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Does information help to overcome public resistance to carbon prices? Evidence from an information provision experiment

Fabienne Cantner* Geske Rolvering†

June 30, 2022

Abstract

To study how different economic information affect people's perceptions and attitudes towards carbon prices, we conduct an online survey experiment in a representative sample of the German voting population. We find that providing information about the efficiency of carbon prices as well as on international emission levels and carbon price initiatives changes people's perceptions and their support. Information about the possibility and benefits of revenue recycling, however, only affect the views of very specific subgroups of the population, such as individuals with low income or high trust in the government. Moreover, we find that none of the information affects the perceptions and support of climate change skeptics.

Keywords: climate change, climate policies, carbon pricing, information, survey experiment

JEL Classification: D72, D83, D91, H23, Q58

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1 Introduction

Climate change is one of the greatest challenges of our times. According to the Intergovernmental Panel on Climate Change (IPCC), human caused emissions have resulted in an increase in the global mean surface temperature of about 1.0℃ since the beginning of industrialization. To keep global warming well below 2.0℃ and thus prevent severe consequences for people and the environment, joint effort is required (IPCC, 2018). However, climate change mitigation can be viewed as a global public good. Contributing to this public good comes at private costs, while everyone else – regardless of their own contribution – benefits. Self-interest and collective interests are thus at odds, which creates incentives for free-riding behavior (Milinski et al., 2006; Hasson et al., 2010). To solve this dilemma, governments need to intervene by implementing effective policies which increase individual contributions to climate protection.

From a societal perspective, most economists agree that implementing a carbon price is the most efficient tool to reduce emissions, and thus an essential component of a climate change mitigation strategy (Carattini et al., 2019; Stiglitz et al., 2017). Yet, carbon prices often face strong public opposition for a number of reasons beyond economic arguments (Carattini et al., 2018, 2019). Since the effective implementation of cost-intensive policy measures strongly depends on the degree of public support (Cherry et al., 2012; Kallbekken & Sælen, 2011), it is important to understand how support for carbon prices can be increased.

In this paper, we study whether people's perceptions and attitudes towards carbon prices are influenced by different (economic) information. To this end, we conduct an online survey experiment in a representative sample of the German voting population. In the experiment we randomly assign respondents to a control group and one of three treatment groups. Each of the treatment groups receives either information about the efficiency of carbon prices, information about the potential of reversing disadvantageous distributional effects by revenue recycling, or information about international emission levels and carbon price initiatives outside Germany. We refer to these treatment groups as the "Efficiency", the "Redistribution" and the "Comparison" treatment, respectively. We then ask the respondents questions about their perceptions and views on carbon prices. The control group needs to answer the same questions without receiving any information.

Overall, we find that respondents across all treatments substantially change their perceptions when they are provided with information on specific aspects of carbon prices. Moreover, focusing on the question whether information also affect public's attitudes, we find that both the "Efficiency" and "Comparison" treatment increase respondents' support. To be precise, whereas only 41% of the respondents in the control group support the introduction of the German carbon price, both information treatments increase this share by approximately two percentage points. Providing information on the distribu-

tional implications of carbon prices, however, does not seem to have an impact on the policy views in the overall population. Since these reduced-form effects do not directly address the link between perceptions and support for carbon pricing, we furthermore estimate an instrumental variables (2SLS) model. The results indicate that support for carbon prices significantly increases by 17.1 percentage points for those respondents whose perceptions changed due to the "Efficiency" treatment. The effects of the "Redistribution" and "Comparison" treatment induced changes in respondents' perceptions indicate a positive, though insignificant, effect on support.

A heterogeneity analysis furthermore reveals that the effectiveness of the information treatments varies considerably across different societal groups. For instance, we find that individuals with low levels of income and individuals that have higher trust in the government are relatively more responsive to the "Redistribution" treatment. Moreover, we find that none of the information treatments changes the perceptions and attitudes of climate change skeptics.

Our work mainly contributes to the economic literature using information provision experiments to study the effects of information on perceptions and attitudes. For instance, several studies investigate, how information affects people's attitudes towards immigration (Bareinz & Uebelmesser, 2020; Grigorieff et al., 2020), their support for education and distributive policies (Alesina et al., 2018; Kuziemko et al., 2015; Lergetporer et al., 2020) or their views on government spending (Roth et al., 2021).[1] The literature using information provision experiments in context of environmental policies has slightly increased recently, but still remains scarce. In one of the few studies, Andre et al. (2021) find that informing respondents about the fact that 62% of Americans try to fight global warming increases individual willingness to fight climate change and raises support for different environmental policies. The same is true when respondents are provided with the information that 79% of Americans think that people in the U.S. should try to fight global warming. Another example is a paper by Douenne & Fabre (2022). In this paper the authors use an information provision experiment to study the effect of beliefs regarding the impact of a carbon tax on purchasing power, its environmental effectiveness and the progressivity of the tax scheme on policy views in France.

An important difference between these studies and our work is that our information treatments aim to improve the public's understanding of carbon prices. For this reason, two of our information treatments contain simple and neutral explanations of specific aspects of carbon prices rather than factual information. In this regard our work is most closely related to a recent paper by Stantcheva (2021) in which she studies how people reason and learn about tax policy. Specifically, the author examines how instructional videos that explain the distributional and efficiency consequences of the income and estate tax affect public's perceptions. In contrast to our results, Stantcheva (2021) finds that

[1]For details on the methodology and a review of the literature see Haaland et al. (2021).

support for both tax policies is mainly influenced by people's views on the benefits of redistribution and their fairness considerations. Efficiency concerns, however, seem to matter less.

We also contribute to a large literature in political science, sociology and economics that focuses on the determinants of public support for climate policy. Among other things, it has been shown that public perceptions of policy measures influence public attitudes towards climate policies.[2] Existing research suggests, for example, that support increases if the policy is perceived as effective and beneficial in addressing climate change or if potentially adverse distributional effects are balanced by revenue recycling (see e.g. Baranzini & Carattini (2017); Carattini et al. (2017); Kallbekken et al. (2011); Kallbekken & Sælen (2011)). On the other side of the coin, support is often shown to decrease if personal costs are perceived too high (see e.g. Tobler et al. (2012)). We thus add to this literature by studying how information that specifically address these perceptions affect people's attitudes towards carbon prices.

The remainder of the paper is organized as follows: Section 2 describes the data collection and the experimental design. Section 3 analyses respondents' views on climate change and carbon pricing *prior* to the information treatments. Section 4 describes the econometric model and presents our results. Section 5 concludes.

2 Study design

2.1 Data collection and final sample

The data for our analysis comes from an online survey experiment that was conducted in December 2020 and thus shortly before a carbon pricing scheme in the heating and transport sector was introduced in Germany. In total, we collected 3.092 responses through the commercial survey company *Respondi* (`https://www.respondi.com/EN/`).

To be more precise, Respondi emailed our survey links to their panel of German respondents. In addition to the link, the email contained information about the duration of the survey and the payment for full participation. The email did not provide any information about the purpose or content of our survey. Respondents who chose to participate in the survey were first directed to a welcome page before being asked to answer three screening questions that ensured our sample was representative in terms of age, gender, and income. Having passed these screening questions, respondents than began with the actual survey. The median time to complete the survey was 15 minutes.

Given that we know how much time a respondent spent on the survey, we drop respondents in the bottom 5% of the survey time distribution per experimental group.[3]

[2] For a comprehensive review see Drews & van den Bergh (2016).

[3] None of our results is affected by dropping these speeders (results available upon request).

Our final sample thus consists of 2.936 German residents between 18 and 69 years of age. Table A1 in the Appendix presents the descriptive statistics for the socio-demographic characteristics of this final sample.

