bias the study. We also addressed hypothetical bias (Ladenburg and Olsen, 2014) by emphasising the real-life importance of the study; informing participants that their answers will later be presented to Polish policymakers. We also included a follow-up question after each vignette, asking participants to indicate their confidence about the choices on a scale of 0-100. Overall, participants were confident in their decisions as the median confidence level was 71, and the bottom quartile was 56 (see Table A2 in Appendix 1). To limit inattention, we provided a time lock for carefully reading the vignette instructions and filling in the answers, making our experiment a good approximation of real-life choices.

Before conducting the experiment on the total sample (n=10,281), we arranged quantitative (n=200) and qualitative (n=16) pilot studies in June 2022. The feedback we received helped us simplify the vignettes, improve the readability of instructions, and provide precise answers. We collected our data in August 2022, during three important events that our study encompasses: (i) the Russian invasion of Ukraine, which impacted trade between the EU and Russia and led to hikes in fossil fuel prices, (ii) the inflation rate in Poland, which reached 16% (Statistics Poland, 2022), and (iii) a coal supply shortage caused by the embargo on Russian coal, which led to anxiety among Poles reliant on this fuel for domestic heating (almost half of all households in Poland (Statistics Poland, 2018) as many were concerned about the availability of coal before the heating season. These impactful developments rendered the choices of our respondents particularly salient, as they were navigating the immediate, real-world implications of these socio-economic and geopolitical shifts on their personal and financial well-being.

2.3. Sample characteristics

Our experiment involved 10,281 respondents, with a slight underrepresentation of men in the sample (45% in the sample vs. 48% in the general population). Additionally, our sample had a lower share of individuals above 55 years of age, with a primary education, from small cities, living in old buildings (built before 1980), as well as a slightly smaller share of households that use coal stoves for heat and are located in rural areas. We applied weights to ensure the sample's representativeness and rebalanced the data by matching the distribution of key variables such as gender, age, and education, to that of the relevant population structure. We derived the weights by using data from the 2020 Polish Household Budget Survey. Table 2 illustrates the weighted structure of our sample.

Table 2. Sample characteristics

	Sample structure			Population structure
	N	%	% (weighted)	%
Gender				
Men	4,653	45.3	48.0	48.0
Women	5,628	54.7	52.0	52.0
Age group[6]				
18-24	1,027	10.0	7.6	6.8
25-34	2,328	22.6	16.1	13.2
35-44	1,897	18.5	15.3	16.5
45-54	2,061	20.0	21.5	13.4
55 or more	2,968	28.9	39.5	43.9
Education				
Primary	914	8.9	16.3	17.9
Secondary	5,867	57.1	61.8	57.7
Tertiary	3,500	34.0	21.9	24.4
Main heating source[7]				
District heating	4,082	39.7	38.8	40.0
Coal	2,456	23.9	26.2	49.0
Biomass	815	7.9	7.7	
Gas	2,365	23.0	22.0	5.0
Heat pump	234	2.3	1.8	3.0
Electric stove	329	3.2	3.5	3.0

Note: the sample structure is weighted with our survey weights, and the population structure is weighted with Household Budget Survey weights.
Source: own calculations using data gathered for the experiment and annual data for 2020 from Poland's Household Budget Survey.

[6] Population structure based on Local Data Bank, Statistics Poland, 2021.

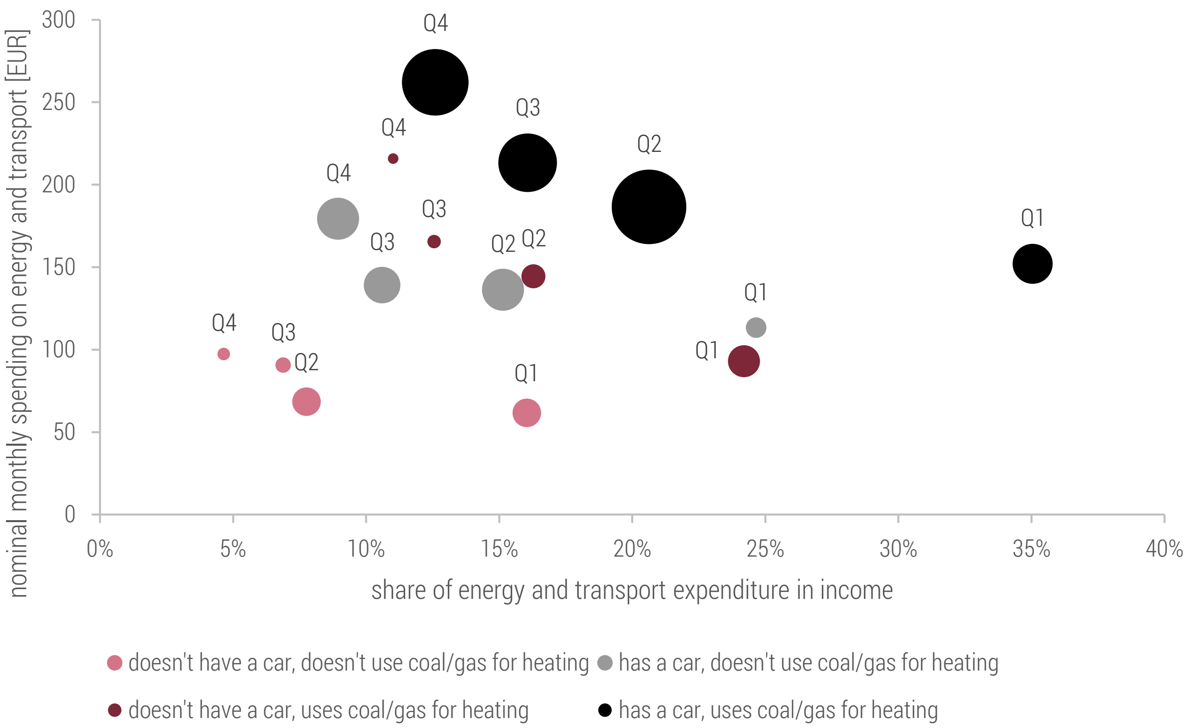
[7] Population structure based on Polish Household Budget Survey data, 2018.

2.4. Descriptive results

In this subsection, we present the descriptive patterns across three dimensions: (1) income and spending, (2) energy and commuting patterns (3) levels of social and political trust and awareness of climate change, as these were the defining characteristics of people who identified with the Yellow Vest movement in France.

In our sample, respondents with the highest incomes pay the most for energy and individual transport in nominal terms, while the low-income population pays the most in relative terms (Figure 2). Moreover, households that either own a car or heat their homes with coal or gas spend the most on energy and individual transport in nominal (260 EUR per month) and relative terms (35% of their incomes) and constitute the highest share of the total population (45%). This pattern forms a key context for introducing a carbon tax as it underscores the disproportionate exposure of the energy and transportation costs can have on low-income citizens, as they are the most vulnerable to increases in energy prices.

Figure 2. Energy and individual transport expenditures in Polish households by income quartile (%)



Note: "Q1-Q4" are income quartiles. Plot size is representative of the relative size of a given group in the total population.
Source: own calculations using data gathered for the experiment (2022).

We found that almost 70% of people in our sample are highly aware of the adverse effects of climate change and that differences between particular groups were not particularly pronounced. Our results are consistent with other studies on social attitudes towards climate change and energy security.[8] It aligns with the study's findings on the Yellow Vest movement in France, which showed that Yellow Vest supporters were not anti-ecological but rather representatives of groups that demanded a more egalitarian approach and effective climate action (Kipfer, 2019).

[8] For example, ESS8 identified 11% of climate change denialists in Poland (Poortinga et al., 2018), which is similar to the results of our sample (12%).

The knowledge that climate change is anthropogenic was widespread, and the share of people who do not believe in climate change was marginal (Douenne and Fabre, 2020).

Below, we present the descriptive results of the five attributes outlined in Table 1: (1) a carbon tax with a revenue recycling mechanism; (2) climate change impacts; (3) air quality impacts; (4) Russian fuel imports; and (5) access to energy and private transport. All proposed policies were largely rejected by respondents, with approximately 60% preferring the status quo regardless of the redistribution measure (Table 3). There were minor differences in preferences between socio-demographic groups, such as men being more likely than women to choose carbon tax and older individuals being slightly more inclined than younger ones. We also observed slight variations in preferences between education groups, with a higher share of respondents with tertiary education choosing attributes related to climate change mitigation, air quality improvement and reducing imports from Russia.

Table 3. Shares of respondents who chose vignettes with particular attributes (%)

	Carbon tax		Climate change impacts		Diseases caused by poor air quality		Purchases of Russian fuels		Access to electricity and individual transport	
Attribute level	Cash benefit	Full Subsidy	Limited	Minimal	Limited by half	Limited to minimum	Limited by half	Limited to zero	Interrupted	Energy rationing
					Total sample					
%	43.1	41.6	52.3	53.63	50.6	55.0	50.3	53.9	50.4	46.0
N	11,031	10,737	17,956	18,319	17,421	18,748	17,285	18,511	17,316	15,789
					Women					
%	43.0	41.3	52.5	54.2	50.6	55.5	50.7	53.5	50.7	45.6
N	6,011	5,847	9,874	10,107	9,525	10,345	9,587	10,058	9,492	8,630
					Men					
%	43.0	42.1	52.1	53.1	50.6	54.3	49.8	54.3	50.2	46.5
N	5,020	4,890	8,082	8,212	7,896	8,403	7,698	8,453	7,824	7,159
					Secondary or lower					
%	43.0	41.8	52.3	53.0	50.7	54.5	50.4	53.0	50.1	46.1
N	7,298	7,079	11,810	11,902	11,484	12,285	11,445	11,970	11,365	10,394
					Tertiary					
%	43.2	41.3	52.4	54.9	50.5	55.9	50.1	55.6	51.1	45.9
N	3,733	3,658	6,146	6,417	5,937	6,463	5,840	6,541	5,951	5,395
					18-34					
%	42.7	41.6	53.2	55.1	51.3	54.3	49.9	52.9	50.8	44.8
N	3,568	3,498	5,959	6,208	5,731	6,008	5,576	5,956	5,749	5,008
					35-54					
%	42.8	40.9	52.0	53.6	50.1	55.1	50.8	53.9	50.0	46.8
N	4,210	4,065	6,876	7,042	6,652	7,277	6,733	7,097	6,543	6,175
					55 or more					
%	44.0	42.7	51.8	52.1	50.4	55.5	49.9	54.9	50.7	46.3
N	3,253	3,174	5,121	5,069	5,038	5,463	4,976	5,458	5,024	4,606

