How Do Pocketbook and Distributional Concerns Affect Citizens' Preferences for Carbon Taxation?[*]

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Abstract:

We shed new light on a long-standing question in political science: when confronted with costly policy-choices, do citizens form their preferences based on material (economic) concerns or other-regarding motivations, such as the distribution of costs, and how these are moderated by political ideology. Using the case of carbon taxation, a widely advocated policy solution to climate change, we conducted survey experiments in Germany and the United States to assess the relative importance of these forms of preferences. The results show that individuals are primarily concerned with how a carbon tax would impact their individual income. There are also important cross-national differences with high-income German respondents being more receptive to redistributive policy design, especially in contrast to high-income Democrats who significantly decrease support for carbon taxation. These findings highlight how the constituencies generated by new policies can significantly alter the distribution of mass support for action upon emerging societal problems.

Keywords: carbon tax; environmental politics; climate policy; political economy; climate change

[*] Replication files are available in the JOP Dataverse (https://dataverse.harvard.edu/dataverse/jop). The empirical analysis has been successfully replicated by the JOP replication analyst.

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1 Introduction

Emerging societal problems, such as climate change, often require the development and adoption of new policy instruments by governments. In such cases, what determines political support and acceptance of new policies by the public? A recurring debate in political science suggests that citizens either form their policy preferences according to a rational (egoistic) utility calculus, or instead form preferences based upon other factors, such as concern for others or general world views (e.g. Bartels 2005, Hainmueller and Hiscox 2006, McCall and Kenworthy 2009, Rehm et. al 2012, Cavaille and Trump 2015). One recent expression of this debate is research on whether citizens' policy preferences are shaped by pocketbook or distributional considerations, and what role inequality aversion plays in this regard (e.g. Mansfield and Mutz 2009, Fordham and Kleinberg 2012, Lu and Scheve 2016, Dimick et. al 2017).

Studying policy responses to climate change can generate important insights into how pocketbook and distributional considerations affect the formation of policy preferences. Climate change is one of the most pressing problems facing humankind and requires swift policy responses to limit its impact. Keeping global warming within 1.5 or 2 degrees, as currently aimed at under the Paris Agreement, requires the decarbonization of economies worldwide in a relatively short time frame. Such decarbonization implicates high opportunity costs, and the distributional effects of policy interventions to that end are strong and politically very salient (e.g. Aklin and Urpelainen 2013; Stokes 2015; Aklin and Mildenberger, 2020; Dolšak, Adolph, Prakash, 2020; Schaffer, Forthcoming). Costs vary strongly across individuals and different types of collective actors (countries, cities, industries, firms, households, individuals). These distributional effects engender political conflicts about fairness in burden sharing, within and between countries, and create vexing problems for decision-makers in trying to identify, enact and implement appropriate policies, in the sense of solving

the problem and being politically acceptable and thus feasible (Beiser-McGrath and Bernauer 2019, Carattini et. al 2019).

The use of fiscal policy instruments, in the form of carbon taxation, to influence emissions behaviour has become widely regarded as an effective way to cut emissions and thus limit climate change (Murray and Rivers, 2015; Beck et al., 2015; Kaplowitz and McCright, 2015; Umit and Schaffer 2020). The idea of a carbon tax is simple and appealing. Taxing fossil fuels according to the amount of emissions they cause makes these fuels more expensive and motivates people, companies, and other users to consume and thus emit less. Carbon taxes are also morally appealing in view of the widely accepted polluter-pays principle.

Yet, carbon taxes directly affect the income of individual energy consumers, who are also citizens and voters, with such income effects on individuals varying strongly according to their dependence on fossil fuel. Carbon taxation is therefore an ideal policy issue to study the relative importance of material and ideational considerations for policy support, given its strong distributional consequences. Our theoretical argument is built around the central importance of how carbon taxation affects individuals' incomes, and the associated distributional implications. Specifically, we look at how carbon taxes would affect individual income and how these pocketbook considerations affect support for (or opposition to) carbon taxes. We then focus on the connection between the distributive consequences of carbon taxation and policy support.

Based upon this framework, we then consider how differing distributional impacts caused by the design of a carbon tax, in particular how revenue use is allocated, affects policy support. Revenue recycling, i.e., how revenues from the carbon tax are allocated, has attracted much attention in recent academic and policy debates over carbon taxes (Carattini et al. 2018, Klenert et al. 2018, Jagers et al. 2018; World Bank 2018, Beiser-McGrath and Bernauer 2019).

Therefore, we also study how changes in the economic effects of a carbon tax by transferring carbon tax income to benefit particular subgroups in society also affect policy support.

To do so, we fielded survey experiments in Germany and the USA. In these experiments we estimate the effect of randomly assigned information on how a carbon tax would affect the respective individual, based upon their income, and how it would affect different income groups in general upon policy support. We also examine how support changes when carbon taxation includes a tax rebate for all individuals and when individuals receive information about how rebates change the individual and distribution of costs associated with a carbon tax.

Our experiments reveal that individuals are first and foremost concerned with how a carbon tax would impact themselves economically. High income groups, who are initially more supportive of environmental policies, such as carbon taxation, become significantly less supportive when provided information about how a carbon tax would impact their incomes. So much so, that their support reaches a similar level to low-income groups. Information about revenue usage also tends to result in effects in line with egoistic economic concerns, with low-income groups in the USA significantly increasing support for carbon taxation when the revenue is used to provide a general tax rebate, a revenue use that would offset the decline in their income otherwise. However, this leads to a divergence in reactions amongst high-income groups across countries, with high-income individuals in the USA decreasing support while high-income individuals in Germany increase support for a carbon tax with rebate when they learn that low-income individuals would benefit from such a policy. This suggests that the political impact of the redistributive implications of tax rebates funded by carbon taxes is context dependent. While this redistributive element can increase support, even amongst high-income individuals, in countries where there is a general support for redistribution, such as Germany, this is not a universal effect.

We also examine how these effects depend upon political partisanship. We find that voters who ostensibly support green and/or re-distributive policies, notably citizens who are supportive of green, liberal, and left-wing political parties, do not always differ from right-wing voters in response to income information. For example, high income Democrats in the US learning about a tax rebate, funded by carbon tax income, that would reduce their own income but benefit the lowest 70% of earners, significantly reduce support for carbon taxation to the same level as Republicans. In comparison, high-income German Green voters, also exhibit higher levels of opposition to carbon taxation when learning about the individual cost they would face. However, learning that a tax rebate would benefit 70% of individuals in society significantly dampens this opposition, suggesting differences in the distributional concerns of left-leaning voters across contexts.

Our paper contributes to the existing literature in three key ways. First, it provides new experimental evidence on the relative importance of various forms of individuals' preferences toward fiscal policy. Specifically, we find that individual ego-tropic pocketbook effects tend to dominate throughout, apart from specific circumstances. This finding also speaks to a broader literature on policy support across a variety of issue areas, such as international trade and welfare policy, where informational factors are a key concern (e.g. Fordham and Kleinberg 2012, Rho and Tomz 2017). Our results suggest that the presumption of this literature, that it is difficult for individuals to assess the individual and distributional costs of policy changes, is likely to be true. Second, our paper speaks to how the usage of revenue generated by taxation, and policy design generally, affects policy support due to the resulting formation of new constituencies of winners and losers (e.g. Pierson 2000; Campbell, 2012). Our results show that once the economic details of a carbon tax are explained to individuals, richer individuals may no longer be significantly more supportive. Thus, pre-existing support for carbon taxation is likely to be sensitive to how informed individuals become about the costs of taxation. Third,

our paper also contributes to the broader literature on environmental policy preferences, and post-material preferences (Inglehart 1977). We contribute to better understanding the relative importance of various components of individuals' environmental preferences. Understanding whether seemingly strong support for climate policy in many countries (McGrath and Bernauer, 2017; Aklin and Mildenberger 2020) is the result of strong environmental norms, or rather an underappreciation of its economic consequences, imply different political concerns in the adoption of policies to limit climate change. The finding that Democrat voters respond similarly to voters on the political right, in particular, emphasizes how policy design can in fact weaken existing support for policy action within societies.

The paper proceeds as follows. In the next section of the paper we outline our theoretical arguments and derive empirical implications. We then describe our research design and present the results. The final section offers concluding thoughts.

2 Theoretical Argument

In this section we outline the theoretical approach that informs our survey experiment and subsequent empirical analysis. First, we examine how carbon taxation in general has consequences for individual incomes and the distribution of these impacts, and how information about these impacts is expected to translate into political support.[4] We then examine how incorporating revenue usage in carbon tax design, in the form of uniform tax

[4] Throughout we examine the role of information about the individual and distributional consequences of carbon taxation under alternative policy designs. Given our view of the public discourse, we think it is the case that there remains information that is not fully understood about the broad distributional consequences of carbon taxation (with and without rebates) as well as the differential costs by income group. In countries that have implemented rebates funded through carbon taxes, information about rebates is either presented in terms of the monetary amount all households receive (e.g., Canada https://www.canada.ca/en/revenue-agency/services/child-family-benefits/cai-payment.html) or is simply a line item in individuals health insurance policies (e.g., Switzerland) (for an overview of such issues see Mildenberger et al 2022). Otherwise, differential effects by income group are often cast purely in terms of poorer individuals being worse off (e.g., https://www.irishtimes.com/business/energy-and-resources/carbon-taxes-put- more-people-in-fuel-poverty-esri-warns-1.4643944). Therefore, we believe there is considerable scope for informational treatment effects to play a role as this form of information is not generally widespread.

rebates, can change support for carbon taxation for different income groups. Finally, we examine how information about the individual and distributional effects of a rebate, in combination with partisan affiliation, can affect support for carbon taxation.

2.1 Income and Support for Carbon Taxation Absent Revenue Usage

There is a considerable body of research suggesting that richer individuals are more supportive of environmental policies (e.g. Franzen and Meyer, 2009; Fairbrother, 2012; Kotchen, Turk, and Leiserowitz, 2017). One explanation for this pattern is that higher income individuals are more likely to have post-material attitudes. Following Inglehart (1977), as individuals reach a certain level of material comfort, they form post-material values. In our context, this implies that the richest individuals within a society should be most supportive of policies to limit global warming.