2.2 The online survey experiment

The online survey experiment that we use for the analysis of this paper, is closely related to prior work by Alesina et al. (2022) and Stantcheva (2021). As shown in Figure 1, our survey experiment consists of six sections, three treatment groups and one control group. In the following we provide some details on our survey design. The complete questionnaire in German language is available on request. A translated version is provided in Appendix A.2.[4]

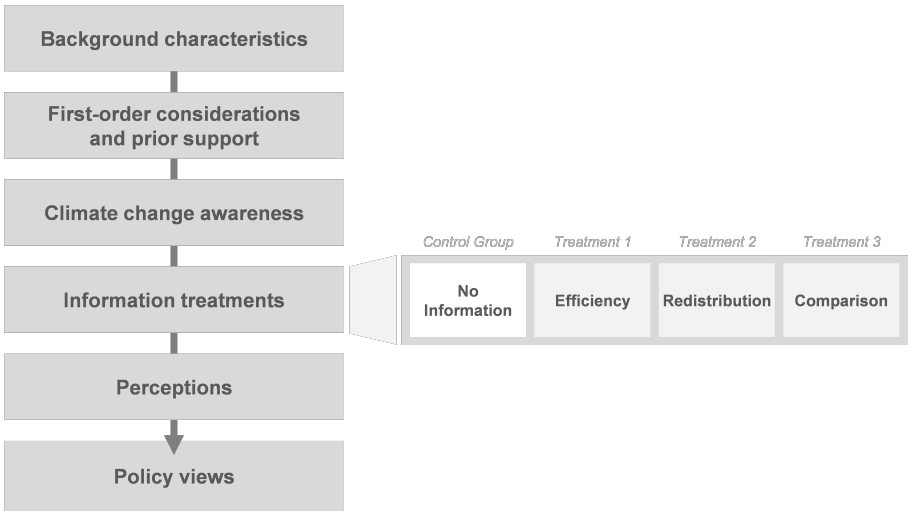


Figure 1. Overview of the survey flow.

Background characteristics The survey starts with several questions on respondents' socio-demographic characteristics. These characteristics include gender, age, household income, the number of household members, level of education, employment status, marital status, number of children, migration background, state of residence and size of the place of residence. Moreover, we collect data on respondents' political attitudes including their political affiliation, a self-assessment of their political knowledge as well as their trust in the government. Collecting these background characteristics at the beginning of the survey ensures that respondents' answers are unaffected by the information treatments.

First-order considerations and prior support To gather peoples' first-order considerations regarding carbon prices, we closely follow Stantcheva (2021) and ask respondents

[4]There are more questions in the survey than those we use in the analysis of this paper. These questions leave the potential for more future analyses.

about the first thoughts, the advantages and disadvantages that come to their minds when thinking about the introduction of the German carbon price. To avoid pushing respondents in any direction, we make use of open-end questions and encourage respondents to write as much as they like in free text-entry boxes. We then evaluate respondents' answers by means of a simple text analysis method.[5]

In addition to eliciting respondents' first-order considerations, we measure respondents' support for carbon prices prior to the information treatments on a seven-point Likert scale (1 = "Not support at all", 7 = „Fully support").

As we do not expect every respondent to know about the introduction of the carbon price in Germany, we provide respondents with the following information in advance: *"Carbon pricing is a climate policy measure that requires payments for every ton of carbon emitted. While such a carbon price has already been in place for most parts of the energy and industry sector at the European level since 2005, there will also be a price on emissions generated by the heating and transport sector in Germany as of January 2021."*

Attitudes towards climate change We then follow Andre et al. (2021) and Brüggemann et al. (2017) and measure respondents' climate change awareness by asking whether they agree that global warming exists, that it is (among others) human-caused, that global warming has serious consequences and whether they agree that scientists exaggerate the dangers of climate change. Moreover, we ask how worried they are about global warming. To ensure that the answers are not affected by the information, we ask these questions immediately before the treatments.

Information treatments At this stage of the survey respondents are randomly assigned to a control group and one of three treatment groups. Each of the treatment groups receives information about a different aspect of carbon pricing. By using this across-subject design, in which each treatment group receives only one part of the information, we are able to distinguish the effects of the three different types of information.

The first treatment informs respondents about negative externalities, the "polluter pays" principle and the carbon prices' intention to incentivize behavioral changes for individuals and firms. Since this treatment mainly deals with the efficiency of carbon prices, we refer to this treatment as the "Efficiency" treatment. The second treatment, which we refer to as the "Redistribution" treatment, provides information about the regressive nature of carbon pricing but also about its potential to reverse disadvantageous distributional effects by revenue recycling. To make the concept of revenue recycling clear, we provide examples on how the revenues from carbon pricing should be used in Germany. Because this treatment is hypothetical in nature, we cannot rule out the possibility that people do not believe the government will redistribute the revenues. If this is the case, we

[5]For details on the design and use of open-ended survey questions see Ferrario & Stantcheva (2022).

could either find no effect of the "Redistribution" treatment on support for carbon pricing, or only for those groups for whom revenue recycling is particularly important (such as individuals with low income) or who have a high level of trust in the government. The third treatment provides a social information. Specifically, it informs respondents about the actual per capita emission levels of Germany and compares it to other countries such as China, the U.S. or the EU member states. Moreover, it provides information about the number of EU member states that have a national carbon price besides the European Emissions Trading System. We call this treatment the "Comparison" treatment. The fourth group of respondents receives no information and is thus considered as control group.

All treatments consist of a written text and an accompanying graphical illustration, which aim to explain the information in a simple and neutral way. A translation of the written text and the graphical illustration of each information treatment is provided in Appendix A.2.5.

Perceptions The fifth section of the survey consists of several questions about respondents' perceptions of carbon prices. The questions thereby focus on the dimensions covered in the three treatments and mostly ask for an individual opinion. For instance, we ask *"How likely do you think is it that the introduction of the carbon price in Germany will encourage companies to invest in climate-friendly technologies?", "How much attention do you think will be paid to a socially balanced financial burden when the carbon price is introduced in Germany?"* or *"How many of the EU member states do you think currently have a national carbon price?"*.

Policy views Finally, we measure attitudes towards carbon pricing by asking respondents different questions about their policy views. Specifically, we again ask whether they support the introduction of the German carbon price (1 = "Not support at all", 7 = „Fully support") or whether they consider it to be fair (1 = "Very unfair", 5 = „Very fair"). Moreover, we use an incentivized variant of the coordination game by Krupka & Weber (2013) to elicit the (anticipated) social norm regarding the support for the German carbon price. To be precise, we ask respondents *"To what extent do you think is the introduction of the carbon price in Germany supported by the overall population?"*(1 = "Not supported at all", 7 = „Fully supported"). If participants' answer matched the mode of answers of the other participants they received a bonus payment.

In the current analysis we focus, however, only on the measure of respondents' support.

3 Status quo in Germany

3.1 Attitudes towards climate change

Support for carbon pricing likely depends on the population's attitudes towards climate change. If a large part of the population is not aware or even denies that climate change exists and that it has serious consequences, we can hardly expect support for environmental policies that lead to individual costs. Before coming to our main results, we thus have a closer look at respondents' attitudes towards climate change and their support for carbon prices *prior* to the information treatments.

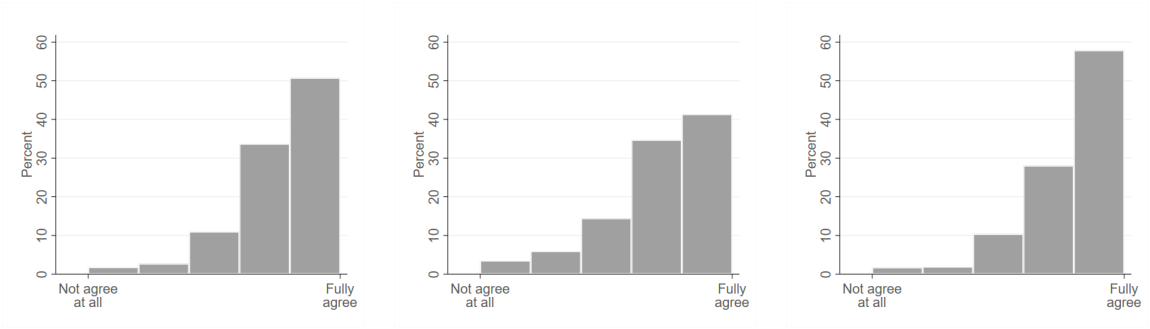
As shown in Figure 2a-2e, climate change awareness is relatively high among respondents. For instance, we find that a vast majority (more than 80%) of the respondents at least somewhat agree that there is a scientific consensus about the existence of global warming (Figure 2a). Moreover, 76% of the respondents agree that human activity is one major reason for global warming (Figure 2b), 86% of the respondents agree that global warming has serious consequences for humans and nature (Figure 2c) and almost 70% of all respondents agree that scientist do not exaggerate the dangers of climate change (Figure 2d). Moreover, in Figure 2e, we find that 72% of all respondents are worried about global warming.

In contrast, following Andre et al. (2021) and using disagreement with the different statements as a proxy for climate change skepticism, we find that less than 25% of the respondents' express doubts regarding climate change in one of the aforementioned dimensions. In the following, we cautiously call this group "climate change skeptics".