Note: participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

3. Methodology

3.1. Stated preferences regarding energy and climate policies

We use logistic regression to estimate the probability that an individual prefers a given alternative for energy and climate policies. The logistic model is specified as follows:

$$\Pr\,(a_j = 1) = F(\beta_0 + \beta_1\tau_i + \beta_2 c_i + \beta_3 s_i + \beta_4 r_i + \beta_5 u_i + \beta_6 D_i + \beta_7 Q_i + \beta_8 \lambda_j + \varepsilon_{ijv}) \quad (1)$$

where $F(Z) = \frac{e^Z}{1+e^Z}$, i stands for the individual, j for a choice, and v for the vignette number. The five attributes described in Table 1 are represented by: τ_i for carbon tax, c_i for climate change impacts; s_i for air quality, r_i for Russian fuel imports, u_i for access to energy and individual commuting. D_i is a vector of personal characteristics (a set of indicator variables for gender, age, education, employment status, and income), while Q_i is a set of indicator variables that represent urbanisation (location), building type, year of construction, and main heating source; λ_j is a set of indicator variables that reflects attitudes towards climate change and levels of political and social trust. The error term, ε_{ijv} is clustered at the level of an individual respondent.

To estimate the conditional logistic regression, we assessed the probability of choosing a particular distributional policy (the preferred policy) against the "status quo" option. The model we used is specified as:

$$\Pr\,(p_j = 1) = F(\beta_0 + \beta_1 c_i + \beta_2 s_i + \beta_3 r_i + \beta_3 u_i + \beta_5 D_i + \beta_6 Q_i + \beta_7 \lambda_j + \varepsilon_{ijv}) \quad (2)$$

In contrast to model (1), the variable of interest here is the choice of a different policy option rather than choosing a particular alternative.

Next, we adapt the logistic regression model into a mixed multinomial logit model while maintaining its general structure. The mixed multinomial logit model allows us to account for unobserved heterogeneity among individuals:

$$\Pr(a_{ij} = 1) = \frac{\exp\,(\beta_0 + \beta_1\tau_i + \beta_2 c_i + \beta_3 s_i + \beta_4 r_i + \beta_5 u_i + \beta_6 D_i + \beta_7 Q_i + \beta_8 \lambda_j + \varepsilon_{ijv})}{\sum_{k=1}^{J} \exp\,(\beta_0 + \beta_1\tau_i + \beta_2 c_i + \beta_3 s_i + \beta_4 r_i + \beta_5 u_i + \beta_6 D_i + \beta_7 Q_i + \beta_8 \lambda_k + \varepsilon_{ikv})} \quad (3)$$

This model has a similar formulation to model (1), with the addition of k, a variable used to iterate over all possible choices in the choice set. The model allows us to estimate the probability of choosing each available alternative, taking into account individual-specific random effects.

3.2. Willingness to pay

Next, we estimate the willingness to pay for specific climate change or energy security attributes to better understand the monetary valuation of each attribute. We model participant utility as:

$$U_{ijv} = \alpha_0 + \alpha_1 X_i + \alpha_2 \theta_j + \alpha_3 W_j + \epsilon_{jiv} \quad (4)$$

Where i stands for the individual, j is the alternative, and v is the vignette number. X_i stands for the individual characteristics of a participant i, θ_j represents particular attributes related to climate and energy security, W_j is the relative income difference after introducing detailed policy j compared to the status quo.[9]

Policy j is chosen if it provides a higher expected utility than the status quo k presented in the same vignette v, $U_{jiv} > U_{kiv}$. The indicator variable Y_{ijv} is equal to one if participant i selected policy j presented in a vignette v. Therefore:

$$Pr\left(Y_{ijv} = 1\right) = \Pr\left(U_{ijv} > U_{ikv}\right) \quad (5)$$

We estimate the parameters using logit models, where $F(U) = \frac{e^U}{1+e^U}$. Standard errors ε_{jiv} are clustered at the level of an individual respondent. We estimate the willingness to pay for a particular attribute as the ratio of point estimates of parameters $WTP(O_j) = -(\frac{\alpha_2}{\alpha_3})$. We then compute the confidence intervals using the Stata *wtp* command with the default delta method (Hole, 2007).

To quantify the heterogeneity in WTP between subgroups, we divide the sample into smaller subsets and estimate the willingness to pay in subgroups based on demographic variables, socio-economic characteristics, energy consumption patterns, and political attitudes.

3.3. Minimising carbon tax aversion

Finally, we focus on the heterogeneity of preferences for redistribution measures in different income groups. We assume that although the lower a participant's income after introducing the tax, the lower the predicted probability that they would choose the climate policy, premiums and penalties showed to have differing impacts. Hereby, redistribution measures do not substantially increase the acceptance of a carbon tax, they can be used to minimise carbon tax aversion, which was only made worse by income penalties. If a particular group has a substantially higher carbon tax aversion than the average, redistribution measures may help close this gap and diffuse any tensions that may arise among this particular category.

We use the estimated probability of accepting a carbon tax (equation 1) paired with a redistribution measure and willingness-to-pay data to identify which groups are more likely to lose from the introduction of the tax, and how the negative loss of income can be eased through the adoption of redistribution measures.

Our procedure was based on three steps. First, we established the carbon tax rate within a range of $0 \leq t \leq \overline{WTP}$. We determine this rate based on participants' average willingness to pay for various attributes associated with the tax. These attributes include climate change mitigation, improved air quality, uninterrupted energy access, and impacts on individual commuting. These collectively represent the intended outcomes of implementing the carbon tax. Second, we calculated the likelihood that respondents would accept a carbon tax rate within the $t = [0, \overline{WTP}]$ range using the formula described in the model (3). This step involved assessing public receptivity to the tax at various levels within the specified range of t. Finally, we compared the probability of accepting the carbon tax across different groups. For example, we measured the difference in acceptance rates between low-income

[9] We checked whether treating the differences in earnings between the status quo, a carbon tax, and a redistribution measure as a continuous variable, instead of as a set of indicator variables, yielded comparable regression results.

respondents (those in the lowest 25% of the income distribution), the overall average acceptance rate in the population, and high-income respondents (those in the highest 25% of the income distribution).

4. Results

This section is divided into three parts. First, an analysis of tax effects, including climate change mitigation and other attributes, as outlined in Section 2.2. Second, a discussion on carbon tax preferences paired with cash transfers or green investment subsidies. Third, a presentation of alternative mechanisms and robustness checks.

4.1. Willingness to pay for climate change mitigation and improved energy security

We consider the following dimensions of heterogeneity when analysing people's willingness to pay for climate change mitigation and energy security: (1) incomes and expenditures, (2) energy consumption patterns, (3) levels of trust and awareness of the effects of climate change, and (4) age. Income and expenditure inform the capacity to afford higher costs due to climate policies. Energy use patterns reveal the potential for consumption reductions. Climate change awareness shapes willingness to contribute to mitigation efforts, while trust influences policy fairness and efficiency perceptions. Age is a factor consistently related to attitudes towards climate change (Syropoulos and Markowitz, 2022). To this end, we estimate how the model specified in equation (5) interacted with respondents' characteristics. We tallied the results for each attribute and variable in Appendix B.

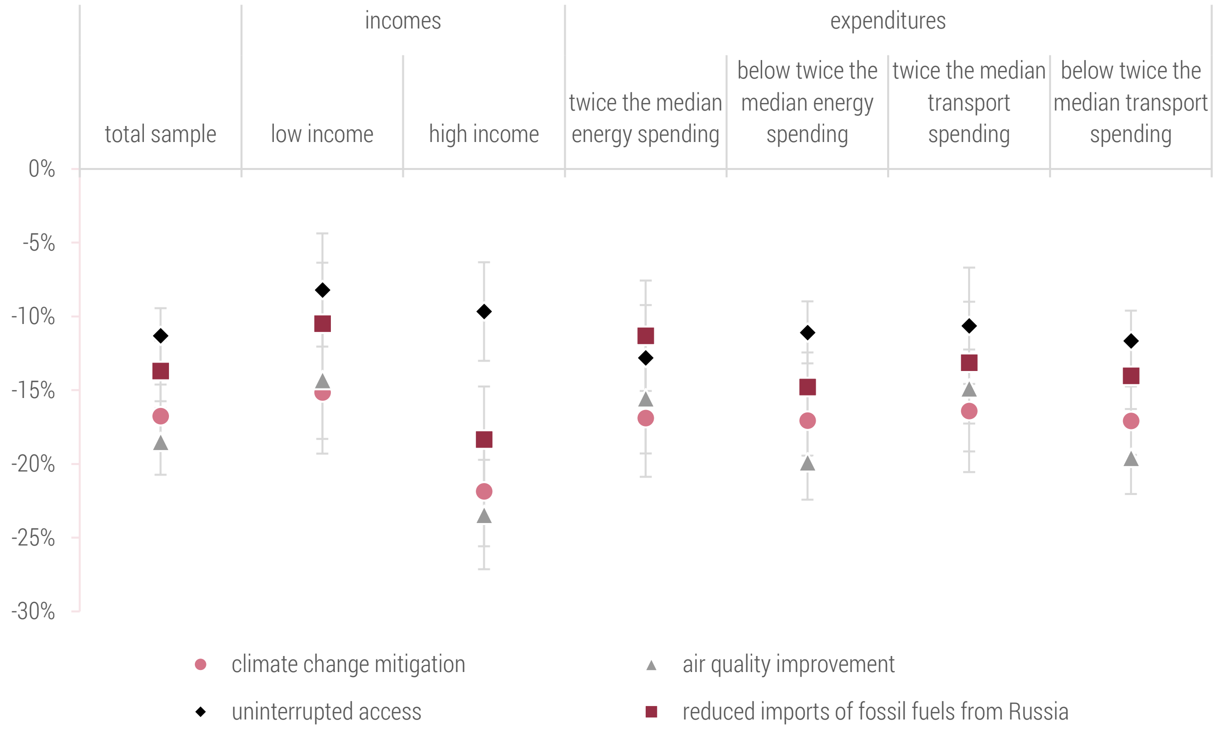
Overall, respondents prefer climate change-related attributes over energy-security attributes. On average, respondents are willing to forego 17-18% of their incomes to mitigate the negative impacts of climate change or achieve better air quality, and 11% to reduce imports of Russian fuel. They would also require compensation of 14% of their incomes if their access to energy and individual car use is limited (Figure 3).