Although support for carbon taxation is be expected if attitudes simply translate into policy support, this overlooks the differential burden a carbon tax would impose upon different income groups.[5] Rich individuals are overwhelmingly the largest emitters, when looking at fossil fuel consumption (Lenzen et. al 2006; Bach et al. 2019; Goldstein et. al 2020). Thus, if individuals were driven primarily by a rational egoistic calculus of policy costs, we should expect rich individuals to oppose carbon taxation, particularly upon learning that they would be primarily responsible for financing such a policy. This should particularly relevant if individuals pay attention to the monetary cost, in terms of dollars or euros, of policy.[6]

[5] When considering existing data on support for carbon taxation in Europe (as part of the European Social Survey), support for carbon tax is increasing in income as displayed in (Figure A10).

[6] While we focus on absolute costs of carbon taxation, a related literature examining income effects of energy use focuses on relative costs (for an overview see Carley and Konisky 2020). However, for our application regarding carbon taxation, it is the case that relative costs also have a positive income gradient, with high-income individuals' income loss being a larger proportion of total income (see Table 1, Horowitz et al. 2017, Bach et al. 2019) than it is for low-income individuals. Therefore, we focus on absolute costs given their more immediate and intuitive interpretation for individuals, especially in comparison to the monetary value of rebates which is presented in absolute terms in real

Dating back to canonical economic models, such as the Meltzer-Richard model (Meltzer and Richard, 1981), individuals' material (economic) preferences have been considered a crucial determinant of the level of taxation. Such models assume that support for, and thus ultimately the level of taxation, is determined by how much a given individual would pay based upon their income.

The key point of this discussion is that while individuals may be supportive of environmental policy in general terms, they may become less supportive or even opposed when a specific policy that is very costly to them personally is proposed.[7] Rich individuals, who are more likely to state support for efforts to mitigate climate change, are also those who will pay the highest absolute cost when carbon emissions are taxed. Taken together, this creates a tension in support for pricing carbon. The positive association between income and carbon tax support we currently see based upon conventional surveys may result from a lack of information that carbon taxation would impose higher absolute costs upon richer individuals. This leads to the following empirical implications:

H1a: *Absent new information about policy costs, richer individuals are more supportive of carbon taxation than poorer individuals.*

H1b (Pocketbook Focused): *Given information about the personal cost of carbon taxation, richer individuals reduce their support more than poorer individuals.*

So far, we have discussed support for carbon taxation as a function of individual material (pocketbook) preferences. Yet, the distributional consequences of carbon taxation may

world communication (e.g. Canada's carbon tax rebate https://www.canada.ca/en/revenue-agency/services/child-family-benefits/cai-payment.html)

[7] There are other costs associated with climate change, such as exposure to occupational risk from climate policy and susceptibility to climatic events (e.g. Tol et al. 2004, Gaikwad et al. 2022), that may also enter an individuals' decisions to support climate policy generally and carbon taxes specifically. While these are important, we choose to focus on these immediate material costs for reasons of tractability and given that they are understudied in the previously literature.

influence an individual's support for the policy as well. Recent research suggests that such distributional preferences play an important role in shaping individuals' policy preferences in a wide range of areas, for instance trade, welfare, and taxation policy (Mansfeld and Mutz, 2009; Lu and Scheve, 2016; Rueda, 2018). Political conflict over differing cost implications of carbon taxes for different parts of society (e.g. by income segment, area of residence, or profession) in a variety of countries strongly suggests that distributional considerations play an important role when citizens form their policy preferences in this area.

Applied to carbon taxation, this implies that information about the distribution of costs across income groups can also affect policy support. Specifically, learning about the distribution of the absolute costs of carbon taxes across different income groups can change individuals' policy support. Information on the fact richer individuals will pay a larger absolute monetary cost from carbon taxation than poorer individuals can therefore lead to an increase support for carbon taxation, through the channel of inequality aversion (e.g. Lu and Scheve, 2016). However, this may also lead to a backlash amongst high-income individuals who learn they primarily bear the cost of the policy.

H1c (Distribution Focused): *Information about the distribution of policy costs increases support for carbon taxation on average.*

H1d (Pocketbook+Distribution focused): *Given information about the distribution of costs from carbon taxation, richer individuals reduce their support more than poorer individuals.*

2.2 Income and Support for Carbon Taxation with Revenue Usage

Thus far, we have primarily considered the link between carbon taxation and income through differential cost burdens. However, when the revenue generated from carbon taxation is considered, there are the possibilities for carbon taxation to in fact generate benefits. A large body of research examines how revenue recycling, that is how revenues raised by a carbon tax

are spent, can potentially increase support for carbon taxation through the provision of benefits to segments of the population (e.g., Beck et. al 2015, Beiser-McGrath and Bernauer 2019, Dolšak et al., 2020, Mildenberger et al. 2022).

One of the most notable forms this can takes is in the form of a tax rebate, often referred to as a "carbon dividend". Such rebates involve redistributing the revenue raised from a carbon tax to every citizen in the form of a flat tax rebate. These rebates have been implemented most notably in Canada and Switzerland (Mildenberger et al. 2022). Although the specifics vary between countries, this results in a tax rebate for households based upon the number of members, either through an income tax credit (Canada) or a discount on health insurance premiums (Switzerland).

We expect that the simple inclusion of a rebate increases support for carbon taxation, relative to a carbon tax with no rebate, due to it reducing the costs individuals face. Additionally, we expect this to have a stronger effect for poorer households as this constitutes a larger percentage of their income, absent any additional information.

H2a: *Including a tax rebate with a carbon tax increases support for carbon taxation.*
H2b: *Low-income individuals increase their support for carbon taxation with a rebate more than high income individuals.*

Including a carbon tax rebate, however, has broader distributional consequences. A flat tax rebate effectively redistributes income from high to low income individuals. While everyone receives the same rebate, low income individuals contribute less to the overall carbon tax revenue due to their lower consumption of carbon intensive goods. Thus, low-income individuals would be net beneficiaries from this form of revenue usage (Horowitz et al., 2017),

with tax rebates in Canada leading to a progressive outcome with 80% of households net-beneficiaries from this policy (Mildenberger et al. 2022).

This has consequences for understanding how information about the costs and benefits from carbon taxation affects public support for different groups, as was the case for carbon taxation without tax rebates discussed in the preceding section. Information about the income and distributional effects of a carbon tax rebate will have different impacts by income. For low- and middle-income individuals, information beyond the inclusion of a rebate likely doesn't significantly increase support on average as it simply reaffirms that they would gain money from a carbon tax that included such a rebate. In contrast, high-income individuals receive more negative information as they learn that they will still lose money even though they receive a tax rebate. This is potentially compounded by the fact they are losing money while most of the population are actually gaining money, when provided information about both the personal income effects and the distribution of these effects. As a result, we expect that the inclusion of a tax rebate can potentially cause a backlash amongst high-income groups if they are informed of the broader distributional consequences.

The preceding discussion leads to the following empirical implications:

H3a (Backlash): *High-income individuals decrease support for carbon taxation with a rebate, when provided information about the individual and distribution of income costs.*
H3b (Distribution Focused): *Low-income individuals increase support for carbon taxation with a rebate, when provided information about the individual and distribution of income costs*.
H3c (Pocketbook Focused): *Low-income individuals do not increase support for carbon taxation with a rebate further, when provided information about the individual and distribution of income costs*.

2.3 Political Ideology

Up until this point, we have examined support for carbon taxation through its income effects, both with and without tax rebates, and how this is received by different income groups, which subsequently affects policy support. However, given the politicization of climate change, both in the importance of the issue and the implementation of policy, we also expect individuals ideological pre-dispositions to condition the distributional mechanisms we have discussed.

Specifically, partisan affiliation is likely to affect the dynamics discussed previously. Previous research documents that the very existence and importance of climate change itself is politicised in many countries, most obviously in the USA (e.g., McCright and Dunlap 2011, Mildenberger et al 2017) but also in Germany (e.g. Pew Research 2015). This politicization also feeds in to general support for carbon taxation (e.g., Davidovic et al. 2020), as well as the role of revenue usage as a means to foster support for carbon taxation (e.g. Anderson et al 2019, Douenne and Faber 2022).

Therefore, we also identify the role of partisan affiliation for understanding the importance of income in support for carbon taxation, when examining the distributional consequences of carbon tax rebates.

In the context of party identification in Germany and the United States, we would expect that individuals supporting green and/or center-left parties, such as the German Social Democrat Party (SPD), the US Democrats, and the German Greens, to be more accepting of redistribution for ideological reasons. High income individuals with these political views are thus likely to be more supportive of a carbon tax if it benefits lower income individuals, even though they face the largest cost burden. As a result, the potential backlash from the cost implications identified previously may be mitigated by incorporating another issue dimension. In contrast, high income individuals who identify with right-wing parties that are generally opposed to

environmental and redistributive policies, such as Republicans in the United States and CDU/CSU voters in Germany, will not be swayed by the promise of carbon taxation benefitting low-income groups. Thus, we expect negative effects to remain amongst this group of voters.

H4a: *Revenue usage from carbon taxation that redistributes income from the rich to the poor will be supported more by left and green party voters.*

H4b (Distribution Focused): *Revenue usage from carbon taxation that redistributes income from the rich to the poor will mitigate the negative income effect for high income left and green voters.*

H4c (Pocketbook Focused): *Revenue usage from carbon taxation that redistributes income from the rich to the poor will not reduce the negative income effect for high income voters.*

3. Research Design

To test the empirical implications of our theoretical arguments, we conducted survey experiments on representative samples in Germany and the United States. The survey was fielded online through Ipsos, using quota sampling for the survey with hard quotas based upon an individual's age, income quintile, sex, and region, and soft quotas on education and employment status.[8][9]

Our experimental design is outlined in Figure 1.[10] With our design we aim to examine how information about costs affects support for carbon taxation without a rebate, and how support subsequently changes when adding a rebate and potentially providing information about the costs and benefits of doing so.[11] Table 1 presents the information used in the treatments on the

[8] The use of a hard quota for income quintiles is particularly important, given our focus on how information about the income effect of carbon taxation affects support. For Germany the total sample size is 3620, and for the USA it is 3640

[9] For further details of our research design please see Appendix SI.3

[10] For full details of the treatment items, see the appendix.