3.2 First-order considerations and support for carbon prices

We next examine respondents' views on the introduction of the German carbon price *prior* to the information treatments. Figure 2f therefore shows how support (measured on a continuous seven-point Likert scale) is distributed across all respondents. Despite the high level of climate change awareness, we find that support for the introduction of the German carbon price is relatively low. While approximately 37% of respondents at least somewhat support the introduction of the German carbon price, 40% are not much in favor of this climate policy. In addition, we find that the group of respondents that does not support the German carbon price includes a non-negligible group of respondents who strongly oppose this policy measure.

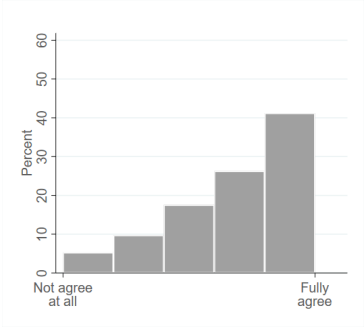
To get an idea of what lies behind people's attitudes towards carbon prices, we elicited intrinsic concerns by means of three open-end questions. We evaluate the answers to these questions using word clouds in which terms are displayed in larger or smaller font according to their frequency of use. Figure 3 shows the word clouds for each of the three



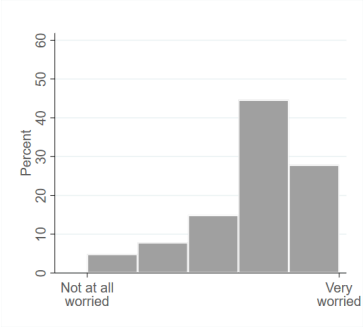
(a) Scientific consensus about global warming

(b) Human activities major reason for global warming

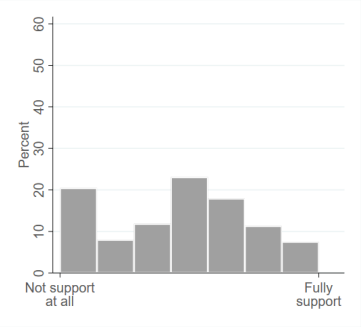
(c) Global warming has serious consequences



(d) Scientists do not exaggerate



(e) Worried about global warming



(f) Support for the German carbon price

Figure 2. Attitudes towards climate change and carbon prices. Figure 2a-2d show respondents' agreement with the following statements (measured from 1 "Strongly disagree" to 5 "Strongly agree"). Figure 2a: "An overwhelming body of science agrees that a long-term warming trend exists.", Figure 2b: "A major cause of climate change is human activity.", Figure 2c: "Climate change has serious consequences for people and nature.", Figure 2d: "Scientists do not exaggerate the dangers of climate change." (For clarity, we have recoded the original question.) Figure 2e shows respondents' level of worry about global warming (measured from 1 "Not at all worried' to 5 "Very worried"). Figure 2f shows respondents' support for the introduction of the German carbon price measured on a seven-point Likert scale (1 = "Not support at all", 7 = „Fully support").

open-end questions.[6]

As shown in Figure 3a, respondents' first thoughts regarding carbon prices are dominated by financial concerns. Terms such as "expensive", "pay", "money" or "costs" are mentioned frequently. Moreover, the terms "good" and "rip-off" are rather prevalent, reflecting the contrasting attitudes towards the introduction of the German carbon price in Figure 2f. When it comes to the disadvantages of the introduction of the German carbon price the word cloud looks remarkably similar (see Figure 3b). Here, too, the considerations are mainly dominated by financial concerns. Finally, focusing on the advantages of the introduction of the German carbon price, we find an accumulation of terms related to environmental protection and lower emission levels (see Figure 3c). Particularly striking, however, is the frequent use of the term "none".

[6]We also explore sociodemographic determinants of support for carbon prices by regressing three different measures of support on a variety of background characteristics. The results are reported in Table A3.

(a) First thoughts

(b) Disadvantages

(c) Advantages

Figure 3. Word clouds. The figure shows word clouds based on the text analysis of the open-end questions. Each panel refers to question indicated in the caption.

4 Results

4.1 Econometric model

Based on the results from the previous section, the question arises whether people's perceptions and support for carbon prices can be influenced by economic information. To identify the causal effects of the information treatments, we rely on random assignment of the respondents to the four experimental groups and use the following reduced-form model[7]:

[7]To ensure that random assignment successfully balanced respondents' characteristics in the four experimental groups, we analyze the difference in means between the control group and the three treatment groups by regressing a variety of background variables on the three treatment indicators. The results are

$$Y_i = \alpha_0 + \alpha_1 * ET_i + \alpha_2 * RT_i + \alpha_3 * CT_i + \alpha_4 * X_i' + \epsilon_i \quad (1)$$

where Y_i is the outcome variable, ET_i, RT_i and CT_i are treatment indicators for the different treatment groups (i.e. the "Efficiency" treatment, the "Redistribution" treatment and the "Comparison" treatment), X_i' is a vector of control variables including respondents' socio-demographic characteristics and ϵ_i is the error term. While this approach allows us to estimate the effect of being assigned to one of the treatments on support for carbon prices, it does not allow us to identify the effect of changes in perceptions on attitudes towards carbon prices.

To address this matter, we also estimate an instrumental variable (2SLS) model that allows us to study how changes in perceptions regarding different aspects of carbon pricing affect policy support. Specifically, we use the three exogenous treatment indicators to instrument for respondents' perceptions and estimate the following first-stage regressions:

$$EI_i = \beta_0 + \beta_1 * ET_i + \beta_2 * RT_i + \beta_3 * CT_i + \beta_4 * X_i' + \eta_i \quad (2)$$

$$RI_i = \gamma_0 + \gamma_1 * ET_i + \gamma_2 * RT_i + \gamma_3 * CT_i + \gamma_4 * X_i' + u_i \quad (3)$$

$$CI_i = \delta_0 + \delta_1 * ET_i + \delta_2 * RT_i + \delta_3 * CT_i + \delta_4 * X_i' + v_i \quad (4)$$

where EI_i, RI_i and CI_i are summary indices that capture respondents' perceptions regarding carbon prices along the three dimensions covered by the information treatments. To be precise, the "Efficiency" index (EI_i) averages together five measures of the perceived efficiency of carbon prices, the "Redistribution" index (RI_i) averages together three measures of the perceived distributional implications and the "Comparison" index (CI_i) averages together three measures of respondents' perceptions of global emission levels and carbon price initiatives. We thereby follow the methodology in Kling et al. (2007) and construct the three indices as the equally weighted average of the z-scores of their components. As we calculate the z-scores by subtracting the control group mean and dividing by the control group standard deviation, each component of the index has mean 0 and standard deviation 1 for the control group. Moreover, the indices are constructed in such a way that they increase the more the perceptions are in line with the content of the respective information treatment. We then estimate the second stage of the IV model using the following regression equation:

provided in Table A2 and suggest that the characteristics hardly differ across the experimental groups.

$$Y_i = \pi_0 + \pi_1 * \hat{EI}_i + \pi_2 * \hat{RI}_i + \pi_3 * \hat{CI}_i + \pi_4 * X_i' + w_i \tag{5}$$

where $\hat{EI}_i$, $\hat{RI}_i$ and $\hat{CI}_i$ are the perceptions predicted by the first-stage. If our instruments are relevant and if they only affect respondents' policy views through their effect on perceptions, then our estimates for π_1, π_2 and π_3 measure the local average treatment effect (LATE), i.e. the effect for only those respondents whose perceptions changed due to the information treatments.

Finally, in order to analyse treatment effect heterogeneities across subgroups of the population, we extend our basic regression model described in Equation (1) as follows:

$$\begin{aligned} Y_i = \theta_0 &+ \theta_1 * ET_i + \theta_2 * RT_i + \theta_3 * CT_i + \theta_4 * Subgroup_i \\ &+ \theta_5 * ET_i \times Subgroup_i \\ &+ \theta_6 * RT_i \times Subgroup_i \\ &+ \theta_7 * CT_i \times Subgroup_i + \theta_8 * X_i' + \vartheta_i \end{aligned} \tag{6}$$

where $Subgroup_i$ equals one if respondent i belongs to the respective group and zero otherwise. In this specification, θ_1, for instance, measures the effect of the "Efficiency" treatment for the baseline group, while θ_5 indicates whether this effect is significantly different for members of the respective subgroup. The overall effect of the "Efficiency" treatment on members of the respective subgroup is thus defined by $\theta_1 + \theta_5$.