We find that income disparities matter more for the valuation of specific attributes than differences in energy and individual transportation expenditures.[10] A carbon tax would disproportionately impact low-income households, aggravate economic hardship, and potentially exacerbate existing inequalities. Low-income individuals place a lower value on reducing climate change impacts and energy security than the general population (by about 2-4 pp). In contrast, those with high incomes value climate change mitigation, air quality improvements and the lowering of fuel imports from Russia by 4-5 pp more than the average respondent.

Additionally, people who spend a large share of their income on energy or individual transportation value the attributes less than the general population. Firstly, the value of reducing Russian fuels purchases is lower by almost 3 pp among those who spend a high share of their income on energy. Secondly, respondents who spend a high share of income on transportation are less willing to pay for better air quality than the average respondent by 3 pp.

[10] We note that two variables related to income also differentiate the valuation of attributes. These are: (i) education (ii) occupation type. Namely, respondents with tertiary education and those working white-collar jobs demonstrated higher valuations across all attributes included in the experiment.

Figure 3. Willingness to pay for attributes in the total sample and selected interactions (%)



Note: the Y-axis represents how much income an average respondent is willing to forego for a specific attribute. Attribute levels are as follows: Climate change impacts: (1) Major; (2) Limited; (3) Minimal; Diseases caused by poor air quality: (1) No change; (2) Limited by half; (3) Limited to a minimum. Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.

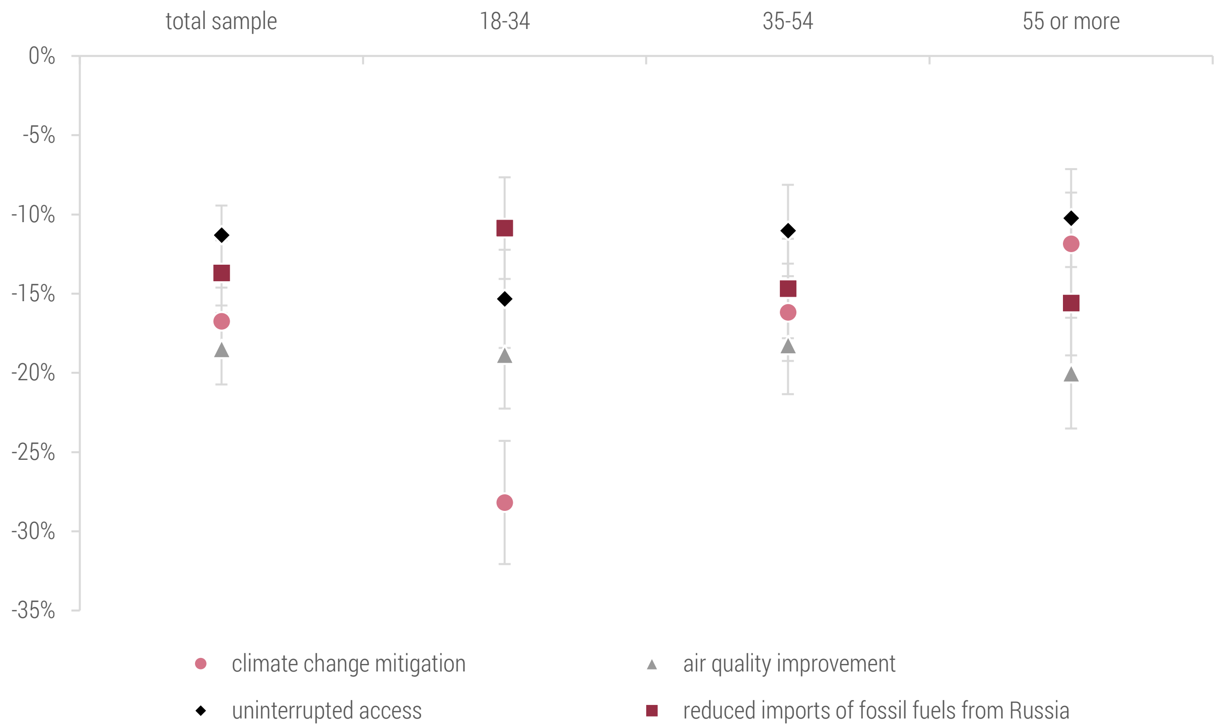
Source: own calculations using data gathered for the experiment.

Next, age is a critical factor for stated preferences for particular attributes (Figure 4). On average, the younger the respondent, the more willing they are to forego income to mitigate climate change (28% willingness to pay among the youngest, compared to 12% among the oldest respondents). This result is consistent with previous research that identified age as one of the best predictors of attitudes towards climate change (Douenne and Fabre, 2020). It is intuitive, as younger people are more likely to experience the consequences of climate change and, therefore, have a greater stake in addressing it. Conversely, older people prioritise more immediate issues that affect their living conditions, such as diseases caused by poor air quality.

An interesting age divide is also reflected in the willingness to pay to reduce imports of fossil fuels from Russia, with young respondents showing a lower WTP (11%) compared to older respondents (16%). This difference might be the result of various life experiences, as older people have experienced Russian influence on Polish politics or shortages in energy supplies. Older generations who remember these experiences feel a stronger solidarity with Ukraine and are more willing to forego money to weaken Russian capacities to finance the war.[11]

[11] Political orientation is also an important factor that consistently shapes attitudes towards carbon taxes (Levi, 2021). Right-leaning individuals are generally less willing to pay to mitigate climate change impacts and improve air quality (by 5 pp and 3

Figure 4. Willingness to pay for attributes in the total sample and selected subgroups (%)



Note: the Y-axis represents how much income an average respondent is willing to forego for a specific attribute. Attribute levels are as follows: Climate change impacts: (1) Major; (2) Limited; (3) Minimal; Diseases caused by poor air quality: (1) No change; (2) Limited by half; (3) Limited to a minimum. Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

Next, we discuss on differences related to characteristics that are difficult to observe but play a critical role in defining attitudes, such as levels of trust and climate change awareness (Mayer and Smith, 2019). Our findings show that people with low trust and low awareness of the adverse effects of climate change demonstrate a substantially lower willingness to pay for climate change mitigation (Figure 5). Individuals with low trust value less the improved air quality and reduced fuel imports from Russia by 4 pp (compared to the total sample). People who do not trust others would also require higher compensation if their access to energy and transportation were interrupted (by 3 pp). Conversely, people with higher trust are more willing to pay for improved air quality (by 3 pp) and reduced Russian imports (by 2 pp) compared to the general population. Finally, respondents with low levels of climate change awareness value all attributes substantially less (nearly 9 pp for Russian fuel imports, 6 pp in the case of climate change mitigation and air quality improvement).[12]

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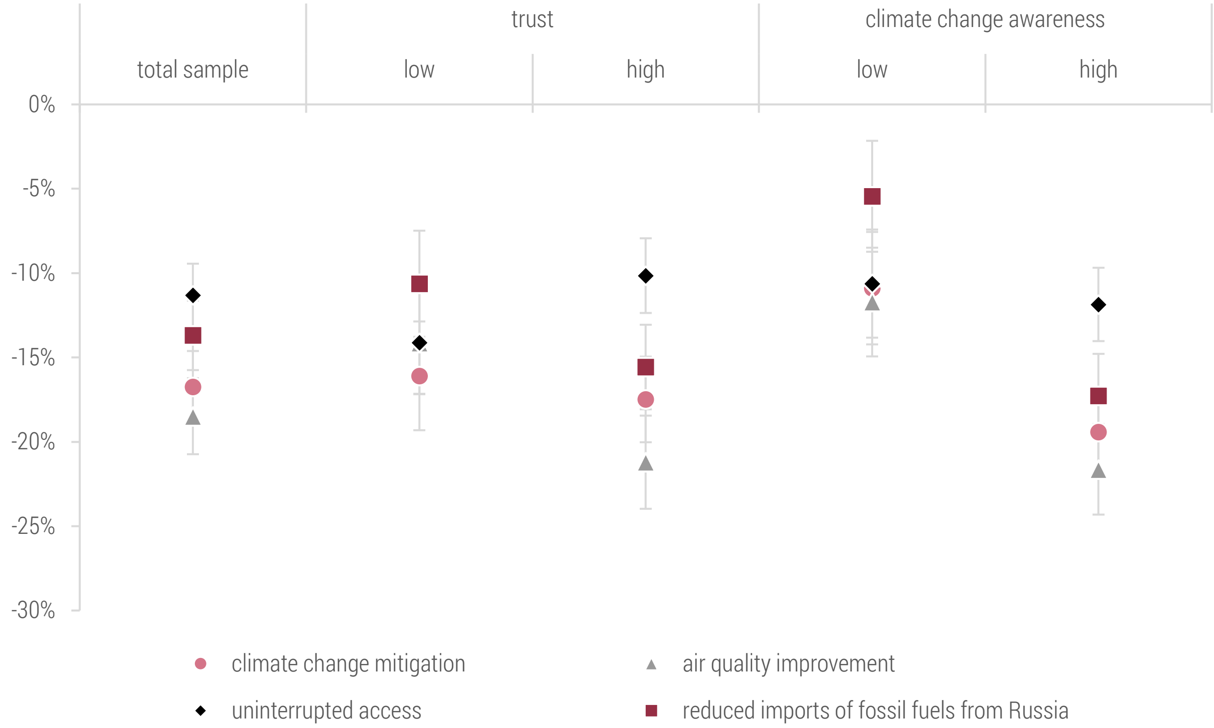
pp, respectively) than the average. In contrast, left-leaning individuals have a higher willingness to pay (by 4 pp and 7 pp, respectively). Interestingly, people who consider themselves centrist are less willing to pay to reduce Russian fuel imports than both left- and right-leaning respondents (11%, compared to 17% and 16%, respectively).