[11] The provision of rebate information in this manner (T4-T6), having first received the carbon tax without rebate information treatment, ensures that we have comparability in the outcome measure

income effect of a carbon tax with and without revenue recycling mechanisms across all income groups in the United States.[12][13]

Table 1 Income Effects of a Carbon Tax in the USA (Horowitz et al. 2017)

Income Decile	$ Impact (no rebate)	$ Impact (w/ rebate)	% Impact (no rebate)	% Impact (w/ rebate)
1	-67.20	747.60	-0.8	8.9
2	-216	846	-1.2	4.7
3	-382.20	846.30	-1.4	3.1
4	-567	756	-1.5	2
5	-800	600	-1.6	1.2
6	-1082.90	382.20	-1.7	0.6
7	-1445.40	80.30	-1.8	0.1
8	-1845	-307.50	-1.8	-0.3
9	-2439	-948.50	-1.8	-0.7
10	-3225	-2150	-1.5	-1

for carbon tax with a rebate across the comparisons we wish to make to the control group and the non-rebate treatments (T1-T3). All respondents, regardless of treatment condition, thus answer the questions in the same order thus facilitating such comparisons.

[12] This information comes from researchers from the US Treasury on the income effects of a potential carbon tax of $49 per metric ton of carbon dioxide equivalent (mt CO2-e) in 2019, that would ultimately increase to $70 in 2028 (Horowitz et al., 2017). We focus on the absolute cost of a carbon tax, rather than as a proportion of income, both to aid respondents' comprehension and due to it being the dominant means of political communication around the issue.

[13] To ensure comparability between Germany and the United States, we base our information about the effect of a carbon tax in Germany on how a tax would look if it were to have the same impact on median incomes as in the USA. Given our focus on the economic effects of a carbon tax, this ensures better comparability between the two countries. To do so, we first calculate how much the USA rebate ($600), derived from the expected revenue of a carbon tax, is worth as a proportion of the median income (≈ 0.02), and then calculate the German rebate value to be this proportion of German median income (0.02 × 28071 ≈ 540 Euro). While absolute values may differ if calculating this more explicitly for the German case, due to differing consumption behaviour, estimates for the income effects of a carbon tax at a different price level maintains the feature of higher-income individuals facing a larger absolute and relative income cost when compared to low-income individuals (Bach et al. 2019).

Our empirical analysis follows four steps to identify the effects of information and policy design upon support for carbon taxation.

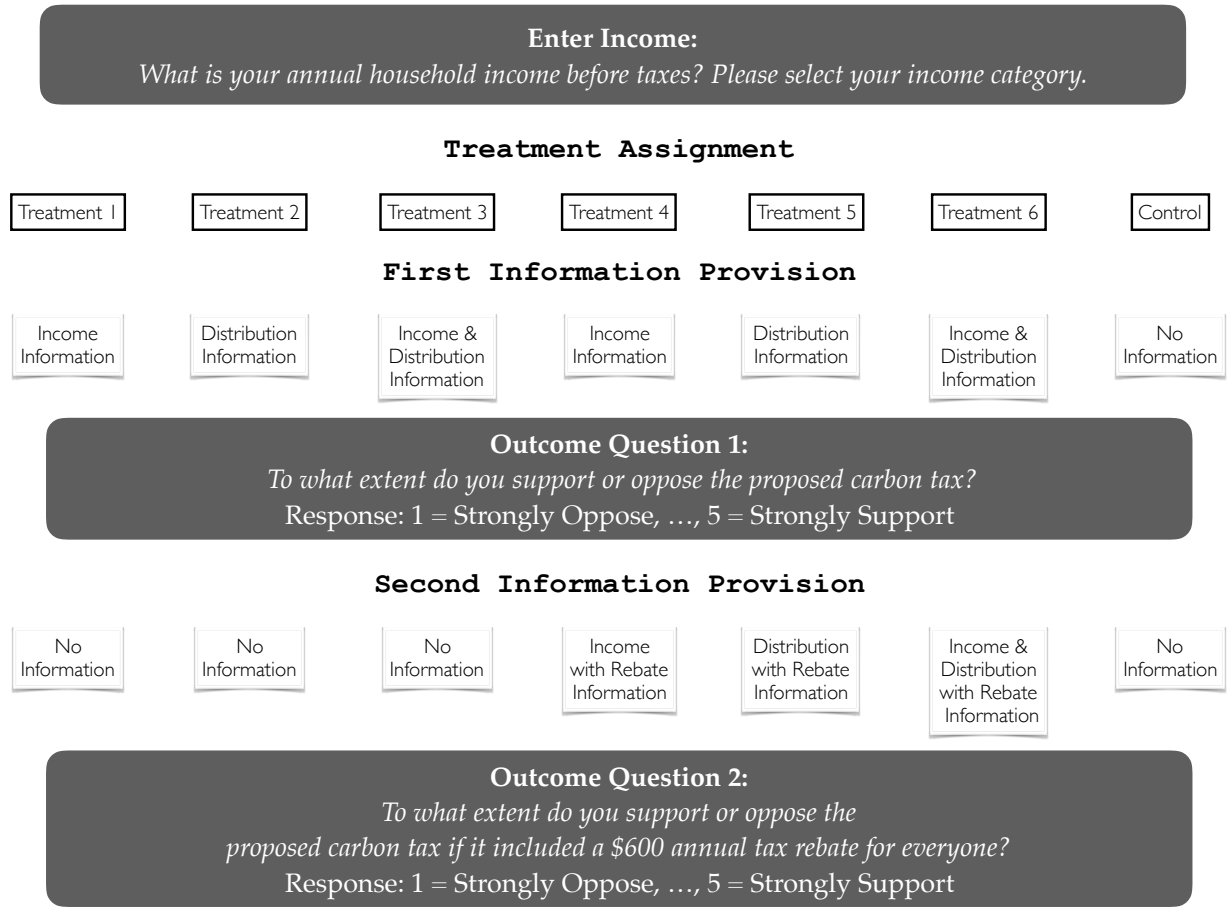

Figure 1: *Diagram illustrating the experimental design. Shaded boxes indicate items respondents answer regarding their income and support for carbon taxation.*

First, we conduct a between-respondent analysis, estimating the effect of information about the income effects of carbon taxation, absent a tax rebate. To do so, we estimate average treatment effects for support for carbon taxation without a rebate using treatments 1-3 in comparison to the no information control. We also examine how these effects vary by income. This allows us to test hypotheses 1a-d.

Second, we conduct a within-respondent analysis, estimating the effect of including a tax rebate upon support for carbon taxation. To do so, we estimate how support changes for a carbon tax that includes a tax rebate when compared to a carbon tax with no rebate, in the no information

control group. We also examine how these effects vary by income. This allows us to test hypotheses 2a-b.

Third, we conduct a between-respondent analysis, estimating the effect of information about the income effects of carbon taxation, both with and without a tax rebate, upon support for a carbon tax with a rebate. To do so, we estimate average treatment effects for support for carbon taxation with a rebate using treatments 4-6 in comparison to the no information control group. We also examine how these effects vary by income. This allows us to test hypotheses 3a-c.

Fourth and finally, we conduct a between-respondent analysis, estimating the unique effect of information about the income effects of carbon taxation with a tax rebate compared to the income effects of carbon taxation without a tax rebate. To do so, we estimate average treatment effects for support for carbon taxation with a rebate using treatments 4-6 in comparison to the associated information treatments without a rebate, treatments 1-3. Specifically, we make matched comparison between treatment 4 and 1, treatment 5 and 2, and treatment 6 and 3. We also examine how these effects vary by income and conduct subgroup analyses for these heterogenous treatment effects by partisan identification. This allows us to test hypotheses 3a-c and 4a-c.

When estimating how treatment effects vary by income decile, we estimate both linear and non-linear interaction effects. For non-linear interaction effects we use the binning estimator developed by Hainmueller, Mummolo, and Xu (2018). To examine how these effects vary by partisanship, we conduct sub-group analysis.[14] For covariate adjustment we include

[14] In appendix Figures A11-12 we show that our inferences do not significantly change when adjusting for multiple comparisons using the Bonferroni correction (where the number of hypotheses equal the number of political parties for each country).

individuals' age, belief in climate change, education level, employment status, party identification, and sex.

4 Results

We now turn to presenting the results from the survey experiment. First, we estimate the effect of information about how a carbon tax would impact an individual's income and the distribution of these costs. Second, we examine how incorporating tax rebates into carbon taxes changes support. To do so, we first examine how support for a carbon tax with a rebate increases support, relative to a carbon tax without such a provision, in the control group. We then examine how information about the individual and distributional consequences of tax rebates affects support levels for different income groups, both in comparison to no information and the income information of a carbon tax with no rebate. Finally, we examine how the impact of this information varies by individuals' income and political party identification.

Table 2 displays how information about the cost of carbon taxation affects support in Germany and USA. We find that information about the effect of a carbon tax upon an individual's income leads to a statistically significant decline in support for the carbon tax. These effects are substantially large, as they lead to an average decline in support by approximately 0.5 points out of a maximal possible change of 4 points when using a 1-5 Likert scale. Comparing to a recent study that examines how support for carbon taxation in 23 countries is associated with individuals' attitudes and characteristics (Umit and Schaffer 2020), our causal effects are similar in size to the largest

Table 2: Effect of Treatments on Support for Carbon Taxation Without Rebate and Revenue Information

	Model 1	Model 2	Model 3	Model 4
T1) Individual	-0.539***	-0.585***	-0.504***	-0.458***
	(0.085)	(0.087)	(0.086)	(0.085)
T2) Distribution	-0.127	-0.165**	-0.141*	-0.118
	(0.083)	(0.084)	(0.084)	(0.083)
T3) Individ. + Distrib.	-0.483***	-0.480***	-0.516***	-0.452***
	(0.085)	(0.088)	(0.086)	(0.085)
Country	Germany	Germany	USA	USA
Covariate Adjustment	No	Yes	No	Yes
Num.Obs.	1612	1267	1618	1435

* p < 0.1, ** p < 0.05, *** p < 0.01

correlational association found (the difference between minimum and maximum level of trust in government). In contrast, there is little impact of simply learning about the distribution of tax burdens. As a result, the treatment that combines both income and distributional information has a similar significant effect as the treatment that only includes individual income information, both substantively and statistically.