4.2 Effect of information on perceptions

For the information to change respondents' attitudes towards carbon pricing, they must change respondents' perceptions as well. Therefore, we first present the effects of the information treatments on respondents' perceptions of carbon prices. Table 1 displays the results based on Equation (2)-(4).

The results suggest that respondents across all treatments substantially change their perceptions regarding carbon prices when they are provided with simple information. To be precise, the "Efficiency" treatment has a positive and significant effect on the "Efficiency" index, the "Redistribution" treatment shapes perceptions regarding the distributional implications of carbon prices and the "Comparison" treatment affects respondents' perceptions regarding international emission levels and carbon price initiatives.

In addition to the effect on the summary indices, we examined the effects of each information treatment on the different indices' components. The results of these regressions are reported in Table A4, A5 and A6.

Table 1. Effect of information on perceptions (First stage)

	Efficiency index	Redistribution index	Comparison index
	(1)	(2)	(3)
Efficiency treatment	0.144***	-0.010	0.013
	(0.024)	(0.026)	(0.030)
Redistribution treatment	0.022	0.110***	0.005
	(0.023)	(0.027)	(0.029)
Comparison treatment	0.069***	-0.028	0.736***
	(0.025)	(0.028)	(0.029)
Observations	2936	2936	2936
Control mean	0.000	0.000	0.000

Notes: The table shows OLS regression estimates. The dependent variables in columns 1, 2, and 3 are summary indices that capture the respondent's perception regarding carbon prices along the three dimensions covered by the information treatments. The indices are constructed following the methodology in Kling et al. (2007) and increase in size the more the perceptions are in line with the information of the respective treatment. All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation, (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Effect of information on policy support

Next, we investigate whether our information treatments do not only change respondents' perceptions but also affect their attitudes towards carbon pricing. Column 1 and 2 of Table 2 therefore report the causal effect of providing different types of information on respondents' support for carbon prices based on Equation (1).

Focusing on column 1, where we measure support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price and zero otherwise, we find a positive and highly statistically significant effect of the "Efficiency" treatment on respondents' support: Whereas 41% of the respondents in the control group support the introduction of the carbon price, providing information on the efficiency of carbon prices significantly increases this share by 2.4 percentage points. The effect of the "Comparison" treatment is equally large, but not statistically significant. If we, however, measure support on a continuous seven-point scale (column 2) and thus exploit more variation in respondents' policy views, the effect of the "Comparison" treatments becomes statistically significant as well. The effect of the "Redistribution" treatment is much smaller and remains statistically insignificant – regardless of how support is measured. It thus seems as if information about the regressive nature of carbon prices as well as about the planned implementation of revenue recycling has no effect on support in the overall population.

Column 3 and 4 of Table 2 report the IV estimates based on Equation (5). Focussing on column 3, where the dependent variable is again measured as a dummy, we find that changes in perceptions of carbon prices that are driven by the "Efficiency" treatment, significantly increase average support by 17.1 percentage points. The effects of the "Redistribution" and "Comparison" treatment induced changes in perceptions regarding

Table 2. Effect of information on support

	Reduced form		IV (2SLS)	
	Average support	Seven-point scale	Average support	Seven-point scale
	(1)	(2)	(3)	(4)
Efficiency treatment	0.024*	0.127***		
	(0.014)	(0.043)		
Redistribution treatment	0.012	0.028		
	(0.014)	(0.043)		
Comparison treatment	0.024	0.093**		
	(0.015)	(0.044)		
Efficiency index			0.171*	0.885***
			(0.099)	(0.302)
Redistribution index			0.074	0.074
			(0.117)	(0.353)
Comparison index			0.019	0.047
			(0.020)	(0.056)
Observations	2936	2936	2936	2936
Control mean	0.409	3.780	0.409	3.780

Notes: Column 1 and 2 show OLS regression estimates. Column 3 and 4 show 2SLS regression estimates with randomized information treatments used as instruments for perceptions regarding carbon prices. The dependent variable in column 1 and 3 measures support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price (0 otherwise). The dependent variable in column 2 and 4 measures support on a seven-point scale (coded 1 = "Not support at all" through 7 = "Fully support"). All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation, (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

carbon prices indicate a positive, though insignificant, effect on support. As before, we find similar results, when measuring support on a seven-point scale instead.

Given that the information treatments significantly affect respondents' perceptions regarding carbon prices (see section 4.2), the validity of the IV estimates reported in this section depends on the exclusion restriction, i.e. the information treatments must only affect respondents' support through the effect on respondents' perceptions. While this is an untestable assumption, we cautiously assume that our exogenous information treatments fulfill this requirement. Nevertheless, we need to be careful when interpreting our IV results.

4.4 Heterogeneous treatment effects

As we assume that the effects vary across different subgroups of the population, we additionally analyze heterogeneities in treatment effects. Given the detailed information on individual background characteristics, we concentrate on three subgroups, namely: individuals with low household income, individuals with high trust in the government and climate change skeptics. The results using the extended regression model described in Equation (6) are reported in the Table 3-5.

Looking at Table 3, which reports heterogeneous treatment effects by income, we find that the effect of the "Efficiency" treatment as well as the effect of the "Comparison" treatment is smaller for individuals with low household income as compared to individuals with medium or high household income. The effect of the "Redistribution" treatment, however, is larger for this subgroup of the population. Although the estimates are not statistically significantly different from zero, the pattern is still interesting: it suggests that while providing information on distributional aspects of carbon prices does not affect support in the overall population, it may still affect individuals in subgroups of the population for which the information is most relevant.

Table 3. Treatment effect heterogeneity by income level

	Average support	Seven-point scale
	(1)	(2)
Efficiency treatment	0.024	0.160***
	(0.018)	(0.056)
Redistribution treatment	0.006	0.003
	(0.018)	(0.054)
Comparison treatment	0.031*	0.147***
	(0.019)	(0.055)
Efficiency treatment × Low income=1	-0.001	-0.085
	(0.029)	(0.088)
Redistribution treatment × Low income=1	0.016	0.066
	(0.030)	(0.089)
Comparison treatment × Low income=1	-0.021	-0.144
	(0.031)	(0.090)
Observations	2936	2936

Notes: The table shows OLS regression estimates. The dependent variable in column 1 measures support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price (0 otherwise). The dependent variable in column 2 measures support on a seven-point scale (coded 1 = "Not support at all" through 7 = "Fully support"). All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation, (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

One potential reason for the lack of a global effect of the "Redistribution" treatment is that respondents may not believe the government will actually redistribute the revenues of carbon prices. If this is the case, we would expect to find a significantly larger effect of the "Redistribution" treatment for individuals who have trust in the government. Table 4, therefore reports heterogeneous treatment effects for this group of individuals and confirms this expectation. While the "Redistribution" treatment has a small negative, though statistically insignificant, effect on the support of the baseline group, this effect is significantly larger for individuals that have trust in the government. Moreover, the overall effect of the "Redistribution" treatment is – as the F-test of joint significance indicates – statistically significant in both specifications.

Table 4. Treatment effect heterogeneity by trust in the government

	Average support	Seven-point scale
	(1)	(2)
Efficiency treatment	0.007	0.100**
	(0.016)	(0.050)
Redistribution treatment	-0.004	-0.011
	(0.016)	(0.050)
Comparison treatment	0.002	0.069
	(0.018)	(0.052)
Efficiency treatment × High trust=1	0.076**	0.128
	(0.033)	(0.099)
Redistribution treatment × High trust=1	0.067**	0.166*
	(0.033)	(0.097)
Comparison treatment × High trust=1	0.087**	0.097
	(0.034)	(0.097)
Observations	2936	2936

Notes: The table shows OLS regression estimates. The dependent variable in column 1 measures support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price (0 otherwise). The dependent variable in column 2 measures support on a seven-point scale (coded 1 = "Not support at all" through 7 = "Fully support"). All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation, (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 5. Treatment effect heterogeneity by climate change skepticism

	Average support	Seven-point scale
	(1)	(2)
Efficiency treatment	0.035**	0.187***
	(0.017)	(0.049)
Redistribution treatment	0.021	0.036
	(0.017)	(0.049)
Comparison treatment	0.041**	0.155***
	(0.018)	(0.049)
Efficiency treatment × CC skeptics=1	-0.047	-0.244**
	(0.030)	(0.101)
Redistribution treatment × CC skeptics=1	-0.036	-0.029
	(0.032)	(0.103)
Comparison treatment × CC skeptics=1	-0.071**	-0.236**
	(0.033)	(0.105)
Observations	2936	2936

Notes: The table shows OLS regression estimates. The dependent variable in column 1 measures support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price (0 otherwise). The dependent variable in column 2 measures support on a seven-point scale (coded 1 = "Not support at all" through 7 = "Fully support"). All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation, (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Finally, Table 5 reports heterogeneous treatment effects by climate change awareness. While we find that both, the "Efficiency" treatment as well as the "Comparison" treatment have large and statistically significant effects on the support of respondents with a high level of climate change awareness, the treatment effects are significantly lower for climate change skeptics. Moreover, the F-test of joint significance suggests that none of the treatment effects is distinguishable from zero. It, therefore, seems as if none of the information treatments is able to change the attitudes of climate change skeptics.