[12] Descriptively, the share of respondents who declared low trust and low climate change awareness is similar among all income groups. We further examine the interrelatedness of low trust and low awareness of climate change effects across income groups by running logistic regressions (see Appendix B, Table B1) in which low trust and low climate change were

Figure 5. Willingness to pay for attributes in the total sample and selected subgroups (%)



Note: the Y-axis represents how much income an average respondent is willing to forego for a specific attribute. Attribute levels are as follows: Climate change impacts: (1) Major; (2) Limited; (3) Minimal; Diseases caused by poor air quality: (1) No change; (2) Limited by half; (3) Limited to a minimum. Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

Additionally, we explore the interaction between two sets of variables: (i) trust and income, (ii) awareness of climate change effects and income (Table X). The purpose of examining these interactions is to separate the relationship between income, trust, climate change awareness, and the valuation of particular attributes, and how sensitive the latter is to interactions between these variables, knowing that the three former characteristics are correlated. Our findings indicate that the most pronounced differences in attribute valuation occur between the groups of high income with high trust and low income with low trust. This notable disparity in attribute valuation underscores the interplay of income and trust or climate change awareness in shaping environmental policy perspectives. It is more pronounced than the variations observed within low income groups with differing trust or awareness levels or within high income groups with varying trust/awareness. Such findings imply that the combination of economic status and trust in others or awareness about climate change impacts plays a more significant role in influencing attitudes towards environmental policies than social capital alone. This suggest that while trust and climate change

dependent variables. We find that both characteristics are correlated with low incomes, and the higher the income, the lower the probability that respondents have low trust or low awareness of climate change effects. For example, the probability of declaring low trust among respondents from the first income quartile is 27 pp higher compared to the fourth quartile.

awareness are important factors, their relation to policy acceptance and attribute valuation is substantially amplified or moderated by an individual's economic status.[13]

Table 5. Willingness to pay in selected subpopulations (continued in Appendix B, Table B3)

Interaction	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
Low income x low trust	-17.3 (-23.7; -10.8)	-11.9 (-17.9; -5.8)	-12.6 (-6.5; -18.7)	-4.8 (-11.6; 2.0)
Low income x high trust	-13.6 (-18.9; -8.3)	-15.9 (-21.0; -10.7)	-5.5 (-0.5; -10.4)	-14.1 (-19.3; -9.0)
High income x low trust	-16.7 (-22.6; -10.9)	-18.2 (-23.8; -12.7)	-13.6 (-7.5; -19.6)	-15.3 (-21.1; -9.5)
High income x high trust	-24.6 (-29.1; -20.1)	-26.3 (-30.8; -21.8)	-7.8 (-3.9; -11.7)	-19.9 (-24.2; -15.6)
Low income x low awareness of climate change	-9.6 (-15.9; -3.4)	-6.3 (-12.3; -0.4)	-8.0 (-2.0; -14.1)	-2.0 (-8.7; 4.7)
Low income x high awareness of climate change	-18.3 (-23.7; -12.9)	-18.9 (-24.1; -13.6)	-8.6 (-3.7; -13.6)	-15.1 (-20.4; -9.9)
High income x low awareness of climate change	-17.2 (-23.8; -10.7)	-19.8 (-25.8; -13.8)	-8.2 (-1.9; -14.5)	-7.2 (-13.5; -1.0)
High income x high awareness of climate change	-23.6 (-27.8; -19.3)	-24.6 (-28.9; -20.4)	-10.3 (-6.5; -14.2)	-22.2 (-26.4; -18.0)

Source: own calculations using data gathered for the experiment.

These findings have important implications for understanding willingness to pay. Firstly, differences in attribute valuation can be addressed through targeted transfers to low-income respondents to improve their economic position. Secondly, individuals who do not believe in the adverse effects of climate change allotted substantially lower valuations than those with a higher awareness of climate change concerns. Knowing the differences in willingness to pay is essential step in analysing the variations among diverse household groups in their likelihood to accept a carbon tax. Consequently, it will allow to identify if and which redistribution measures could effectively minimise their aversion or enhance their acceptance of this policy measure.

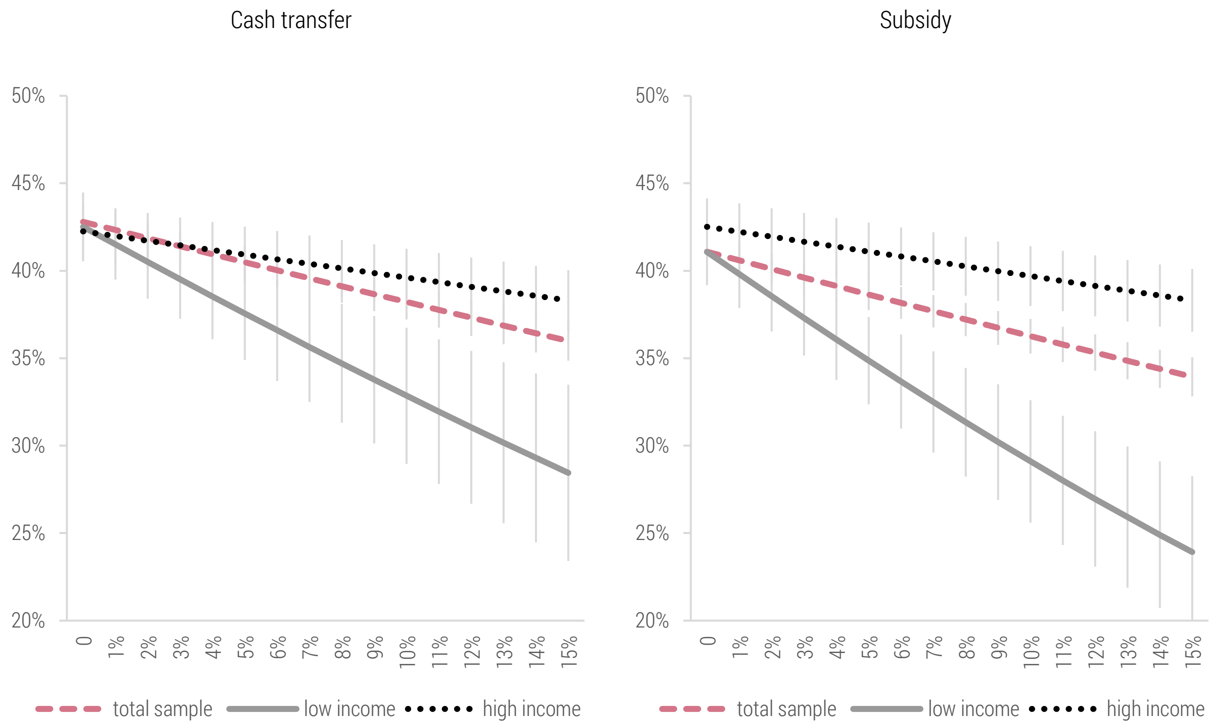
4.2. Minimising carbon tax aversion with redistribution measures

Our findings indicate that income penalties decrease the probability of accepting a carbon tax, while premiums do not bolster policy acceptance. Consequently, we concentrate on the disparities among heterogeneous groups of households, aiming to discern whether their aversion to carbon tax can be effectively minimised through different redistribution measures. First, we find that individuals with low incomes have substantially higher aversion towards

[13] Finally, we examined the results of interactions separated into dummy variables representing each attribute level, Table B4 in Appendix. In all cases, our results remained robust and reliable, helping to understand the willingness to pay for particular policy objectives (e.g. limiting Russian fuel imports by half or completely).

a carbon tax, compared to people with high incomes.[14] Second, we provide suggestive evidence that preferences for redistribution measures differ between low- and high-income households. Low-income households prefer cash transfers as a redistribution measure, whereas high-income households prefer subsidies for investments in green technologies (Figure 6). Low-income households also display a greater aversion to carbon taxes, even at low rates such as 5% (when paired with a subsidy) and 8% (when paired with a cash transfer). Therefore, a carbon tax paired with a cash transfer reduces tax aversion among people with low incomes more effectively than redistributing revenues through subsidies. High-income households have a lower carbon tax aversion than the general populace. For this particular group, subsidies for green investments would work better in minimising their tax aversion – contrary to the case of low-income respondents.[15]

Figure 6. Predicted probabilities of respondents choosing a carbon tax paired with a cash transfer or subsidy, conditional on differences in income after introducing the policy measure (%)



Note: the figure shows predicted acceptance probabilities for a carbon tax coupled with a cash benefit (left) and a carbon tax coupled with a full investment subsidy (right). Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

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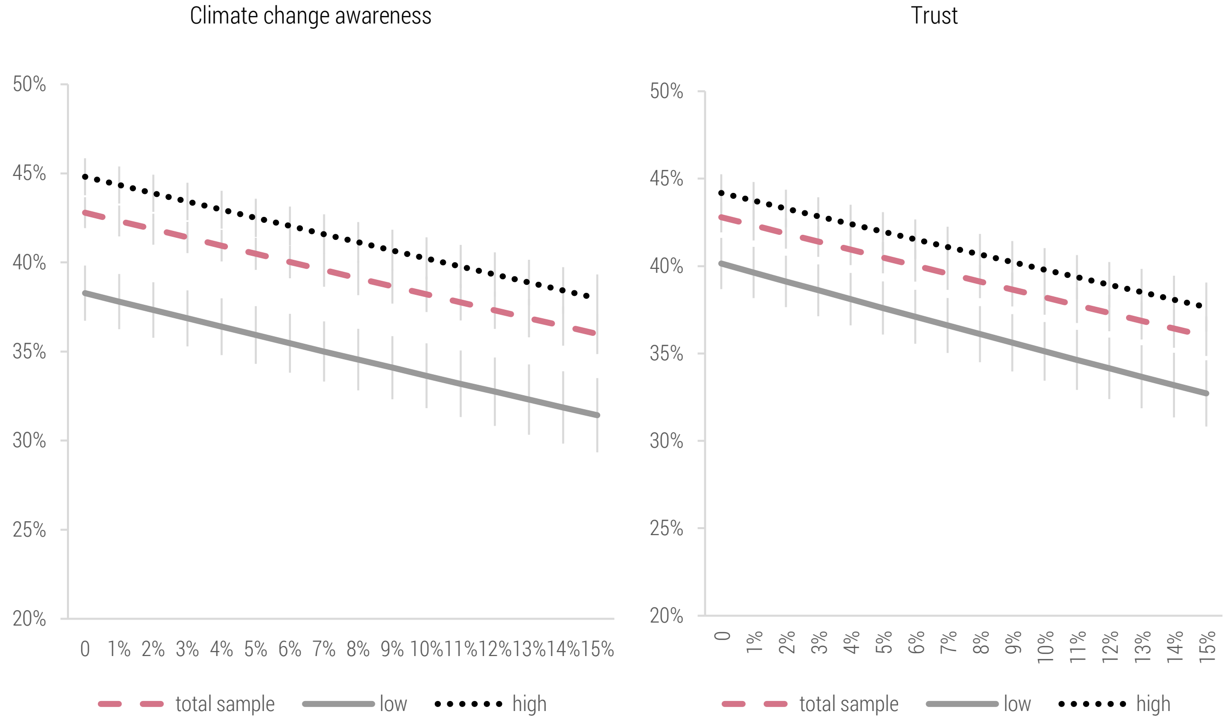
[14] Overall, our findings are consistent with previous studies that examined the differences in carbon tax aversion between low- and high-income households (Sommer et al., 2022). The results also align with macro-microeconomic modelling simulations for Poland, which suggest supporting households directly as the most effective and progressive revenue recycling scheme (Antosiewicz et al., 2022a).