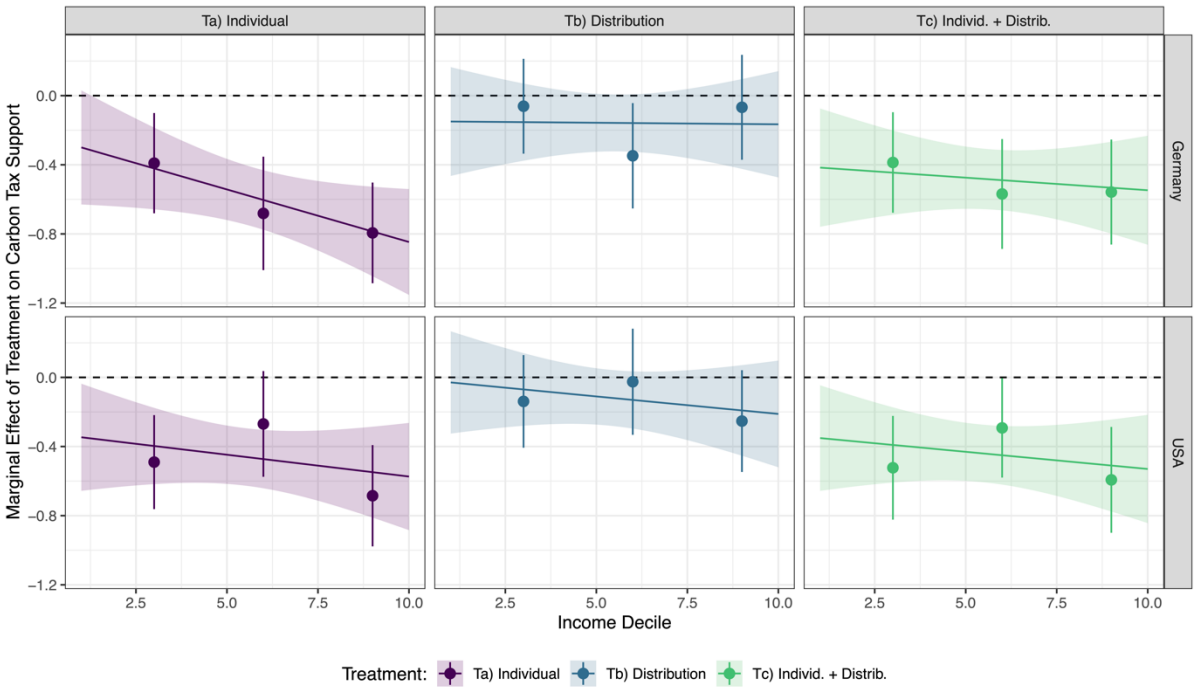

Figure 2 How information about the effect of carbon taxation upon incomes affects support for carbon taxation, conditional upon income. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals. Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income (terciles), with vertical lines indicating 95% confidence intervals.

We now turn to examining how these effects vary by income group, given that average treatment effects mask the variation in costs from carbon taxation faced by different income groups. Figure 2 shows how the effect of this information is conditional upon an individual's income. We see that, in general, cost information generally has a negative effect upon support for a carbon tax, and that the negative effect becomes stronger the higher an individual's income is. This interaction effect exhibits non-linearity, particularly in the case of US respondents. For US respondents effects are similar for those in the first and second tercile of income, while they are statistically significantly negative for those amongst the top tercile. This is even the case for the distribution information treatment (T2), that did not display statistically significant effects on average. This is less the case for the German respondents. There is a monotonically negative treatment effect for the income information treatment (T1), however introducing distributional information negates the negative effect for the richest respondents (T2 and T3). As displayed in the appendix (Figure A1) this arises due to a rise in the level of

support in Germany from the 7th decile onwards when provided this information. The direction of these results is suggestive of cross-national differences in how the distributional consequences of carbon taxation affects policy preferences amongst high-income voters.

The Role of Carbon Tax Rebates

We now turn to examining how policy design, in terms of how revenue generated from the carbon tax is used, subsequently affects policy support. In particular, we focus on the effect of an income tax rebate that would be given to all individuals, independent of income. The effect of such a rebate would lead to individuals below the 70th percentile of the income distribution becoming net beneficiaries of the policy, as the money received through the rebate would be larger than the cost imposed by the carbon tax. In contrast, richer individuals would remain net losers as the cost of a carbon tax remains higher than the amount of money received from the rebate.

Before estimating the effect of information about carbon tax rebates, we first examine whether simply stating that a carbon tax will include a rebate increases support for carbon taxation. To do so, we estimate the difference in support for a carbon tax with a rebate compared to a carbon tax without a rebate for those who receive no information (the control group). As displayed in Table 3, we find that a carbon tax with a rebate is significantly more popular than one without. While this is statistically significant across both countries, it is substantively larger in Germany (approximately twice as large) which is again suggestive of cross-national differences in support for the redistributive elements of carbon taxation.

Table 3 Effect of Including a Rebate upon Support for Carbon Taxation in the Control Group

	Model 1	Model 2	Model 3	Model 4
Tax Rebate	0.375***	0.355***	0.133***	0.158***
	(0.047)	(0.055)	(0.047)	(0.050)
Country	Germany	Germany	USA	USA
Covariate Adjustment	No	Yes	No	Yes
Num.Obs.	806	626	810	720

* p < 0.1, ** p < 0.05, *** p < 0.01

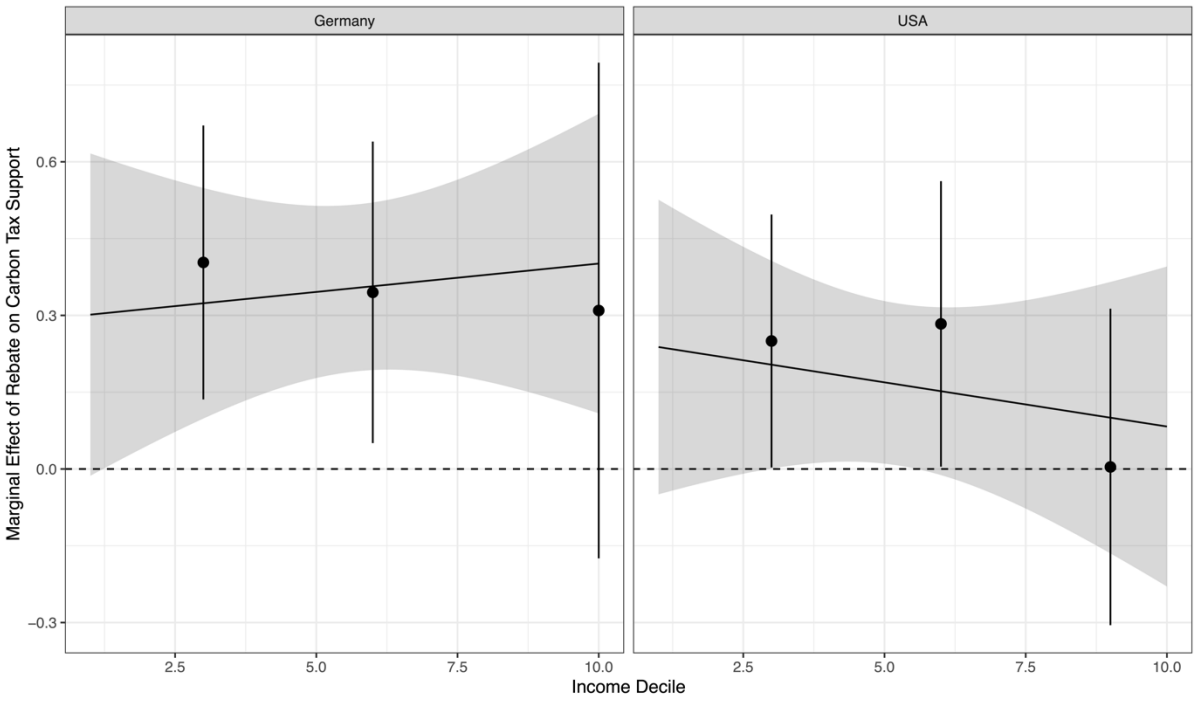

Figure 3 Effect of Including a Rebate upon Support for Carbon Taxation in the Control Group

Figure 3, shows how change in support for carbon tax when including a rebate (analogous to Table 3) depends upon individuals' income absent any information about the income effects of carbon taxation. We see further evidence for cross-national effects of including rebates. While

the income gradient is flat for Germany, implying that individuals uniformly increase support for carbon taxation with a rebate, this is not the case for the USA. In this case, while there is a statistically significant increase in support for carbon taxation when there is a tax rebate amongst individuals in the 1st and 2nd tercile of the income, individuals in the 3rd tercile do not significantly increase support. However, it should be noted that due to large confidence intervals these effects are hard to clearly distinguish statistically. As displayed in the appendix (Figure A2) this arises due to support for a carbon tax with a rebate being flat across middle- to high-income deciles, unlike the increasing support for carbon taxation by income in the control group.

We now turn to examining how information about individual and distributional income effects of carbon tax rebates shapes support for carbon taxation with a rebate, conditional upon individuals' income.