5 Conclusion

In this paper, we explored whether different types of information affect people's perceptions and attitudes towards carbon prices. To this end, we conducted a large-scale online survey experiment in a representative sample of the voting population in Germany shortly before the German government introduced a national carbon price in the heating and transport sector.

Overall, our results suggest that providing information can change people's perceptions and their support for carbon prices. To be precise, we find that informing respondents about the efficiency of carbon prices as well as about global emission levels and national carbon pricing initiatives outside of Germany increases average support by approximately 2 percentage points. Providing information on the possibility to counteract negative distributional implications from carbon pricing by means of revenue recycling does not affect the policy views of the total population. Looking at treatment effect heterogeneities, we, however, find that the effect of this "Redistribution" treatment is comparatively strong for individuals with low income. Moreover, the treatment effect is much larger for individuals that have high trust in the government. Given that the information on revenue recycling is formulated in a hypothetical way, this result supports our assumption that most respondents do not find it credible that the government will redistribute the revenues from carbon pricing. Finally, we also find that none of our information treatments effectively changes the perceptions and policy support of climate change skeptics.

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A Appendix

A.1 Tables and figures

Table A1. Summary statistics final sample

	N	Mean	SD	Min	Max
Female	2936	0.49	0.50	0.00	1.00
Age	2936	45.14	14.15	18.00	69.00
HH income: 0-1,499 €	2936	0.15	0.36	0.00	1.00
HH income: 1,500-2,499 €	2936	0.23	0.42	0.00	1.00
HH income: 2,500-3,999 €	2936	0.34	0.47	0.00	1.00
HH income: 4,000 € +	2936	0.28	0.45	0.00	1.00
University degree	2936	0.34	0.47	0.00	1.00
Employed	2936	0.69	0.46	0.00	1.00
Married	2936	0.50	0.50	0.00	1.00
Children	2936	0.52	0.50	0.00	1.00
German	2936	0.94	0.24	0.00	1.00
Political pref.: CDU/CSU	2936	0.26	0.44	0.00	1.00
Political pref.: SPD	2936	0.15	0.35	0.00	1.00
Political pref.: Grüne	2936	0.18	0.39	0.00	1.00
Political pref.: AfD	2936	0.10	0.29	0.00	1.00
Political pref.: FDP	2936	0.06	0.24	0.00	1.00
Political pref.: Linke	2936	0.10	0.30	0.00	1.00
Political pref.: Other	2936	0.06	0.24	0.00	1.00
Policy knowledge (self-reported)	2936	3.57	0.86	1.00	5.00
CCA: Existence	2936	4.29	0.90	1.00	5.00
CCA: Human caused	2936	4.04	1.05	1.00	5.00
CCA: Serious consequences	2936	4.38	0.88	1.00	5.00
CCA: No exaggeration	2936	2.12	1.20	1.00	5.00
CCA: Worry	2921	3.83	1.07	1.00	5.00
Prior support	2936	3.74	1.87	1.00	7.00

Notes: This table shows summary statistics using the data from the online survey experiment.

Table A2. Balancing test

	Control group Mean (1)	Efficiency treatment Difference (2)	Redistribution treatment Difference (3)	Comparison treatment Difference (4)
Female	0.48	0.03	-0.02	0.05*
Age	45.12	-0.08	0.50	-0.38
HH income: 0-1,499 €	0.15	0.00	-0.01	-0.00
HH income: 1,500-2,499 €	0.22	0.02	0.02	0.01
HH income: 2,500-3,999 €	0.36	-0.05**	-0.01	-0.02
HH income: 4,000 € +	0.27	0.03	0.01	0.02
University degree	0.35	-0.02	-0.02	-0.02
Employed	0.70	0.00	-0.01	-0.01
Married	0.49	0.01	0.03	0.02
Children	0.48	0.06**	0.07***	0.05**
German	0.94	-0.01	0.01	-0.02
Political pref.: CDU/CSU	0.27	-0.02	0.00	-0.03
Political pref.: SPD	0.13	0.02	0.02	0.03*
Political pref.: Grüne	0.18	0.00	-0.01	0.01
Political pref.: AfD	0.10	0.01	-0.01	-0.01
Political pref.: FDP	0.06	-0.01	0.00	0.01
Political pref.: Linke	0.11	-0.01	-0.01	-0.01
Political pref.: Other	0.06	-0.01	0.00	-0.00
Policy knowledge (self-reported)	3.61	-0.07	-0.02	-0.07
CCA: Existence	4.27	0.03	0.06	-0.05
CCA: Human caused	3.99	0.06	0.08	0.09
CCA: Serious consequences	4.38	-0.01	0.05	-0.02
CCA: No exaggeration	2.15	0.01	-0.11*	-0.06
CCA: Worry	3.85	-0.10*	0.00	0.02
Prior support	3.74	-0.08	0.03	0.05

Notes: Column 1: group mean. Columns 2 to 3: difference in means between the control group and the respective treatment group. Significance levels are based on linear regressions of the respective background variables on the respective treatment indicator. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Determinants of support for carbon pricing (*prior* to the information treatments)

	Average support	Seven-point scale	No support at all
	(1)	(2)	(3)
Female	0.04**	0.29***	-0.06***
	(0.02)	(0.07)	(0.02)
Age	-0.00***	-0.01***	0.00***
	(0.00)	(0.00)	(0.00)
HH income: 1,500-2,499€	-0.01	-0.05	-0.01
	(0.03)	(0.11)	(0.02)
HH income: 2,500-3,999€	0.04	0.05	-0.02
	(0.03)	(0.11)	(0.02)
HH income: 4,000€ +	0.04	0.10	-0.04*
	(0.03)	(0.12)	(0.03)
University degree	0.08***	0.27***	-0.03**
	(0.02)	(0.07)	(0.01)
Employed	-0.04**	-0.16**	0.04***
	(0.02)	(0.07)	(0.02)
Married	-0.02	-0.07	0.00
	(0.02)	(0.07)	(0.02)
Children	0.01	-0.04	0.01
	(0.02)	(0.07)	(0.02)
German	0.06*	0.14	-0.03
	(0.03)	(0.13)	(0.03)
Political pref.: CDU/CSU	0.14***	0.33***	-0.06*
	(0.03)	(0.12)	(0.03)
Political pref.: SPD	0.17***	0.73***	-0.13***
	(0.03)	(0.13)	(0.03)
Political pref.: Grüne	0.42***	1.58***	-0.19***
	(0.03)	(0.12)	(0.03)
Political pref.: AfD	-0.07**	-0.94***	0.28***
	(0.03)	(0.14)	(0.04)
Political pref.: FDP	0.03	-0.15	0.01
	(0.04)	(0.17)	(0.04)
Political pref.: Linke	0.17***	0.64***	-0.10***
	(0.04)	(0.15)	(0.04)
Political pref.: Other	0.06	-0.00	0.00
	(0.04)	(0.16)	(0.04)
Policy knowledge (self-reported)	0.09***	0.27***	-0.00
	(0.01)	(0.04)	(0.01)
Observations	2936	2936	2936
Sample mean	0.37	3.74	0.20

Notes: The table shows OLS regression estimates. The dependent variable in column 1 measures support as a dummy, that is equal to one if the respondent at least "rather supports" the introduction of the German carbon price (0 otherwise). The dependent variable in column 2 measures support on a seven-point scale (coded 1 = "Not support at all" through 7 = "Fully support"). The dependent variable in column 3 is a dummy variable, that is equal to one if the respondent does not support the introduction of the German carbon price at all (0 otherwise). Omitted modalities are: HH income: 0-1,499€, Political pref.: Not specified. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Effect of information on "Efficiency" perceptions