[15] Additionally, we find that car owners and people who heat their homes with coal or gas have a similar aversion to a carbon tax to the general population, and therefore, a means-tested approach may be effective than policies targeted at owners of particular heating technologies or vehicles. We present the results in figure B1 and B2 in Appendix.

Finally, we test the probability to accept a carbon tax paired with a redistribution measure[16] among groups defined by two latent characteristics, namely awareness of adverse effects of climate change and trust. We have shown that these features are key in shaping preferences for the effects of a carbon tax. Generally, people who are unaware of the negative effects of climate change or who do not trust others follow a similar pattern compared to people with low incomes. Their acceptance of a carbon tax paired with a redistribution measure is significantly lower compared to individuals with high trust and knowledge about adverse effects of climate change, or the average in our sample (Figure 7). Thus, alongside a means-tested approach targeting low-income groups, it is advisable to also consider enhancing social capital. This strategy should incorporate the preferences of groups characterised by less observable traits, such as climate change awareness or trust levels.

Figure 7. Predicted probabilities of respondents choosing a carbon tax paired with a cash transfer, conditional on differences in income after introducing the policy measure (%)



Note: the figure shows predicted acceptance probabilities for a carbon tax coupled with a cash benefit (left) and a carbon tax coupled with a full investment subsidy (right). Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

4.3. Alternative mechanisms and robustness

In this section, we present the results of an alternative mechanism and several robustness tests we conducted to assess the reliability and consistency of our findings.

[16] We present the results for subsidy in the figure B2 in Appendix B.

First, we tested alternative mechanism, and estimated the model outlined in equation (2) for specific subpopulations instead of incorporating interactions with the variables of interest (refer to Table 4).[17] The disparities we identify in these estimations served to validate the robustness of our chosen approach, which prioritises interactions over subpopulations. Notably, we observe two differences in attribute valuation between respondents with low and high incomes when focusing on subpopulations rather than interactions (for the air quality and limiting imports from Russia attributes). These differences can be due to the presence of unaccounted-for heterogeneity within the subpopulation, therefore the model estimated on subpopulations might not fully capture the complexities inherent in the diverse characteristics of these subgroups. However, in other instances, our results prove consistent across all subgroups, affirming the reliability of our findings.

Table 4. Willingness to pay in selected subpopulations (continued in Appendix B, Table B2)

subpopulation	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
high income	-19.2 (-25.6; -12.8)	-18.3 (-24.8; -11.9)	-9.6 (-4.4; -14.7)	-12.7 (-18.4; -7)
low income	-18.2 (-21.7; -14.7)	-19.5 (-23.1; -15.9)	-8 (-5.1; -10.9)	-15.5 (-18.9; -12.1)
high awareness of climate change	-18.6 (-21.1; -16.1)	-20.7 (-23.4; -18)	-11.4 (-9.2; -13.5)	-16.6 (-19.1; -14.1)
low awareness of climate change	-11.5 (-15.3; -7.7)	-12.5 (-16.4; -8.7)	-11.2 (-7.4; -15)	-5.5 (-9.1; -1.9)
18-34	-23.7 (-27.4; -19.9)	-15.8 (-18.9; -12.7)	-12.9 (-10.1; -15.7)	-9.1 (-11.9; -6.3)
35-54	-14.3 (-17.3; -11.4)	-16.3 (-19.3; -13.2)	-9.7 (-7.1; -12.4)	-13.1 (-16.2; -10.1)
55 or more	-13.8 (-18; -9.7)	-23.3 (-28.7; -17.8)	-12 (-8; -16)	-18.2 (-22.9; -13.5)

Source: own calculations using data gathered for the experiment.

Next, we performed robustness checks to validate the reliability and consistency of our findings. We estimated our models on the entire dataset. It included individuals identified as protest voters (e.g. those who always chose the left/right panel) and those who completed the survey relatively quickly (the 5% of the respondents who took the least time to complete the experiment). By including these subgroups, we aimed to ensure that our results were not skewed by selective sampling. This robustness check affirmed that our results remained consistent and robust (Table 5).[18]

Table 5. Willingness to pay estimated on a total sample (including protest voters)

interaction	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
high income	-23.8 (-27.8; -19.7)	-24.9 (-28.8; -20.9)	-10.1 (-6.5; 13.6)	-20.9 (-24.8; -17.0)

[17] The mean marginal effects are reported in Appendix B, Table B1.

[18] For clarity we present only the heterogeneities presented in the paper, the additional robusnteness checks are available at a request.

low income	-16.1 (-20.1; -12.2)	-15.5 (-19.3; -11.7)	-9.0 (-5.4; 12.5)	-9.7 (-13.5; -6.0)
high awareness of climate change	-20.6 (-23.3; -17.8)	-23.2 (-26.0; -20.3)	-12.6 (-10.3; -14.9)	-18.6 (-21.3; -16.0)
low awareness of climate change	-12.2 (-15.5; -8.8)	-11.3 (-14.5; -8.0)	-10.6 (-7.3; 13.8)	-6.1 (-9.4; -2.9)
high trust	-18.8 (-21.5; -16.1)	-21.7 (-24.5; -18.8)	-10.7 (-8.4; -13.0)	-16.5 (-19.1; -13.9)
low trust	-16.6 (-20.0; -13.3)	-15.4 (-18.6; -12.3)	-14.4 (-11.3; -17.6)	-11.6 (-14.8; -8.4)
18-34	-29.8 (-33.9; -25.7)	-19.5 (-23.1; -16.0)	-15.8 (-12.6; -19.1)	-9.7 (-12.9; -6.4)
35-54	-17.2 (-20.4; -13.9)	-18.9 (-22.1; -15.7)	-12.4 (-9.4; -15.4)	-15.5 (-18.8; -12.3)
55 or more	-12.6 (-15.9; -9.2)	-20.8 (-24.4; -17.1)	-9.9 (-6.7; -13.0)	-17.9 (-21.3; -14.4)

Source: own calculations using data gathered for the experiment.

Additionally, we conducted analyses on an unweighted sample. This was done to assess the impact of our weighting methodology on the results and to ensure that the findings were not artifacts of the weighting process. The outcomes remained consistent across both weighted and unweighted samples, reinforcing the robustness of our findings (Table 6).

Table 6. Willingness to pay estimated on an unweighted sample

interaction	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
high income	-23.6 (-26.8; -20.5)	-21.5 (-24.5; -18.5)	-9.5 (-6.7; -12.3)	-17.6 (-20.6; -14.6)
low income	-14.1 (-17.7; -10.6)	-13.1 (-16.4; -9.7)	-8.9 (-5.6; -12.2)	-9.7 (-13.2; -6.3)
high awareness of climate change	-21.2 (-23.5; -19.0)	-20.1 (-22.2; -18.0)	-11.1 (-9.3; -12.8)	-16.9 (-18.9; -14.9)
low awareness of climate change	-12.2 (-14.9; -9.4)	-11.1 (-13.8; -8.4)	-10.0 (-7.3; -12.7)	-4.9 (-7.6; -2.1)
high trust	-19.3 (-21.5; -17.1)	-19.4 (-21.6; -17.2)	-9.5 (-7.7; -11.3)	-15.3 (-17.4; -13.2)
low trust	-17.9 (-20.6; -15.1)	-14.4 (-16.9; -11.9)	-13.4 (10.8; 15.9)	-10.3 (-12.9; -7.7)
18-34	-26.9 (-30.1; -23.6)	-18.4 (-21.2; -15.6)	-13.9 (-11.3; -16.6)	-11.0 (-13.7; -8.3)
35-54	-17.3 (-20.0; -14.7)	-17.0 (-19.6; -14.5)	-9.4 (-7.0; -11.8)	-15.0 (-17.6; -12.4)
55 or more	-12.5 (-15.3; -9.7)	-18.6 (-21.6; -15.7)	-10.0 (-7.3; -12.7)	-15.3 (-18.3; -12.4)

Source: own calculations using data gathered for the experiment.

Finally, we merge these two approaches for a robustness check as we re-estimate the model on a sample including all observations without weights (Table 7). Overall, the consistent results across different sample types and analytical methods demonstrate the resilience of our findings to various testing conditions. Our findings, therefore, hold significant relevance and can be considered robust for policy formulation and further academic exploration in similar socio-economic contexts.