Figure 4 displays how the effect of information changes support for a carbon tax with a rebate, relative to the no information control group, conditional upon income. These treatment effects thus identify the effect of receiving information about the cost implications of both a carbon tax with and without a rebate, in comparison to receiving no information whatsoever.[15] We find that richer individuals in the USA significantly decrease their support for a carbon tax, while poorer individuals do not decrease support. The treatment effects reflect the fact that providing tax rebates to all individuals provides a net benefit to poorer individuals, and a net cost to richer individuals. A similar pattern emerges for German respondents when considering information about individual costs and benefits from a tax rebate. Richer individuals respond negatively to the information about the costs of carbon taxation, while poorer individuals no

[15] In subsequent analyses we identify the unique effect of rebate information, relative to information about a carbon tax without a rebate.

longer do so. However, in contrast to US respondents, this effect is non-linear in income when provided with both the individual and distributional costs and benefits. While individuals in the middle of the income distribution statistically significantly decrease support, richer individuals do not significantly decrease support when learning about the distributional implications in combination with the effect upon their own income.[16]

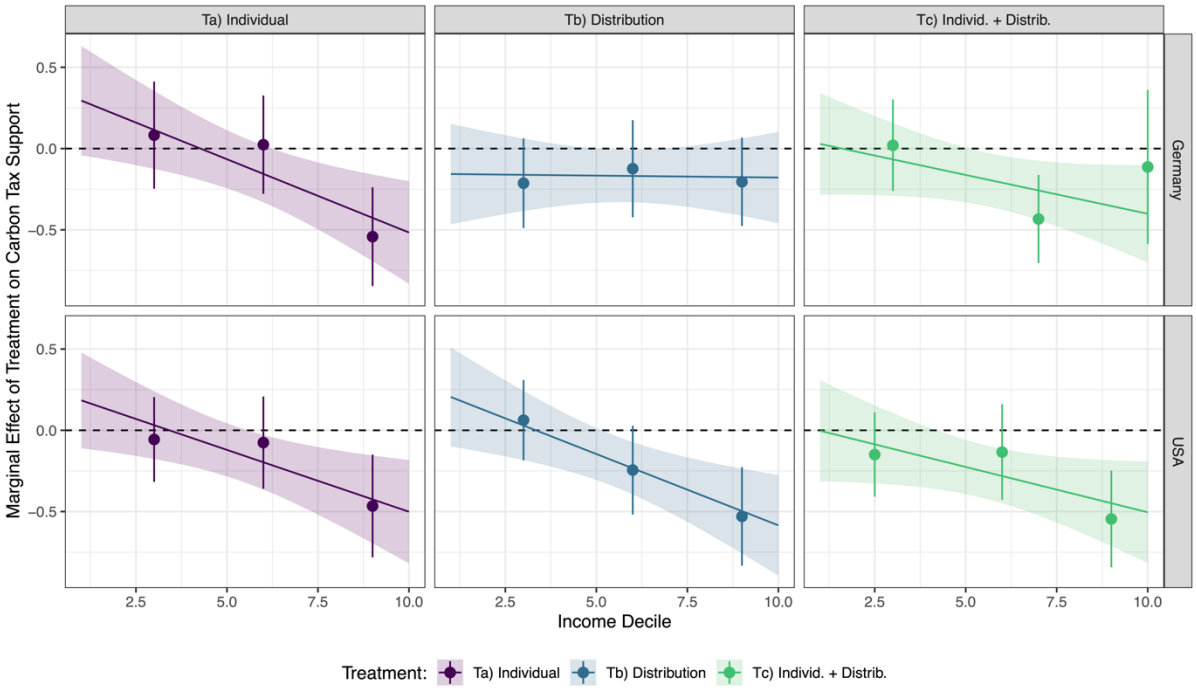

Figure 4 How information about the effect of carbon taxation rebates upon incomes affects support for carbon taxation with rebates, conditional upon income. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals. Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals.

It is important to note that the null effects of the information for low- and middle-income groups does not mean that these individuals do not increase support for carbon tax rebates that benefit them personally. As evidenced by Figure 3, simply stating that a carbon tax will include a rebate significantly increases support. Rather, the result show that providing additional

[16] See Figure A3 in the appendix for more descriptive results on the levels of support by income, with Figures A4-A5 further breaking this down by party identification.

information beyond the rebate offered does not lead to a *further* increase in support. Thus, beyond the individual income effect contained in the policy itself, low- and middle-income individuals support is not increased by providing information about the distributional consequences and more specifics about the exact benefit they receive.

In contrast, high-income individuals in both Germany and the USA significantly decrease support when they learn that the benefit provided by the tax rebate does not offset their income loss (T4). However, adding distributional information (T6) avoids this backlash effect in Germany, while this fails to do so in the USA. This suggests, that support for carbon taxation is primarily driven by individual ego-tropic concerns in the USA, while distributional information can mitigate backlash effects amongst high-income individuals in Germany.

This, in addition to the next results on party identification, suggests that the redistributive element of a carbon tax that provides a rebate to all individuals lessens opposition among the rich in Germany even though they personally lose out.

We now identify the unique effect of income information about tax rebates, compared to simply including a rebate and income information about a carbon tax absent a rebate, by making this the comparison group rather than the no information control (Figure 5).[17] Examining these treatment effects, we see that distributional effects (T5) have a strong statistically significant effect amongst US respondents. Interestingly, this does not translate to significantly reduced support for the treatments amongst high-income groups in the USA when including individual income information treatment (T4 and T6). This is ultimately due to the fact that the unique information about income effects from a rebate, can be inferred from receiving the information about costs from not having a rebate (T1 and T3) and

[17] See Figure A6 in the appendix for associated descriptive results on the levels of support by income.

knowing the value of the rebate (included in the outcome question). As a result, only the distributional information about a rebate (T5 and T6) is completely novel. Thus, in the US case, we see statistically significant negative effects for those high-income individuals who have only been exposed to distributional information (T5), while the null effect for those who received both income and distributional information (T5 and T6) is likely a result of the individual income information dominating the distributional information which they can infer in the way noted above. This lends further credence to the view that individual ego-tropic effects are a strong determinant of high-income individuals' policy support in response to information about carbon taxation.

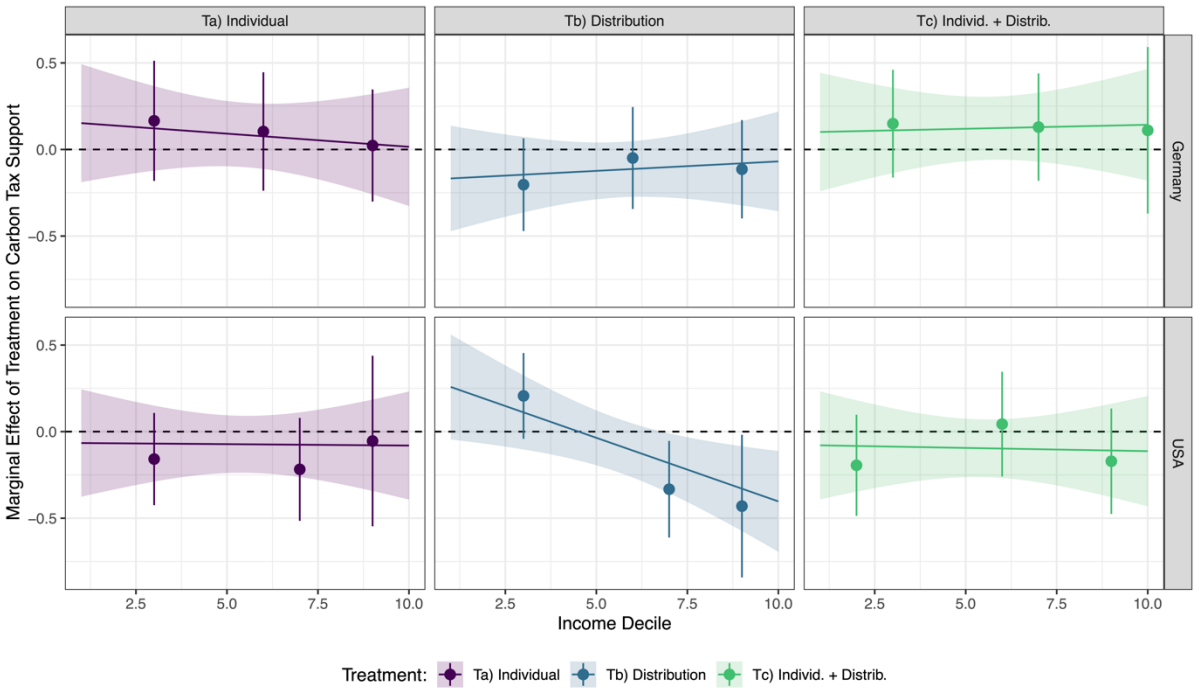

Figure 5 How information about the effect of carbon taxation rebates upon incomes, relative to information about carbon taxation without a rebate, affects support for carbon taxation with rebates, conditional upon income. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals. Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals.

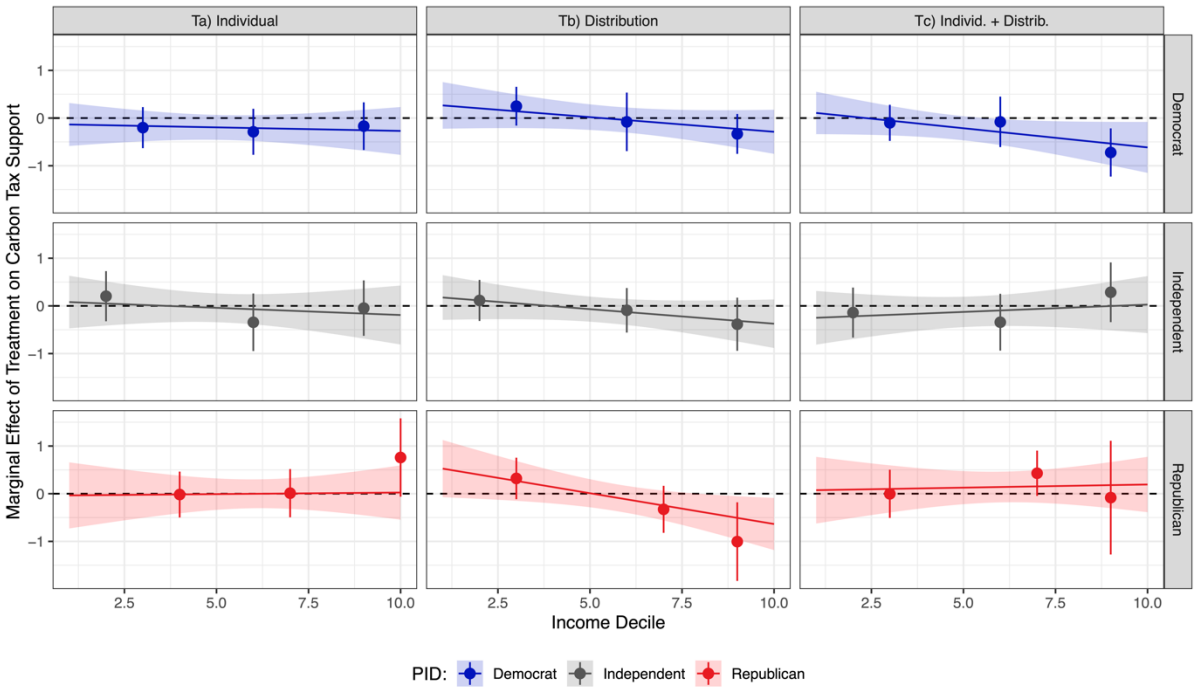

Figure 6 How information about the effect of carbon taxation rebates upon incomes (T4-T6), relative to information about carbon taxation without a rebate (T1-T3), affects support for carbon taxation with rebates, conditional upon income and PID in the USA. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals. Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals.