	Efficiency index	Polluter pays principle	Indivividuals change behavior	Firms change behavior	Carbon price helps econ. (long-run)	Suitable measure to ↓ CC
	(1)	(2)	(3)	(4)	(5)	(6)
Efficiency treatment	0.144***	0.151***	0.061***	0.043**	0.057***	0.065***
	(0.024)	(0.024)	(0.016)	(0.017)	(0.021)	(0.019)
Redistribution treatment	0.022	-0.037	0.007	0.026	0.018	0.029
	(0.023)	(0.024)	(0.015)	(0.017)	(0.020)	(0.019)
Comparison treatment	0.069***	0.034	0.022	0.044**	0.030	0.051**
	(0.025)	(0.026)	(0.016)	(0.017)	(0.022)	(0.020)
Observations	2936	2936	2936	2936	2936	2936
Control mean	0.000	0.409	0.393	0.653	0.316	0.370

Notes: The table shows OLS regression estimates. The dependent variable in column 1 is a summary index constructed following the methodology in Kling et al. (2007), that combines the efficiency perception variables in column 2 to 6. The index increases in size the more the perceptions are in line with the information of the "Efficiency" treatment. The dependent variables in column 2 to 6 are indicator variables equal to one if: *Polluter pays principle*: the respondent thinks that the polluter pays for the consequences of carbon emissions if there is a carbon price in place; *Individuals change behavior*: the respondent believes that individuals will change their behavior as response to the introduction of the German carbon price; *Firms change behavior*: the respondent believes that firms will change their behavior as response to the introduction of the German carbon price; *Carbon price helps econ. (long-run)*: the respondent thinks that the introduction of the carbon price will help the German economy in the long term; *Suitable measure to ↓ CC*: the respondent believes that the German carbon price is a suitable measure to reduce climate change. All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5. Effect of information on "Redistribution" perceptions

	Redistribution index	Carbon price initially regressive	Low income HH pay higher share	Revenue recycling
	(1)	(2)	(3)	(4)
Efficiency treatment	-0.010	0.023	-0.023	-0.017
	(0.026)	(0.023)	(0.025)	(0.023)
Redistribution treatment	0.110***	-0.001	0.066***	0.098***
	(0.027)	(0.023)	(0.024)	(0.023)
Comparison treatment	-0.028	-0.025	-0.022	0.008
	(0.028)	(0.025)	(0.026)	(0.025)
Observations	2936	2936	2936	2936
Control mean	0.000	0.697	0.573	0.408

Notes: The table shows OLS regression estimates. The dependent variables in column 1 is a summary index constructed following the methodology in Kling et al. (2007), that combines the redistribution perception variables in column 2 to 4. The index increases in size the more the perceptions are in line with the information of the "Redistribution" treatment. The dependent variables in column 2 to 4 are indicator variables equal to one if: *Carbon price initially regressive*: the respondent thinks low income households carry a larger financial burden than high income households; *Low income HH pay higher share*: the respondent believes that low-income households on average have to pay a higher share of their income for the carbon price; *Revenue recycling*: the respondent believes that adverse distributional effects can be counterbalanced by revenue recycling. All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6. Effect of information on "Comparison" perceptions

	Comparison index	CHN has lower p.c. emissions than GER	German p.c. emissions above EU average	Several EU MS have national carbon price
	(1)	(2)	(3)	(4)
Efficiency treatment	0.013	0.005	0.004	0.008
	(0.030)	(0.022)	(0.020)	(0.025)
Redistribution treatment	0.005	-0.015	0.015	0.005
	(0.029)	(0.022)	(0.019)	(0.025)
Comparison treatment	0.736***	0.577***	0.145***	0.255***
	(0.029)	(0.022)	(0.016)	(0.025)
Observations	2936	2936	2936	2936
Control mean	0.000	0.254	0.814	0.457

Notes: The table shows OLS regression estimates. The dependent variables in column 1 is a summary index constructed following the methodology in Kling et al. (2007), that combines the perception variables in column 2 to 4. The index increases in size the more the perceptions are in line with the information of the "Comparison" treatment. The dependent variables in column 2 to 4 are indicator variables equal to one if: *CHN has lower p.c. emissions than GER*: the respondent thinks that China has lower per-capita emission levels than Germany; *German p.c. emissions above EU average*: the respondent believes that Germany has per-capita emission levels that are above EU average; *Several EU MS have national carbon price*: the respondent thinks that several EU member states have a national carbon price already. All regressions include covariates, i.e. gender, age, household income, education, employment status, children, migration background, political affiliation (self-reported) policy knowledge, and pre-acceptance. Robust standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.2 Full questionnaire (English)

A.2.1 Welcome and introduction

Welcome to this survey! We are pleased that you are taking the time to help us. We are a group of scientists from the University of Passau and the Technical University of Munich. In this survey we would like to learn about human attitudes and views on various topics. Please read the following information carefully before starting the questionnaire.
This is an anonymous survey. Your name is not recorded at any time, i.e. your answers can never be assigned to your person and all stored data is anonymized. The resulting data will only be analyzed as a whole.
You will be rewarded for participating in this survey. In addition, you have the opportunity to win extra mingle points. To receive the full reward and possible extra points, the following criteria must be met:

- You must fill in the questionnaire to the end.
- You must complete the questionnaire to the best of your knowledge.

For the success of this study, it is very important that you read all the questions carefully and answer honestly. It is not a problem if you should not know answers to one or more questions. In this case, please provide your best guess without using other sources. In addition, please note that there is no possibility to go back throughout the survey. Therefore, do not click any further until you have double-checked your answers.
We hope you enjoy the survey!

A.2.2 Background information

The survey is about to start! At the beginning of the survey we would like to ask you to provide us with some information about yourself. It is very important for the success of the study that you reply truthfully.

1. Please indicate your gender:
   Female; Male; Diverse
2. How old are you?
3. What is your household's net monthly income (that is, the sum of all household members' monthly income after taxes and duties)?
   Less than 1.500€; 1.500€ - 2.499€; 2.500 - 4.000€; more than 4.000€
4. What is your household's gross annual income (that is, the sum of all household members' incomes before taxes and duties)?
   Less than 10.000€; 10.000€ - 14.999€; 15.000€ - 19.999€; 20.000€ - 29.999€;

30.000€ - 39.999€; 40.000€ - 49.999€; 50.000€ - 69.999€; 70.000€ - 89.999€; 90.000€ - 109.999€; 110.000€ - 149.999€; 150.000€ - 199.999€; more than 200.000€

5. How many people are in your household?

6. What is your marital status?
   Married or registered partnership; Single; Divorced; Widowed

7. How many children do you have?
   I have no children; 1; 2; 3; 4; 5 or more

8. What is your highest level of education?
   No qualification (yet); Hauptschulabschluss (elementary school leaving certificate) or equivalent qualification; Realschulabschluss (Mittlere Reife) or equivalent qualification; Allgemeine oder fachgebundene Hochschulreife/Abitur (Gymnasium or EOS); vocational training, apprenticeship or training at a technical college; (Fach-) Hochschulabschluss (Bachelor's, Master's, Magister, Diplom, Staatsexamen); doctorate or habilitation; other qualification

9. Are you currently employed?
   Full-time employee; Part-time employee; Trainee or apprentice or retrainee; Not employed, job-seeking; unemployed, not job-seeking; Pupil or student; Self-employed; Retired, pensioner; Other

10. Were you born in Germany?
    Yes; No

11. In which state do you live?
    Baden-Württemberg; Bavaria; Berlin; Brandenburg; Bremen; Hamburg; Hesse; Mecklenburg-Western Pomerania; Lower Saxony; North Rhine-Westphalia; Rhineland-Palatinate; Saarland; Saxony; Saxony-Anhalt; Schleswig-Holstein; Thuringia; I do not live in Germany

12. How many inhabitants does your current place of residence have?
    Less than 5,000 inhabitants (rural municipality); More than 5,000 and less than 20,000 inhabitants (small town); More than 20,000 and less than 100,000 inhabitants (medium-sized town); More than 100,000 inhabitants (large town)

Below we ask you some questions about your political interests and attitudes. We are aware that the Corona pandemic is having a major impact on all of us. Nevertheless, try to answer the following questions as far as possible independently of Corona. Additionally, keep in mind that your data will be treated strictly anonymously.