Table 7. Willingness to pay estimated on the total and unweighted sample

interaction	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
high income	-25.4 (-28.8; -22.0)	-22.9 (-26.1; -19.7)	-10.1 (-7.1; -13.0)	-19.5 (-22.7; -16.3)
low income	-15.3 (-18.6; -12.0)	-13.9 (-17.0; -10.8)	-9.8 (-6.8; -12.9)	-8.9 (-12.0; -5.8)
high awareness of climate change	-22.4 (-24.8; 20.1)	-21.5 (-23.8; -19.3)		-18.1 (-20.3; -16.0)
low awareness of climate change	-12.9 (-15.7; -10.1)	-10.8 (-13.5; -8.2)		-5.0 (-7.7; -2.2)
high trust	-20.3 (-22.6; -18.0)	-19.9 (-22.2; -17.7)	-9.9 (-8.0; -11.7)	-16.0 (-18.1; -13.8)
low trust	-18.6 (-21.4; -15.7)	-15.4 (-18.0; -12.8)	-14.2 (-11.6; -16.9)	-11.0 (-13.7; -8.4)
18-34	-28.4 (-31.8; -25.0)	-19.2 (-22.1; -16.3)	-14.8 (-12.0; -17.5)	-10.2 (-12.9; -7.4)
35-54	-18.0 (-20.8; -15.3)	-17.7 (-20.4; -15.1)	-10.5 (-8.0; -12.9)	-16.0 (-18.7; -13.4)
55 or more	-12.9 (-15.9; -10.0)	-19.0 (-22.0; -16.0)	-9.5 (-6.8; -12.3)	-17.1 (-20.1; -14.1)

Source: own calculations using data gathered for the experiment.

5. Discussion and conclusions

In this study, we examined the preferences towards the implementation of a carbon tax. Our analysis revealed that there is a strong aversion to carbon taxes in Poland, and implementing such policies in a country with low political trust, deep social divisions, and low climate policy priority may exacerbate social tensions. Such tensions can trigger anti-establishment movements and, in turn, effectively oppose carbon tax adoption and deflect climate policy goals in other European countries. To this end, we diagnosed and calculated the willingness to pay for climate change mitigation and improving energy security in particular groups of Polish society. We found that income plays a crucial role in shaping preferences regarding climate and energy policies, with the general population valuing climate change and energy security more than those with low incomes (a 2-4 pp difference in the share of income people were willing to forego to achieve climate goals).

Our study is the first to identify the preferences for climate change mitigation and energy security improvement of a society highly impacted by the Russian invasion of Ukraine and the energy market shocks that followed. These events have highlighted the importance of energy security and climate change mitigation for Poland, a country which heavily relied on Russia for its energy supply before the invasion. With this knowledge, policymakers can consider societal preferences regarding climate and energy policies to avoid a further worsening of social tensions.

Our study also demonstrates that redistributive policies may help mitigate the risks of social tensions associated with the introduction of carbon taxes, responding to the demand for designing recycling paths for a specific country (Lamb et al., 2020). However, these policies, in a studied country context, are unlikely to increase the acceptance of new taxes. Policymakers should, therefore, focus on introducing targeted measures to alleviate the burden of an additional tax on low-income households, as these can improve public acceptability and support of climate policies (Baranzini et al., 2017). Importantly, using carbon tax revenues to compensate lower-income households may not be the preferred option (Büchs et al., 2011), and households with higher income may be the primary driver of using carbon tax revenues as subsidies for green investments. Therefore, policymakers must consider public preferences and distributional effects when designing carbon pricing policies (Bureau, 2011), as effective policy design can improve public acceptability and support, ultimately leading to the successful implementation of carbon taxes and a reduction in carbon emissions.

Furthermore, our study highlights the importance of difficult-to-observe factors, such as attitudes and trust, in shaping preferences for climate change mitigation and energy security. Specifically, varying levels of awareness of the effects of climate change among parts of the population were related to differences in their valuation of particular potential outcomes of a carbon tax. People who were more aware of the effects of changing climate were willing to forego more income to mitigate these effects (19% vs. 11%) and decrease fossil fuel imports from Russia (17% vs. 5%). We found that increasing social capital and awareness of climate change may help build the acceptance of new policy measures and resilience to possible social tensions. Therefore, we consider crucial to involve social NGOs in climate actions and promote more socially-oriented initiatives within climate NGOs (Adger, 2003; Dombrowski, 2010). Additionally, we identified the heterogeneity of preferences among respondents of different age groups – climate change mitigation was more important for younger respondents, while older respondents preferred improvements in air quality. Hence, all efforts aimed at fostering intergenerational solidarity in the environmental domain would be advisable. Policymakers should frame the effects of a carbon tax based on these principles, as public acceptability and support for carbon pricing policies are essential for the successful implementation (Köppl and Schratzenstaller, 2022). Furthermore, the design of these policies should go beyond technical parameters, as they must include measures that address distributional consequences (Jagers et al., 2019).

Finally, our study underscores the need for policymakers to be transparent and engage in dialogue with the public to build trust and foster cooperation. The energy crisis caused by Russia's invasion of Ukraine has exerted additional pressure on the energy and climate policy agenda. Therefore, policymakers should ensure that the public is adequately informed about the causes and implications of the energy crisis, the importance of climate change mitigation, and the distributional consequences of climate policy instruments to build understanding, trust, and support for climate policies. Overall, our study suggests that policymakers should adopt a socially just approach to climate policies that balance the immediate needs of vulnerable groups with long-term climate goals while considering the heterogeneity of preferences regarding climate and energy policies.

While our study provides understanding of social preferences for mitigating climate change and improving energy security, we acknowledge its limitations. First, it is limited in its generalisability to other countries as it focuses on the context of society in Poland. Nevertheless, our findings provide useful recommendations for integrating social and climate policies in varied socio-economic contexts, especially in societies affected by the 2022 energy crisis and other Central and Eastern European countries. Second, our study relied on a survey-based approach which may be prone to biases. Aware of this fact, we used a representative sample and applied rigorous survey methods to mitigate these limitations. Third, our study is limited in capturing the complexity of social tensions and their impacts on climate policy adoption. While we refer to the Yellow Vest movement in France as an illustrative example, we did not fully capture the complexity of the social and political dynamics that could lead to new anti-systemic and anti-elitist movements. Finally, our study did not explore the potential trade-offs between climate change mitigation and other policy objectives such as economic growth, employment and social welfare. Future research could explore these trade-offs to better inform policy design and help strike a balance between multiple policy goals.

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Appendix A: Methodological details

Table A1. Information on interpreting each attribute (translated)

Attribute	Definition
Climate change impacts	Permanent changes and climate properties that affect the intensity and frequency of weather events such as droughts, floods, heavy and intense rainfall, storms, heatwaves and changes in the scale and structure of agricultural crops
Air quality	Air quality assessed by analysing the presence and concentration of substances harmful to health
Purchases of Russian fuels	Natural gas and oil imported to Poland from Russia This gas and oil is used by households (heating, cooking, refuelling cars) and industry
Access to electricity and individual transport	Access to electricity and car usage Interruptions in access: a power outage once a week for 1 hour and a ban on using cars on two Sundays a month Energy rationing means no electricity for 1 hour a day and a ban on using cars on Sundays
Climate and energy policy	Government actions designed to limit climate change by reducing the use of coal, oil and gas for energy production. As part of the climate and energy policy, the government may, for example, introduce environmental fees, i.e. a tax on the use of coal, oil and gas. Tax revenues to the state budget can then finance: 1. cash transfers – a monthly amount paid unconditionally by the government to all households in Poland, 2. full subsidies for green investments – (heat pumps, photovoltaic panels), building insulation, electric car.

Source: own elaboration.

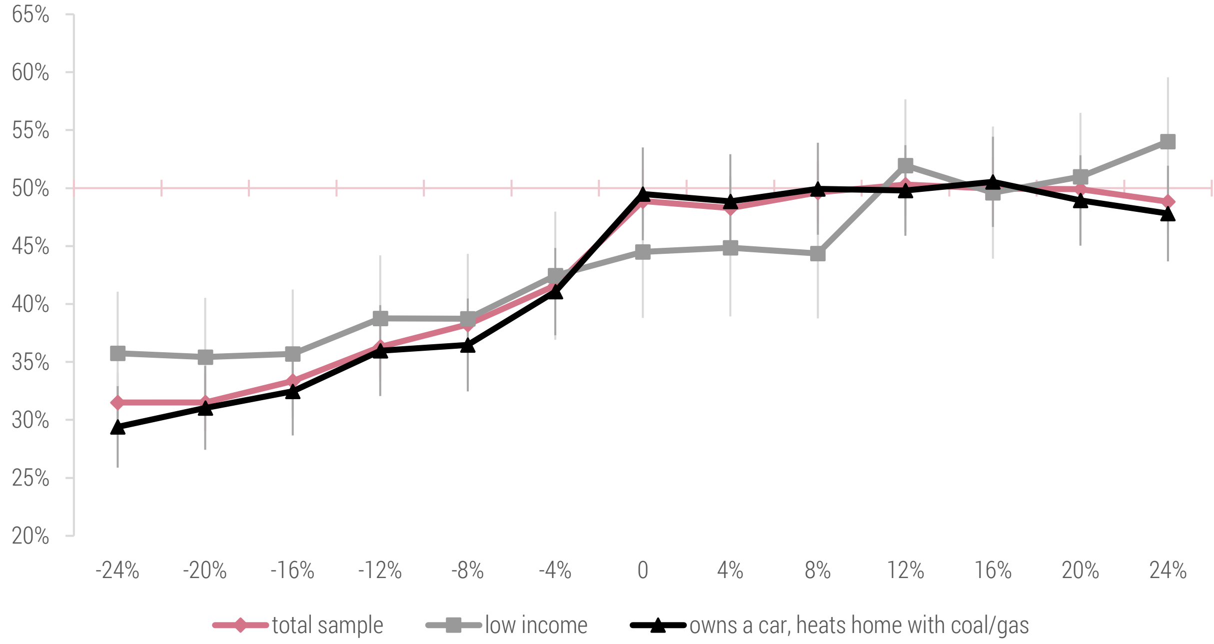
Table A2. Confidence among study participants regarding their choices

	Mean	SD	Min	Max	Q1	Median	Q3
Confidence level (points on a scale from 0-100)	69.0	21.0	0.0	100.0	56.0	71.0	85.0

Source: own calculations using data gathered for the experiment.