Finally, we examine whether this effect varies by partisanship, to examine whether this backlash effect is widespread or mitigated by prior attachment to climate policy (i.e., amongst Democrats). As displayed in Figure 6, we find that the lack of significant effect in Figure 6 for the combined income and distributional treatment (T3) amongst high-income individuals, is masking a strong negative effect amongst Democrats which is counterbalanced by a positive (but not statistically significant) positive effect amongst Independents. Examining levels of support, this treatment effect is driven by the fact that absent new information about rebates, high-income Democrats still have very high levels of support for carbon taxation (Appendix Figure A7). When provided information that shows that a rebate does not offset their own income loss from a carbon tax without a rebate, and that the bottom 70% of the distribution in fact benefit, their level of support matches Independents and Republicans. This leads to strong negative treatment effects, suggesting that the consequences of redistribution through carbon taxation erodes support from a constituency

that is initially strongly in favor of the policy. This contrasts, with similar voters in Germany (Greens and SPD voters), where this distributional information offsets any potential negative effects amongst high-income voters (Appendix Figures A8 and A9).

5 Conclusion

Policy preferences of the mass public act as important enablers or constraints in many if not most areas of policy-making, particularly in democratic societies (e.g. Pierson 2000, Brooks and Manza 2007, Rehm et. al 2012). This is particularly the case when policy choices have very costly, clearly visible and direct, and thus highly salient implications for most individuals in society. We focus on one such case, carbon taxes in climate policy, in order to study a fundamental question in political science: namely, how citizens form their policy preferences and what the relative importance of pocketbook and distributional considerations is in this regard.

Carbon taxation is supported by most environmental economists and also an increasing number of policy-makers because it is viewed as an effective and economically efficient means for reducing greenhouse gas emissions to limit global warming. Yet, the policy design of carbon taxation raises various longstanding issues in political economy which are not yet fully understood. Are citizens, without whose support or at least tolerance a carbon tax is virtually impossible to implement, primarily concerned with their own individual tax burden (pocketbook consideration), or instead concerned with its distributional consequences in society as a whole, as controversies over carbon taxation in many countries suggest (Harrison 2010, Rabe 2018, Carattini et. al 2019)? Recent debates on how to design carbon taxes, and in particular what to do with such tax revenues, are closely related to the general question about pocketbook versus other-regarding considerations. Do individuals become more supportive of carbon taxation if revenue is used in a way that offsets negative individual or distributional

effects, or are individuals mainly unconcerned with economic aspects, and simply focused on the ability of carbon taxes to reduce emissions and mitigate climate change? Does pre-disposition for tackling climate change, affect the pocketbook and distributional economic calculus of citizens when they form their policy-preferences with respect to carbon taxes?

Our experiments reveal that individuals are first and foremost concerned with how a carbon tax would impact themselves economically, i.e., the pocketbook effect. High income groups, which are generally more supportive of environmental policies, including carbon taxation, become significantly less so when provided information about how a carbon tax would impact their incomes. So much so, that their support reaches the same level as in low income groups. Information about revenue usage also tends to display effects in line with individual economic concerns, with high income groups in the United States becoming more opposed to carbon taxation when the revenue is used for a flat tax rebate that would benefit primarily middle-to-low- income households, a revenue use that would lead to the bottom 70% of incomes no longer seeing a decline in their income. Distributional information, absent the context of individual burdens, play a weaker role in individuals' decision to support or oppose carbon taxation. However, high-income Germans when they learn that tax rebates benefit low-income individuals increase their support for carbon taxation, suggesting important contextual differences in the political efficacy of the redistributive consequences of carbon taxes including rebates.

From a policy perspective, our results suggest that attempts to limit emissions by means of taxing carbon face considerable stumbling blocks in the design and implementation stages. Individuals who are ostensibly in favor of limiting emissions and also in favor of using carbon taxes to this end, such as higher income individuals, become much less supportive when they learn about the cost implications. Various options for mitigating support decreasing effects

through recycling of carbon tax revenues are seemingly unable to solve this problem in the US context. Moreover, the strong gap between general support for climate policy and carbon taxes on the one hand and "informed" (about the costs) support for carbon taxes is an important barrier for broad based climate policy, particularly those that focus on market-based (e.g., Beiser-McGrath et al. Forthcoming).

With a view to the broader political science literature, our findings point to the need for more systematic consideration of policy design informational environments in which citizens form their preferences for emerging problems. Our findings emphasize that pocketbook effects in particular, are important for understanding political coalitions behind policies aimed at emerging societal problems. While political coalitions are often thought of in terms of those who seek action on a particular issue, we find that the specifics of policy, and associated information, can run counter to this initial support.

These impacts likely vary by issue area. For example, social policy and international trade are areas where it is difficult to estimate a-priori the policy costs incurred by particular types of individuals in society. In such cases, citizens may display rather high levels of concern about the distributional consequences of policy. In some cases, obfuscation of individual policy costs may even be a deliberate policy-design choice. However, in areas, such as carbon taxation, where the cost implications are easier to assess and grasp once implemented and cannot be obfuscated by design, citizens may be more prone to rational egoism centered on a personal pocketbook calculus. Most of the research in this area, including the one presented in this paper, are issue-specific. Further research would benefit from comparisons across policy areas when trying to assess how particular types of informational environments affect how citizens form their policy preferences and when and why this process is shaped by pocketbook or distributional factors. Additionally, research designs to identify why cross-national differences

emerge, particularly in relation to individuals' with ostensibly ideological position, would help better understand the development of political coalitions around emerging societal problems.

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How Do Pocketbook and Distributional Concerns Affect Citizens' Preferences for Carbon Taxation?

Supplementary Information

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Table of Contents

SI.1 Treatment Conditions

Our treatment conditions consist of providing individuals with information about the income effects of a proposed carbon tax. The specific figures and estimates we use are derived from a US Treasury report, that analyses the effect of a carbon tax starting at $49 per metric ton of carbon dioxide equivalent in 2019 and increasing to $70 in 2028 (Horowitz et al., 2017). Respondents randomly receive information about how this tax would change their income and/or how this tax would change incomes in general, and/or how these changes would vary dependent upon how the revenue from the carbon tax is used. The control group receives no such information about the income effects of the carbon tax.

In the following we present the exact treatment conditions implemented in the survey. We use as a running example an individual in the USA who stated that their income was $56,026 - $72,000, to better illustrate the treatment information.

SI.1.1 Control Information Received by all respondents

Carbon dioxide emissions from burning coal, oil, gas, gasoline, diesel, and other fossil fuels are widely regarded as the principal cause of global warming, also called climate change. Climate change, in turn, is widely regarded as the main cause of more droughts, heat-waves, floods, storms, and other extreme weather events that harm people and nature. Governments around the world are thus trying to reduce carbon dioxide emissions.

One of the most important measures being considered is a carbon tax. This means that producers and distributors of fossil fuels would have to pay a tax according to the amount of carbon dioxide emissions these fuels cause. This would make fossil fuels more expensive and motivate people, companies, and others to consume less fossil fuels and thus reduce emissions.

SI.1.2 Treatment 1 Own Income Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

You previously stated that your annual household income was $56,026 - $72,000.

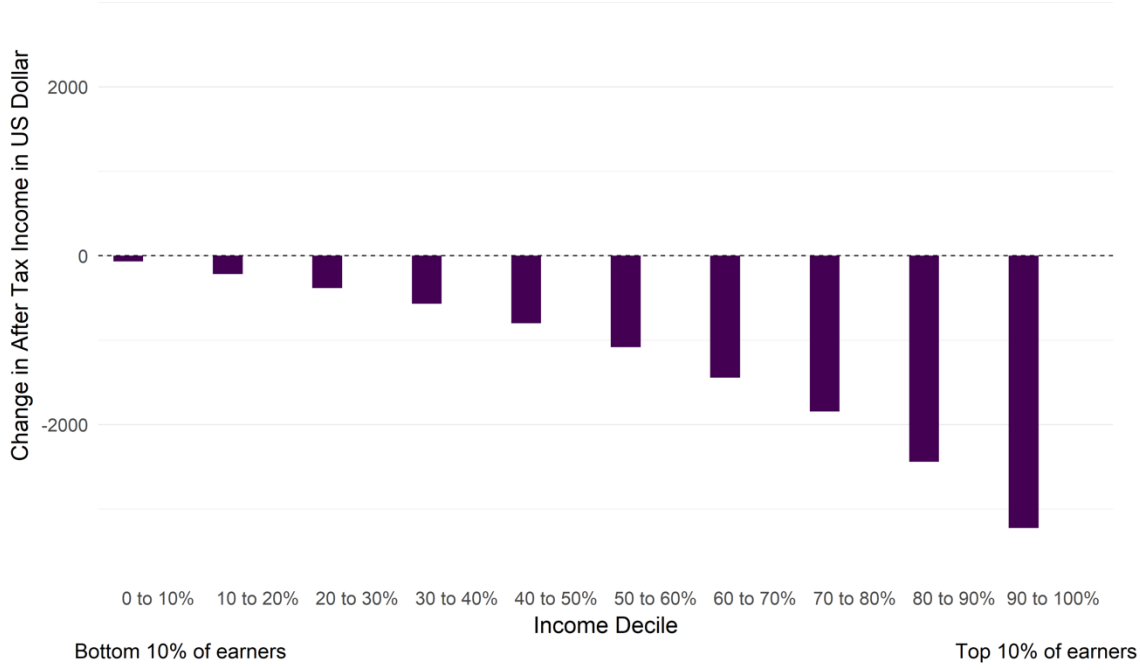
With an income of $56,026 - $72,000, the carbon tax will cause your after-tax income would decrease by $1082.90.