13. Have you participated in the last federal election?
    Yes; No

14. (if 13. = yes) Which party did you vote for in the last federal election?
    CDU/CSU; SPD; Bündnis 90/Die Grünen; AfD; FDP; Die Linke; Another party; Not specified

15. (if 13. = no) Which party would you most likely have voted for in the last federal election?
    CDU/CSU; SPD; Bündnis 90/Die Grünen; AfD; FDP; Die Linke; Another party; Not specified

16. Imagine that there were federal elections today. Which party would you vote for today?
    CDU/CSU; SPD; Bündnis 90/Die Grünen; AfD; FDP; Die Linke; Another party; Not specified

17. To what extent do you agree with the following statements?

    - In general, people can be trusted.
    - You can trust the government to do the right thing.
    - The government is using taxpayer money well.

    Strongly disagree; Disagree; Neither agree nor disagree; Agree; Strongly agree

18. What sources do you mainly use to keep up to date with political events in Germany and the world?
    Television; Print media (newspaper and magazines); Online offerings of established media; Radio; Social media (Facebook, Twitter, YouTube, Instagram, etc.); Other

19. Do you primarily use a particular website, social media outlet, TV or radio program, or newspaper/news magazine to get breaking news?
    Yes; No

20. (if 19. = yes) Which particular offer do you use?

21. How important do you consider it to be politically informed?
    Very unimportant; Rather unimportant; Neither important nor unimportant; Rather important; Very important

22. How important do you consider it for others to be politically informed?
    This question is meant to check your attention. Please select all answers.

Very unimportant; Rather unimportant; Neither important nor unimportant; Rather important; Very important

23. How well do you think you are informed about political topics and issues?
    Very bad; Rather bad; Neither important nor unimportant; Rather good; Very good

24. What do you think are the two most important problems that Germany is facing at the moment? Please try to not consider the Corona pandemic for you answer.
    You can select a maximum of two topics.
    Crime; Economic situation; Rising prices/inflation/cost of living; Taxes; Unemployment; Terrorism; Housing/housing; National debt; Immigration; Health and social security; Education system; Pensions; Environmental and climate and energy issues; Other

Thank you for answering the personal questions! In the following, we would now like to ask you a few more general questions. We are interested in your opinion and thoughts. There are no right or wrong answers!

A.2.3 First-order considerations and prior support

25. Carbon pricing is a climate policy measure that requires payments for every ton of carbon emitted. While such a carbon price has already been in place for most parts of the energy and industry sector at the European level since 2005, there will also be a price on emissions generated by the heating and transport sector in Germany as of January 2021.

    When you think of the introduction of the carbon price in Germany, what are the first thoughts that come to your mind?
    Please use the text box and write as much as you like.

26. In your view, what are the advantages of introducing the carbon price in Germany?
    Please use the text box and write as much as you like.

27. In your view, what are the disadvantages of introducing the carbon price in Germany?
    Please use the text box and write as much as you like.

28. Do you support the introduction of the carbon price in Germany in 2021?
    Not support at all; Not support; Rather not support; Neither nor; Rather support; Support; Fully support

A.2.4 Attitudes towards climate change

29. Below you can read several opinions on climate change. To what extent do you agree with these opinions?

    - An overwhelming body of science agrees that a long-term warming trend exists.
    - A major cause of climate change is human activity.
    - Climate change has serious consequences for people and nature.
    - Scientists exaggerate the dangers of climate change.

    Strongly disagree; Disagree; Neither agree nor disagree; Agree; Strongly agree

30. To what extent do you feel a personal responsibility to try to reduce climate change?
    Not responsible at all; Rather not responsible; Neither nor; Rather responsible; Very responsible

31. How concerned are you about climate change?
    Not worried at all; Rather not worried; Neither worried nor unworried; Rather worried; Very worried

A.2.5 Information treatments

This part is skipped in the control group.

The second part of the survey begins! In the following, we will provide you with information on carbon pricing. Please read the information carefully. We will ask you questions about it afterwards. Please do not proceed to the next page until you have read the entire text.

"Efficiency" treatment The carbon price is a climate policy instrument which is being discussed all over the world for its application to reduce carbon emissions (or greenhouse gases) and thus to fulfill national and international climate agreements. A carbon price leads to price increases of goods and services that cause carbon during production or consumption. This creates additional financial burdens for people and companies. This particularly affects those who release a high level of emissions into the air through their consumption, behavior or production methods. However, the unpriced emission of carbon also results in societal costs in the long term. These costs include rising global temperatures and the associated impacts on the climate. Without a carbon price, it is not the polluter who pays for these costs, but the general public. For this reason, the carbon price is based on the principle: whoever emits carbon is obliged to pay for it. This creates incentives to reduce carbon-intensive behavior. For instance, it becomes financially more

attractive for people to drive their cars less, use more environmentally friendly means of transport, reduce their energy consumption or consume renewable energies. For companies, incentives arise to invest in climate-friendly technologies. Since innovations in the field of climate protection are thus also becoming increasingly attractive, a carbon price can be seen not only as a means of combating climate change, but also as an innovation driver for the economy.
The following figure summarizes the information in the text:

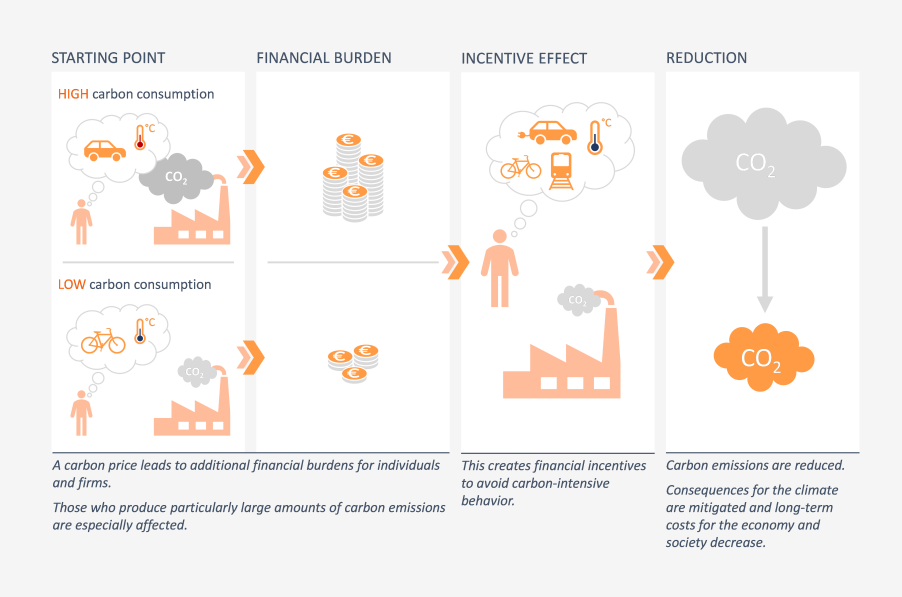

Figure A1. Graphical illustration "Efficiency" treatment.

"Redistribution" treatment The carbon price is a climate policy instrument discussed around the world for its application in reducing carbon emissions (or greenhouse gases) and thus fulfilling national and international climate agreements. Although low-income households are, on average, more climate-friendly, they are, relatively speaking, more heavily burdened by a carbon price than high-income households. This is because low-income households on average have to pay a higher proportion of their income for fuel and heating, for instance, and thus for carbon pricing. At the same time, however, a carbon price also generates additional government income. This can be returned to citizens in a socially balanced way - e.g. in the form of lump sums or other tax reductions. This will provide financial relief for all households, but especially for those with a low income. In Germany, the redistribution is to take place primarily through falling electricity prices, an increase in the commuter tax allowance and an improvement in the situation of housing benefit recipients.
The following figure summarizes the information in the text:

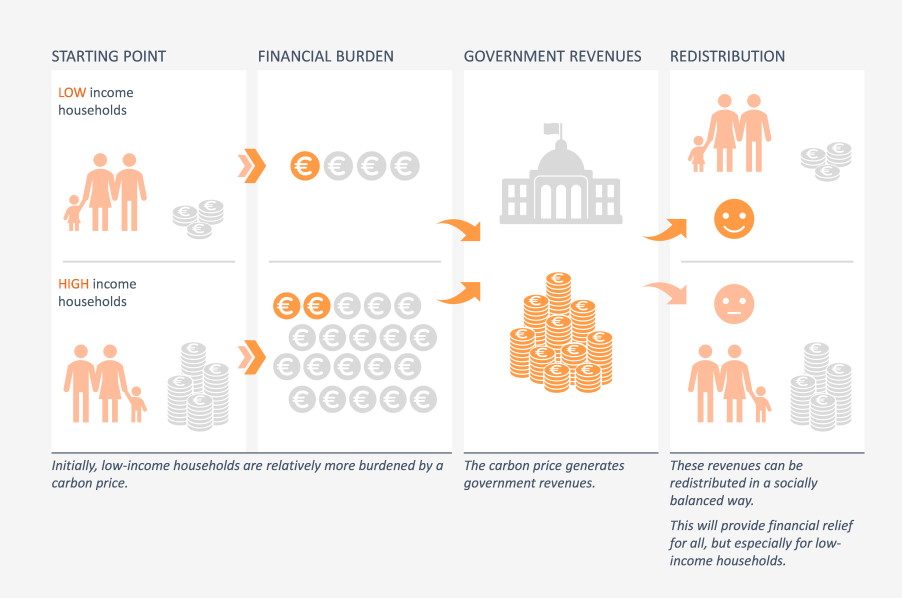

Figure A2. Graphical illustration "Redistribution" treatment.