Appendix B: Additional results

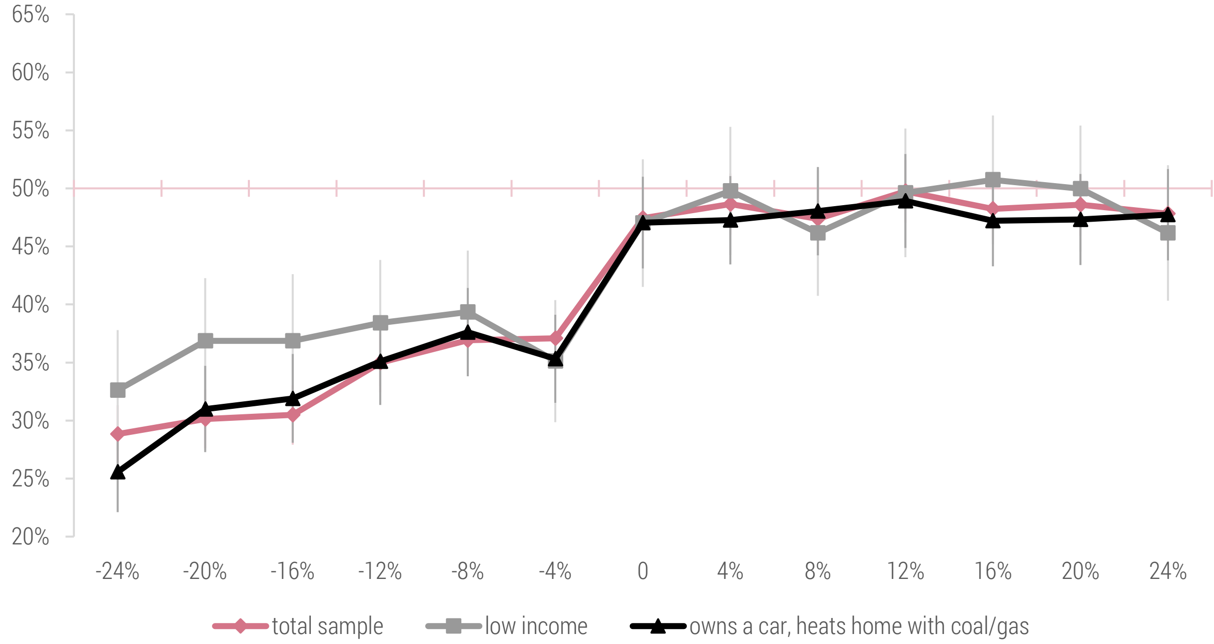
Figure B1. Predicted probabilities of respondents choosing a carbon tax paired with a cash transfer, conditional on differences in income after introducing the policy measure (%)



Note: participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.

Source: own calculations using data gathered for the experiment.

Figure B2. Predicted probabilities of respondents choosing a carbon tax paired with an investment subsidy, conditional on differences in income after introducing the policy measure (%)



Note: participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.

Source: own calculations using data gathered for the experiment.

Figure B3. Predicted probabilities of respondents choosing a carbon tax paired with a subsidy, conditional on differences in income after introducing the policy measure (%)

Note: the figure shows predicted acceptance probabilities for a carbon tax coupled with a cash benefit (left) and a carbon tax coupled with a full investment subsidy (right). Participants had to choose between introducing a carbon tax and a status quo. Among the vignettes with a carbon tax, 50% contained a carbon tax paired with an unconditional cash transfer, while the other 50% were paired with a full subsidy for investments in a new heating source, a PV installation, or an electric car. Sample sizes refer to the total number of vignettes presented.
Source: own calculations using data gathered for the experiment.

Table B1. Marginal effects from logistic regressions

	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels	Climate change impacts
high income	0.441*** (0.034)	0.473*** (0.033)	-0.195*** (0.033)	0.370*** (0.033)	2.020*** (0.088)
low income	0.304*** (0.041)	0.287*** (0.039)	-0.165*** (0.039)	0.210*** (0.041)	2.005*** (0.087)
Above double the median energy spending[19]	0.340*** (0.039)	0.313*** (0.036)	-0.258*** (0.035)	0.228*** (0.037)	2.016*** (0.088)

[19] The share of actual energy expenditures is higher than twice the median of this value in the sample.

Above double the median transport spending	0.329*** (0.040)	0.298*** (0.042)	-0.213*** (0.039)	0.263*** (0.041)	2.005*** (0.087)
Below double the median energy spending	0.352*** (0.021)	0.410*** (0.021)	-0.228*** (0.020)	0.305*** (0.021)	2.060*** (0.089)
Below double the median transport spending	0.354*** (0.021)	0.406*** (0.020)	-0.242*** (0.020)	0.290*** (0.020)	2.072*** (0.089)
car owners	0.359*** (0.034)	0.372*** (0.033)	-0.264*** (0.035)	0.336*** (0.035)	2.011*** (0.087)
coal/gas heating	0.361*** (0.052)	0.421*** (0.050)	-0.221*** (0.048)	0.298*** (0.051)	2.014*** (0.087)
without a car or coal/gas heating	0.336*** (0.051)	0.406*** (0.050)	-0.188*** (0.046)	0.258*** (0.048)	2.002*** (0.087)
low trust	0.325*** (0.031)	0.285*** (0.028)	-0.285*** (0.029)	0.214*** (0.031)	2.017*** (0.087)
high trust	0.361*** (0.023)	0.438*** (0.023)	-0.209*** (0.022)	0.321*** (0.022)	2.064*** (0.089)
high awareness of climate change	0.406*** (0.022)	0.452*** (0.022)	-0.248*** (0.021)	0.361*** (0.022)	2.090*** (0.090)
low awareness of climate change	0.218*** (0.033)	0.234*** (0.031)	-0.212*** (0.031)	0.109*** (0.033)	1.998*** (0.087)
18-34	0.572*** (0.033)	0.382*** (0.032)	-0.311*** (0.029)	0.220*** (0.032)	2.028*** (0.088)
34-54	0.326*** (0.029)	0.367*** (0.028)	-0.222*** (0.028)	0.296*** (0.029)	2.016*** (0.088)
55 or more	0.240*** (0.032)	0.406*** (0.032)	-0.207*** (0.031)	0.316*** (0.032)	2.028*** (0.088)
left	0.435*** (0.034)	0.508*** (0.033)	-0.184*** (0.032)	0.344*** (0.034)	2.035*** (0.088)
centre	0.347*** (0.028)	0.347*** (0.027)	-0.239*** (0.026)	0.221*** (0.027)	2.018*** (0.088)
right	0.252*** (0.037)	0.313*** (0.034)	-0.292*** (0.035)	0.326*** (0.036)	2.018*** (0.087)
social	0.327*** (0.035)	0.379*** (0.034)	-0.192*** (0.033)	0.331*** (0.034)	2.020*** (0.088)
central	0.304*** (0.032)	0.336*** (0.031)	-0.262*** (0.030)	0.180*** (0.031)	2.014*** (0.088)
liberal	0.404*** (0.030)	0.431*** (0.029)	-0.248*** (0.029)	0.337*** (0.030)	2.032*** (0.088)
N			87,736		

Source: own calculations using data gathered for the experiment.

Table B2. Willingness to pay interacted with particular socio-economic characteristics (continued from Table 4)

interaction	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
left	-20.8 (-24.9; -16.6)	-24 (-28.6; -19.5)	-8.5 (-5.4; -11.7)	-16.4 (-20.3; -12.5)
centre	-16.4 (-19.4; -13.3)	-16.2 (-19.3; -13.1)	-11.1 (-8.4; -13.9)	-10.4 (-13.2; -7.6)
right	-13 (-17.2; -8.8)	-16.5 (-21; -12)	-14.9 (-10.7; -19.2)	-16.7 (-21.3; -12.1)
social	-16 (-20.1; -11.9)	-18.9 (-23.3; -14.4)	-9.6 (-6.1; -13.1)	-16.3 (-20.5; -12.1)
central	-16.2 (-20.2; -12.2)	-18.2 (-22.6; -13.9)	-14.3 (-10.5; -18.1)	-9.9 (-13.6; -6.2)
liberal	-17.4 (-20.5; -14.3)	-18.5 (-21.7; -15.3)	-10.4 (-7.8; -13)	-14.5 (-17.5; -11.6)
women	-19.4 (-22.2 ; -16.6)	-19.7 (-22.5 ; -16.9)	-12.0 (-9.5 ; -14.4)	-13.0 (-15.5 ; -10.4)
men	-14.4 (-17.3 ; -11.6)	-17.9 (-20.9 ; -14.9)	-11.1 (-8.4 ; -13.8)	-15.1 (-18.1 ; -12.2)
rural	-18.0 (-21.5 ; -14.6)	-19.1 (-22.5 ; -15.7)	-9.8 (-6.8 ; -12.9)	-12.4 (-15.7 ; -9.1)
urban	-16.6 (-19 ; -14.1)	-18.7 (-21.2 ; -16.1)	-12.3 (-10.1 ; -14.5)	-14.6 (-17 ; -12.2)
Multifamily	-18.1 (-21 ; -15.1)	-19.0 (-22 ; -16)	-11.9 (-9.1 ; -14.6)	-12.0 (-14.9 ; -9.2)
Detached	-16.4 (-19.1 ; -13.7)	-18.8 (-21.5 ; -16)	-11.3 (-8.9 ; -13.7)	-15.4 (-18 ; -12.7)
Buildings built until 1980	-17.4 (-20.2 ; -14.6)	-18.9 (-21.9 ; -16)	-11.4 (-8.8 ; -13.9)	-13.5 (-16.2 ; -10.8)
Buildings built after 1981	-16.7 (-19.4 ; -14)	-18.8 (-21.5 ; -16.1)	-11.8 (-9.4 ; -14.2)	-14.7 (-17.3 ; -12.1)
employed	-20.1 (-22.7 ; -17.5)	-18.4 (-21 ; -15.8)	-12.5 (-10.1 ; -14.8)	-13.7 (-16.1 ; -11.2)
Unemployed	-12.6 (-15.8 ; -9.4)	-19.6 (-22.9 ; -16.2)	-10.2 (-7.3 ; -13.1)	-14.5 (-17.7 ; -11.3)
Primary, secondary education	-18.2 (-20.5 ; -15.9)	-18.3 (-20.6 ; -16.1)	-11.2 (-9.3 ; -13.2)	-15.0 (-17.1 ; -12.8)
Tertiary education	-24.3 (-27.8 ; -20.8)	-21.2 (-24.6 ; -17.8)	-10.0 (-7.1 ; -13)	-20.6 (-24 ; -17.2)
Blue-collar occupations	-13.3 (-18.1 ; -8.5)	-15.1 (-20 ; -10.3)	-13.9 (-8.9 ; -18.9)	-8.7 (-13.6 ; -3.9)
White-collar occupations	-22.5 (-26.3 ; -18.7)	-21.6 (-25.3 ; -17.9)	-10.7 (-7.2 ; -14.1)	-19.0 (-22.8 ; -15.2)

Source: own calculations using data gathered for the experiment.