SI.1.3 Treatment 2 Distribution Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

The picture below shows how people in different income groups would be affected by this tax:



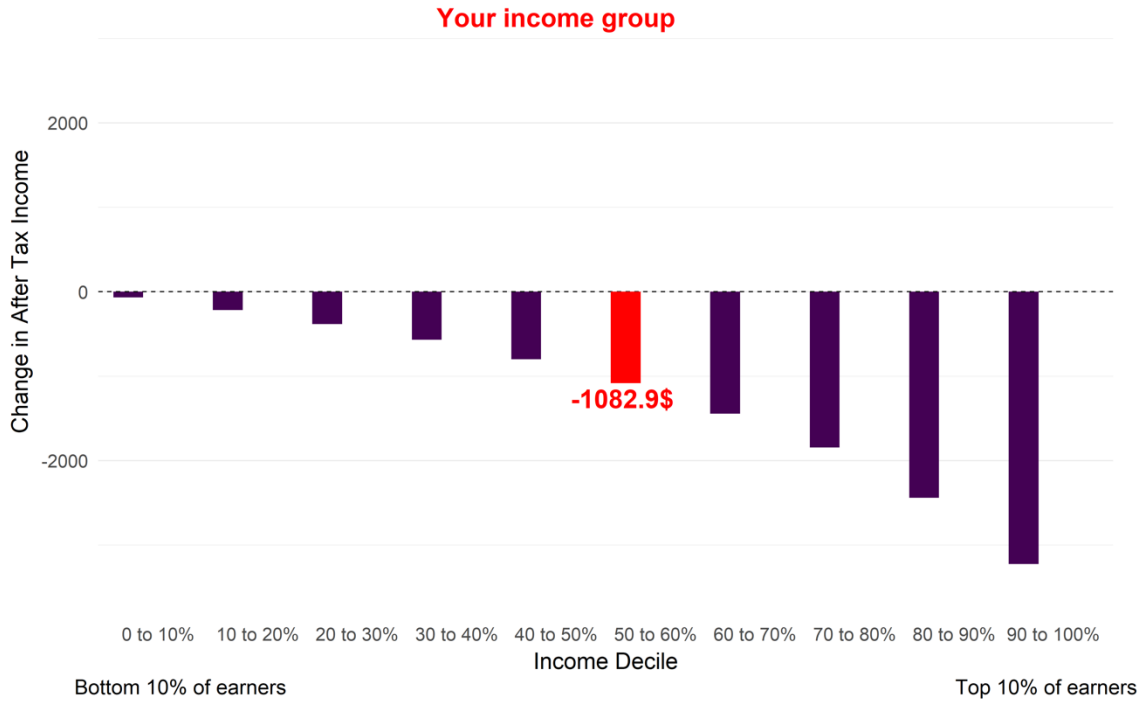
SI.1.4 Treatment 3 Own Income & Distribution Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

You previously stated that your annual household income was $56,026 - $72,000.

With an income of $56,026 - $72,000, the carbon tax will cause your after-tax income to decrease by $1082.90. The picture below shows how other income groups would be affected, with your income group highlighted:



SI.1.5 Treatment 4 Own Income & Revenue Recycling Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

You previously stated that your annual household income was $56,026 - $72,000.

With an income of $56,026 - $72,000, the carbon tax will cause your after-tax income to decrease by $1082.90.

<GO TO OUTCOME QUESTION 1, THEN RETURN HERE>

However, the impact of the new carbon tax on your income could change depending on how the revenue from the carbon tax is used.

If the revenue raised from the carbon tax is used to give each person in the United States a yearly $600 tax rebate, your income would instead increase by $382.20 each year.

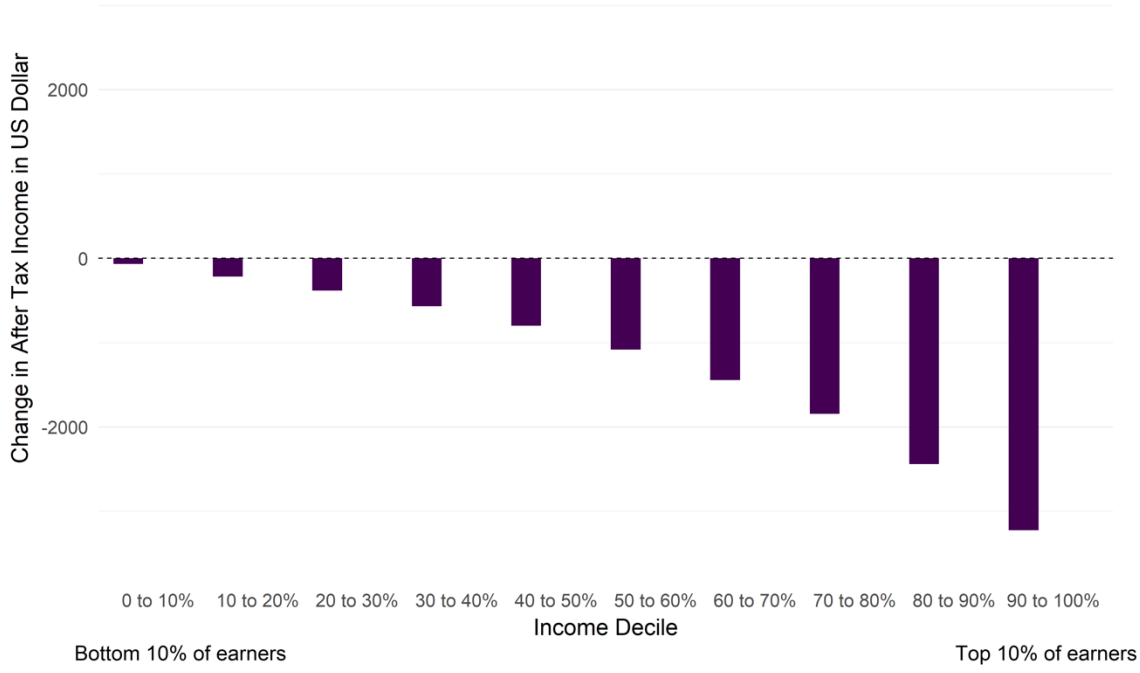
<GO TO OUTCOME QUESTIONS 2 >

SI.1.6 Treatment 4 Distribution & Revenue Recycling Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

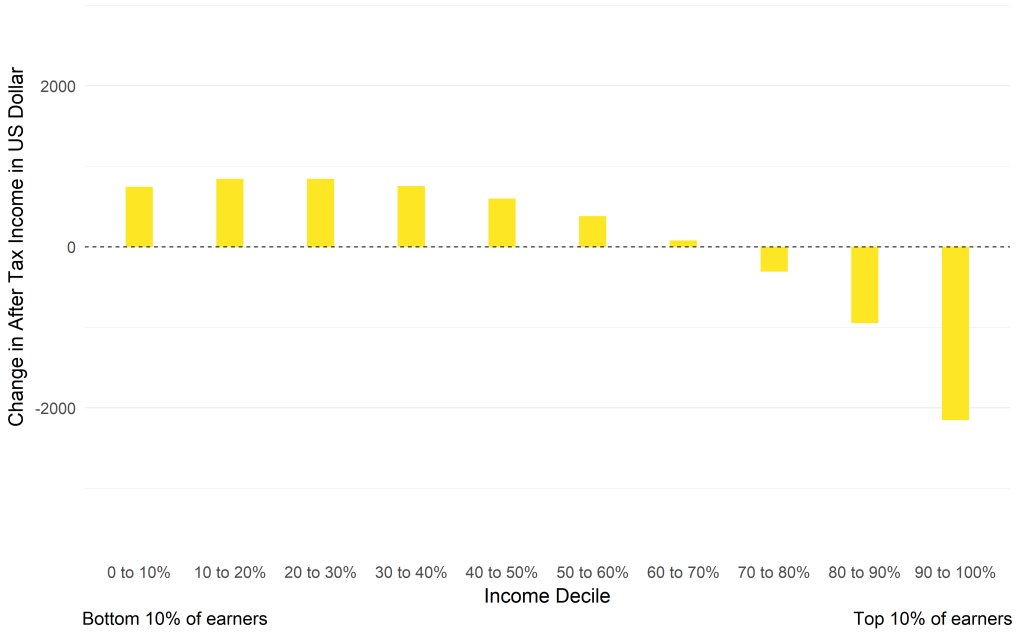
How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

The picture below shows how people in different income groups would be affected by this tax:



However, the impact on people's incomes depends on how the revenue from the carbon tax is used.

The picture below shows how people in different income groups would be affected, if the revenue raised from the carbon tax is used to give everyone a yearly **$600 tax rebate**



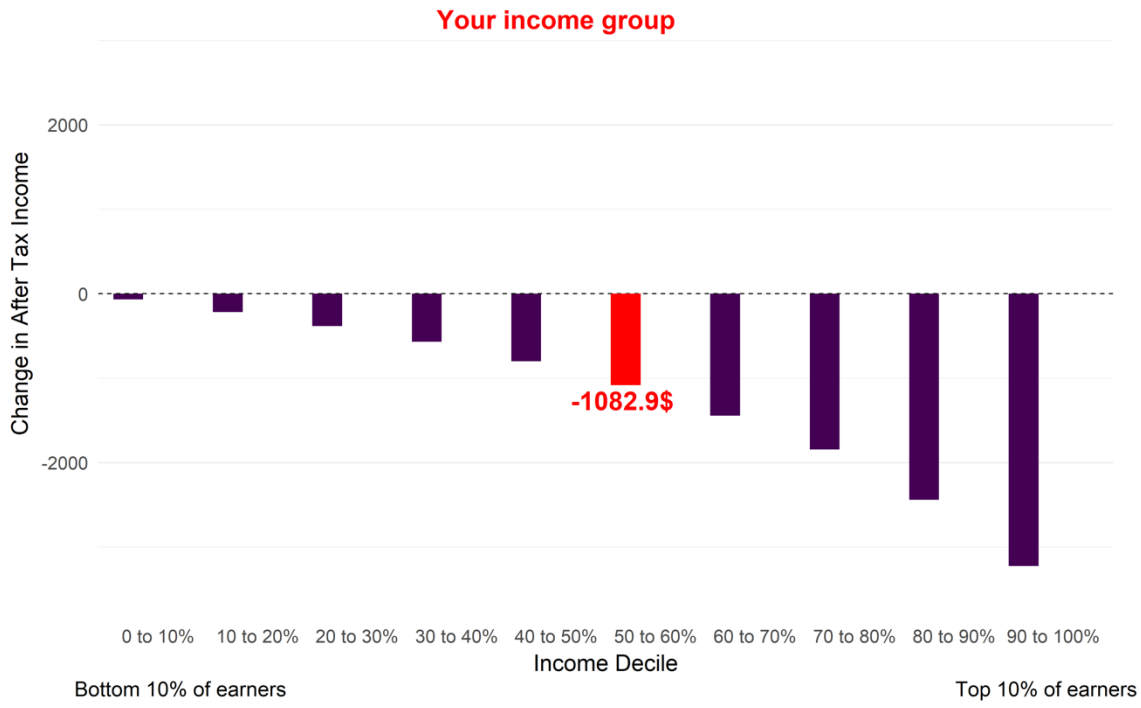
SI.1.7 Treatment 6 Own Income & Revenue Recycling & Distribution Effect

Specifically, a new carbon tax starting in 2019 at $50 per ton of carbon content in fossil fuels and increasing to $70 per ton by 2028 has been proposed.