"Comparison" treatment A look at the per capita carbon emissions of different countries shows that China produced 8.1 tons of carbon per capita in 2019. This means that China has lower per capita emissions than Germany.
When comparing per capita carbon emissions in the EU, Germany ranks 6th with emissions of 8.5 tons of carbon per capita, which is above the EU average. To reduce emissions, 11 of the EU member states currently have a national carbon price in addition to the European one.

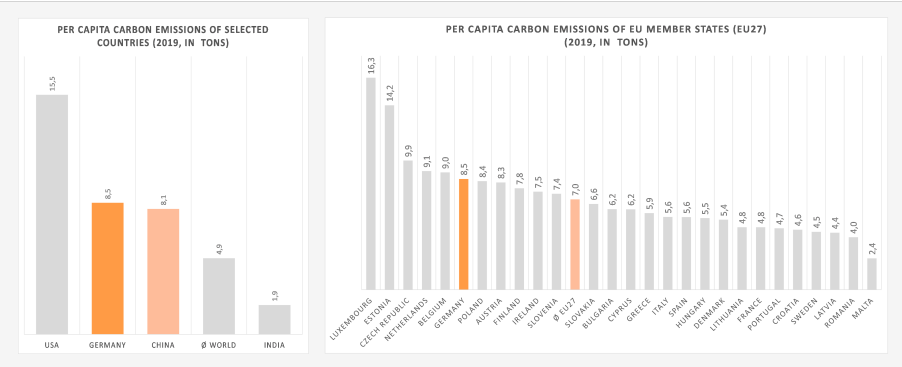

Figure A3. Graphical illustration "Comparison" treatment.

A.2.6 Perceptions

The last part of the survey begins! Thank you for reading the information![8] On the following pages, we will again ask you some questions. In doing so, we ask you for your personal assessment or conviction. Your opinion is of great importance to us. Therefore, please answer as well as possible and do not use third party sources.

[8]This sentence is not displayed for respondents of control group

32. What do you think the per capita carbon emissions were in China in 2019 (in tons)?
Additional information: In Germany, per capita carbon emissions in 2019 were 8.5 tons per inhabitant.
Please enter your answer in the text field.

33. Which rank do you think Germany holds in terms of per capita carbon emissions in the EU?
Additional information: Rank 1 corresponds to the highest per capita carbon emissions in the EU. The EU has 27 member states.
Please enter only one number as an answer in the text box.

34. How many of the EU member states do you think currently have a national carbon pricing scheme in place alongside the European carbon price?
Please enter your answer in the text field.

35. In your opinion, what share does Germany contribute to reducing global carbon emissions?
Much less than the fair share; Less than the fair share; The fair share; More than the fair share; Much more than the fair share

36. Do you think that Germany should do as much, more or less to reduce carbon emissions in the future?
Much less; Somewhat less; Same amount; Somewhat more; Much more

37. Who will pay for the consequences of carbon emissions if there is no carbon price?
The general public; The polluter; Nobody

38. Who will pay for the consequences of carbon emissions if there is a carbon price?
The general public; The polluter; Nobody

39. How likely do you think it is that the introduction of the carbon price in Germany will make people...

    - ...drive less.
    - ...choose environmentally friendly means of transport (e.g. bicycle, public transport).
    - ...save energy (e.g. turn down the heating).
    - ...use renewable energies.

    Very unlikely; Somewhat likely; Neither likely nor unlikely, Somewhat likely; Very likely

40. How likely do you think it is that the introduction of the carbon price in Germany will encourage companies to invest in climate-friendly technologies?
Very unlikely; Somewhat likely; Neither likely nor unlikely, Somewhat likely; Very likely

41. How much do you think the introduction of the carbon price in Germany will promote innovation in the field of climate protection?
Not at all; Little; Medium; Strongly; Very strongly

42. Which statement do you agree with the most?
Please select the one that is closest to your views, even if it does not perfectly match your views.

    - The introduction of the carbon price will harm the German economy in the long run
    - The introduction of the carbon price will have no effect on the German economy in the long run
    - The introduction of the carbon price will help the German economy in the long run.

43. To what extent do you consider the carbon price in Germany to be a suitable means of reducing climate change?
Very unsuitable; Somewhat unsuitable; Neither suitable nor unsuitable; Somewhat suitable; Very suitable

44. How fair do you think it is that people and companies that cause particularly high levels of carbon through their behavior or production methods should be financially burdened more by the introduction of the carbon price in Germany?
Very unfair; Somewhat unfair; Neither fair nor unfair; Somewhat fair; Very fair

45. To what extent do you think the following groups will initially be financially burdened by the introduction of the carbon price in Germany?

    - High income households
    - Middle income households
    - Low income households

    Not at all; Little; Medium; Strongly; Very strongly

46. Imagine two families. Family "A" has an annual income of 100,000 EUR. Family "B" has an annual income of 35,000 EUR. Which statement do you agree with the most?

Please select the one that is closest to your views, even if it does not perfectly match your views.
Family "A" spends a larger share of its income on e.g. fuel and heating and thus on the carbon price than family "B"; family "A" spends a smaller share of its income on e.g. fuel and heating and thus on the carbon price than family "B"

47. How much attention do you think will be paid to a socially balanced financial burden when the carbon price is introduced in Germany?
Not at all; Little; Medium; Strongly; Very strongly

48. How fair do you think it is that low-income households pay the same price for a ton of carbon as high-income households?
Unfair; Somewhat unfair; Neither fair nor unfair; Somewhat fair; Very fair

A.2.7 Policy views

49. How fair do you think the introduction of the carbon price in Germany is overall?
Very unfair; Somewhat unfair; Neither fair nor unfair; Somewhat fair; Very fair

50. Do you support the introduction of the carbon price in Germany in 2021?
Not support at all; Not support; Rather not support; Neither nor; Rather support; Support; Fully support

A.2.8 Behavioral measures

By participating in this survey, you automatically take part in a lottery in which you can win an additional 1,000 mingle points. Three participants will be drawn at the end of the survey and will have this amount credited to their account. Below you can donate a part of the lottery winnings for the reduction of carbon. This amount will only be donated if you actually win the lottery. You will then also receive a certificate of your donation. The rest of the winnings will be credited to your account.

51. If you win the lottery, how many of the 1,000 mingle points will you donate to a carbon offset?
Please enter a value between 0 and 1,000.

For the following question, please select the answer you think most other survey participants will give. If your answer actually matches the answer of most of the other participants, you will receive an additional 50 mingle points credited to your account.

52. To what extent is the introduction of the carbon price supported by the population in Germany?

Please select what you think most other survey participants answered to this question.
Not support at all; Not support; Rather not support; Neither nor; Rather support; Support; Fully support

A.2.9 Self-reported questions and feedback

53. To what extent have you already been looking into the introduction of the carbon price in Germany before today?
Not at all; Little; Medium; Much; Very much

54. How confident did you feel in answering the questions about the carbon price?
Very uncertain; Rather uncertain; Neither certain nor uncertain; Rather certain; Very certain

55. TREATMENT GROUP In the course of the survey, you were given information about the carbon price. How trustworthy do you rate this information?
Not at all trustworthy; Rather not trustworthy; Neither; Rather trustworthy; Very trustworthy

56. Would you like to receive a summary of relevant information on the carbon price? The information will be made available to you following the survey. You can then also share this with your family, friends and acquaintances.
Yes; No

57. How much effort did you put into answering the questions?
None at all; Little; Medium; Much; Very much

58. Is there anything else you would like to share with us at the end of this survey?

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