Table B3. Willingness to pay for attributes of selected subgroups (continued from Table 5)

subpopulation	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
Above 2M energy spending	-20.1 (-26.1; -14.2)	-19.1 (-24.9; -13.2)	-15.3 (-10; -20.6)	-13.4 (-18.6; -8.2)
Above 2M transport spending	-20.2 (-26.7; -13.6)	-18.4 (-24.8; -12.1)	-13.4 (-7.8; -18.9)	-16.5 (-22.5; -10.5)
Below 2M energy spending	-15.8 (-18; -13.6)	-18.4 (-20.8; -16)	-10.3 (-8.3; -12.3)	-13.7 (-15.9; -11.5)

Below 2M transport spending	-16.1 (-18.3; -13.9)	-18.4 (-20.8; -16)	-11.1 (-9.1; -13)	-13.3 (-15.5; -11.1)
car owners	-16.2 (-19.9; -12.6)	-16.6 (-20.4; -12.8)	-11.7 (-8.3; -15.1)	-15.3 (-19.1; -11.5)
coal/gas heating	-20 (-27.9; -12.1)	-24.6 (-33.1; -16)	-12.4 (-6.1; -18.6)	-17.5 (-25.1; -9.8)
without a car or coal/gas heating	-16.7 (-22.6; -10.9)	-19.9 (-26.3; -13.4)	-9.2 (-4.4; -14)	-13.3 (-18.7; -7.8)
low trust	-15.3 (-18.7; -11.9)	-13.6 (-16.8; -10.4)	-13.7 (-10.5; -17)	-10.1 (-13.2; -6.9)
high trust	-17.4 (-20; -14.7)	-21.2 (-24.2; -18.2)	-10 (-7.8; -12.3)	-15.4 (-18.1; -12.8)

Source: own calculations using data gathered for the experiment.

Table B4. Willingness to pay interacted with particular attribute levels

Interaction	Attribute level	Climate change impacts	Diseases caused by poor air quality	Access to electricity and individual transport	Purchases of Russian fuels
high income	1	-8.2 (-11.3; -5.1)	-4 (-6.9; -1.1)	3.4 (6.4; 0.4)	-1.4 (-4.5; 1.7)
	2	-13.8 (-17.1; -10.4)	-18.8 (-22.3; -15.2)	-12.9 (-9.6; -16.3)	-16.5 (-20; -12.9)
low income	1	-6.6 (-10.3; -2.9)	0.2 (-3.4; 3.9)	-1.1 (2.6; -4.8)	-1.1 (-5; 2.8)
	2	-8.9 (-12.8; -5)	-14.3 (-18.4; -10.2)	-7.3 (-3.3; -11.3)	-9.2 (-13.3; -5.2)
high awareness of climate change	1	-7.1 (-9.1; -5.1)	-2.6 (-4.5; -0.7)	1.3 (3.2; -0.6)	-1.1 (-3.1; 0.9)
	2	-12.9 (-15.2; -10.7)	-18.9 (-21.5; -16.4)	-13 (-10.7; -15.2)	-16.4 (-18.8; -14)
low awareness of climate change	1	-5.5 (-8.6; -2.3)	-1 (-4; 2)	-0.2 (2.8; -3.2)	-1.3 (-4.5; 1.8)
	2	-5.7 (-8.7; -2.6)	-10.8 (-14.1; -7.5)	-10.8 (-7.5; -14)	-3.8 (-7.2; -0.5)
18-34	1	-10.6 (-13.5; -7.6)	-4.4 (-7.2; -1.6)	3 (5.8; 0.3)	-1.4 (-4.3; 1.4)
	2	-16.9 (-20.2; -13.6)	-14.2 (-17.4; -11)	-18.4 (-15; -21.7)	-9 (-12.1; -5.9)
35-54	1	-4.9 (-7.5; -2.3)	-0.6 (-3.2; 2.1)	-1.6 (1; -4.3)	-2.2 (-4.9; 0.5)
	2	-11.7 (-14.5; -8.9)	-17.5 (-20.6; -14.5)	-9.2 (-6.4; -12)	-12.4 (-15.4; -9.5)
55 or more	1	-5.9 (-8.9; -2.9)	-2.2 (-5.1; 0.6)	1.8 (4.6; -1)	-0.2 (-3.1; 2.8)
	2	-6.5 (-9.6; -3.4)	-17.6 (-21.1; -14.1)	-11.9 (-8.7; -15.1)	-15.6 (-19; -12.2)
Above 2M energy spending	1	-4 (-7.5; -0.5)	0.2 (-3.1; 3.6)	-0.6 (2.8; -4)	-1.3 (-4.8; 2.3)
	2	-13.5 (-17.3; -9.8)	-16.3 (-20.1; -12.5)	-12.8 (-9.1; -16.6)	-10.1 (-13.7; -6.4)
Above 2M transport spending	1	-6.2 (-10; -2.4)	-0.2 (-3.8; 3.4)	1.1 (4.8; -2.5)	0.1 (-3.7; 3.9)
	2	-10.9 (-14.9; -6.8)	-14.9 (-19; -10.9)	-12.3 (-8.2; -16.4)	-12.9 (-17; -8.8)

Below 2M energy spending	1	-7.5 (-9.5; -5.5)	-2.9 (-4.8; -1.1)	1.3 (3.1; -0.6)	-1.2 (-3; 0.7)
	2	-9.9 (-12; -7.9)	-16.7 (-19.1; -14.3)	-12.2 (-10.1; -14.4)	-13.6 (-15.9; -11.3)
Below 2M transport spending	1	-6.7 (-8.6; -4.8)	-2.6 (-4.4; -0.8)	0.8 (2.6; -1.1)	-1.5 (-3.3; 0.4)
	2	-10.8 (-12.8; -8.7)	-16.9 (-19.3; -14.6)	-12.3 (-10.2; -14.4)	-12.7 (-14.9; -10.5)
car owners	1	-6.9 (-10; -3.8)	-1.9 (-5; 1.3)	-0.1 (3; -3.1)	-1.4 (-4.6; 1.8)
	2	-10.6 (-14; -7.1)	-16 (-19.6; -12.4)	-12.7 (-9.2; -16.2)	-15.4 (-19; -11.8)
coal/gas heating	1	-6.7 (-11.3; -2)	-2.3 (-6.8; 2.2)	1.7 (6.5; -3.2)	-2.8 (-7.5; 1.9)
	2	-11.7 (-16.6; -6.9)	-18.8 (-23.8; -13.7)	-12.3 (-7.4; -17.2)	-12.5 (-17.7; -7.4)
without a car or coal/gas heating	1	-6.4 (-10.8; -2.1)	-2.7 (-7.1; 1.6)	0.8 (5.1; -3.5)	0.4 (-3.8; 4.7)
	2	-10.8 (-15.5; -6.1)	-17.1 (-21.9; -12.2)	-10.6 (-6; -15.1)	-12.8 (-17.4; -8.2)
low trust	1	-4.3 (-7.1; -1.5)	-1 (-3.7; 1.8)	-0.8 (2; -3.6)	-1.4 (-4.2; 1.5)
	2	-12 (-15.1; -9)	-13.2 (-16.3; -10.2)	-13.3 (-10.2; -16.4)	-9 (-12.3; -5.8)
high trust	1	-7.8 (-10; -5.7)	-2.8 (-4.8; -0.7)	1.7 (3.7; -0.3)	-1.1 (-3.1; 1)
	2	-10.1 (-12.3; -7.9)	-18.3 (-20.9; -15.7)	-11.9 (-9.6; -14.2)	-14.6 (-17; -12.2)
left	1	-9.4 (-12.6; -6.3)	-3.9 (-6.9; -0.8)	0.9 (3.8; -2.1)	-1.5 (-4.6; 1.5)
	2	-12.5 (-15.7; -9.2)	-20.7 (-24.2; -17.2)	-9.8 (-6.6; -12.9)	-15.2 (-18.6; -11.7)
centre	1	-5.7 (-8.1; -3.2)	0 (-2.4; 2.5)	2 (4.5; -0.4)	-0.3 (-2.8; 2.2)
	2	-11.6 (-14.3; -8.9)	-17 (-20; -14)	-14.2 (-11.3; -17)	-10.9 (-13.6; -8.1)
right	1	-4.9 (-8.3; -1.4)	-3.8 (-7; -0.7)	-1.5 (1.8; -4.7)	-2.4 (-5.7; 0.9)
	2	-7.9 (-11.3; -4.4)	-11.6 (-15.1; -8.1)	-12.8 (-9.2; -16.4)	-13.6 (-17.3; -9.9)
social	1	-6.1 (-9.3; -2.9)	-3 (-6; 0)	1.4 (4.4; -1.6)	-0.1 (-3.2; 3.1)
	2	-10.8 (-14.1; -7.5)	-15.2 (-18.6; -11.7)	-10.9 (-7.6; -14.2)	-16.5 (-20.1; -12.9)
central	1	-5.3 (-8.2; -2.4)	-1 (-3.8; 1.9)	-1.2 (1.7; -4)	0.3 (-2.6; 3.3)
	2	-9.7 (-12.7; -6.7)	-15.7 (-19; -12.4)	-12 (-8.7; -15.3)	-9.2 (-12.3; -6)
liberal	1	-8.2	-2.5	2.2	-3.4

	(-10.9; -5.4)	(-5.1; 0.1)	(4.9; -0.4)	(-6.1; -0.7)
2	-12 (-14.9; -9.1)	-18.9 (-22.1; -15.7)	-14.1 (-11.2; -17)	-13.2 (-16.2; -10.1)

Source: own calculations using data gathered for the experiment.

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