How much the new carbon tax would add to your energy and fuel bill is likely to depend on your income level.

You previously stated that your annual household income was $56,026 - $72,000.

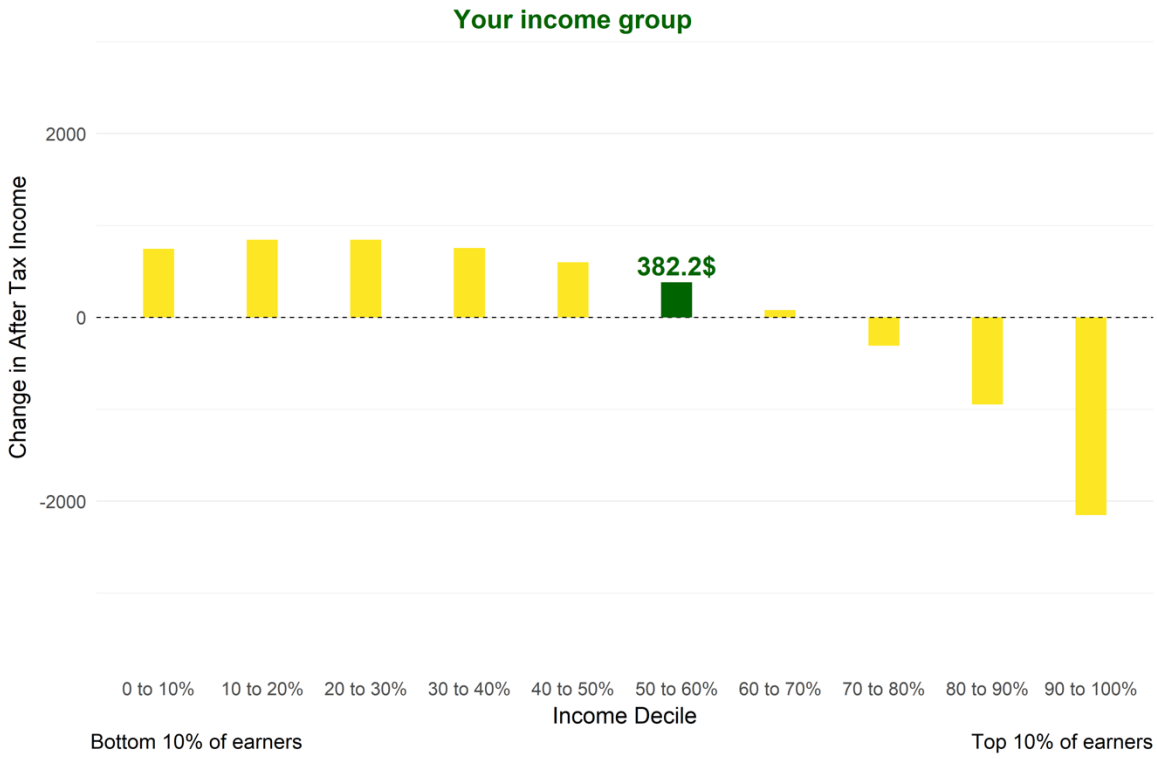
With an income of $56,026 - $72,000, the carbon tax will cause your after-tax income to decrease by $1082.90. The picture below shows how other income groups would be affected, with your income group highlighted:



<GO TO OUTCOME QUESTION 1, THEN RETURN HERE>

However, the impact on your income can change depending on how the revenue from the carbon tax is used.

If the revenue raised from the carbon tax is used to give each person in the United States a yearly $600 tax rebate, your income would instead increase by $382.20 each year. The picture below shows how other income groups would be affected, with your income group highlighted:



<GO TO OUTCOME QUESTION 2 >

SI.2 Outcome Questions

Outcome Question 1: To what extent do you support or oppose the proposed carbon tax?

1. Strongly Oppose
2. Oppose
3. Neither Oppose nor Support
4. Support
5. Strongly Support

Outcome Question 2: To what extent would you support or oppose the proposed carbon tax if it included a $600 annual tax rebate for everyone?

1. Strongly Oppose
2. Oppose
3. Neither Oppose nor Support
4. Support
5. Strongly Support

SI.3 Research Design

To test the empirical implications of our theoretical arguments, we conducted survey experiments on representative samples in Germany and the United States. The survey was fielded online through Ipsos, using quota sampling for the survey with hard quotas based upon an individual's age, income quintile, sex, and region, and soft quotas on education and employment status. The use of a hard quota for income quintiles is particularly important, given our focus on how information about the income effect of carbon taxation affects support. For Germany the sample size is 3620, and for the USA it is 3640.

Our experimental design distinguishes between the theoretical mechanisms outlined previously, that shape individuals' support for carbon taxation and its specific policy design. After having entered their income at the start of the survey, individuals in our experiment randomly receive information on either: i) how their personal income would be affected by the carbon tax, ii) what the distribution of income effects looks like, iii) a combination of i) and ii), or iv) are in the control group and receive no information. Having received this information individuals are asked "To what extent do you support or oppose the proposed carbon tax?", with responses captured on a five-point Likert scale from Strongly Oppose to Strongly Support.

Additionally, some individuals randomly receive additional information about how revenue from the carbon tax is used. Specifically, we display information on how providing everyone a tax rebate changes the individual and/or income distribution information they received previously. Figure 2 in the main text outlines the experimental design. Table 1 in the main text presents the information used in the treatments on the income effect of a carbon tax with and without revenue recycling mechanisms across all income groups in the United States. This information comes

from researchers from the US Treasury on the income effects of a potential carbon tax of $49 per metric ton of carbon dioxide equivalent (mt CO2-e) in 2019, that would ultimately increase to $70 in 2028 (Horowitz et al., 2017). We focus on the absolute cost of a carbon tax, rather than as a proportion of income, both to aid respondents' comprehension and due to it being the dominant means of political communication around the issue.

Before receiving this experimental condition, all respondents are provided an introductory text on the topic of carbon taxes to contextualize their use in mitigating climate change:

"Carbon dioxide emissions from burning coal, oil, gas, gasoline, diesel, and other fossil fuels are widely regarded as the principal cause of global warming, also called climate change. Climate change, in turn, is widely regarded as the main cause of more droughts, heat-waves, floods, storms, and other extreme weather events that harm people and nature. Governments around the world are thus trying to reduce carbon dioxide emissions.

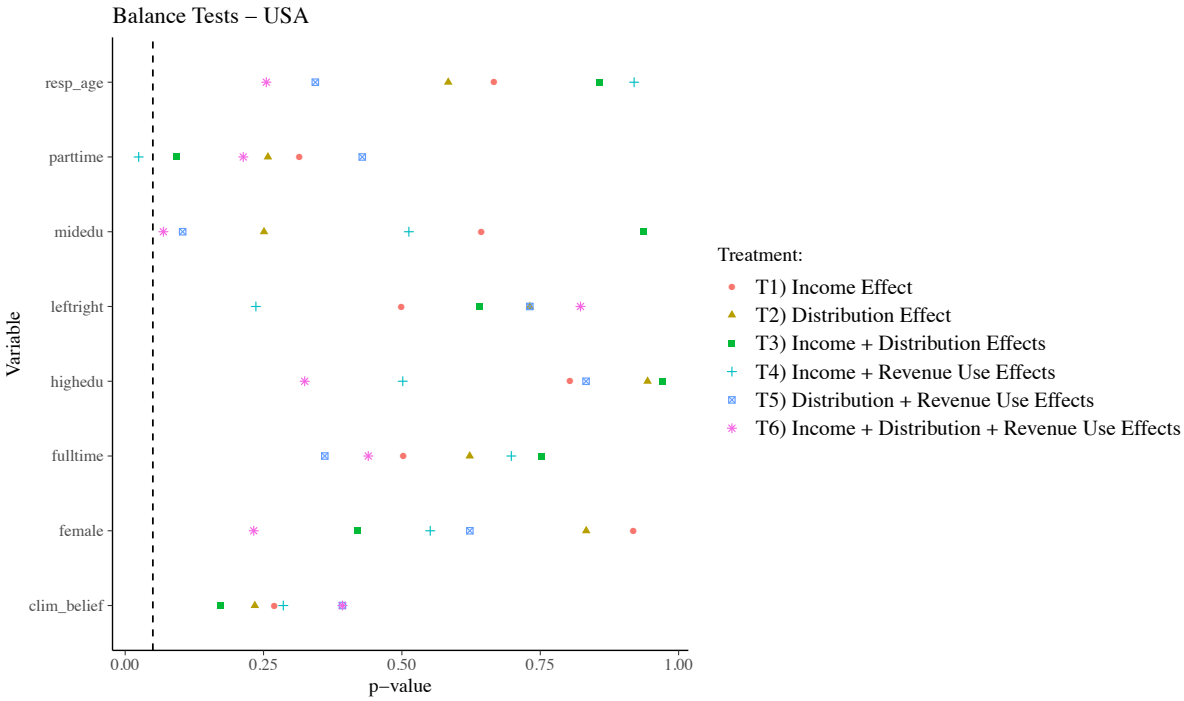
One of the most important measures being considered is a carbon tax. This means that producers and distributors of fossil fuels would have to pay a tax according to the amount of carbon dioxide emissions these fuels cause. This would make fossil fuels more expensive and motivate people, companies, and others to consume less fossil fuels and thus reduce emissions."

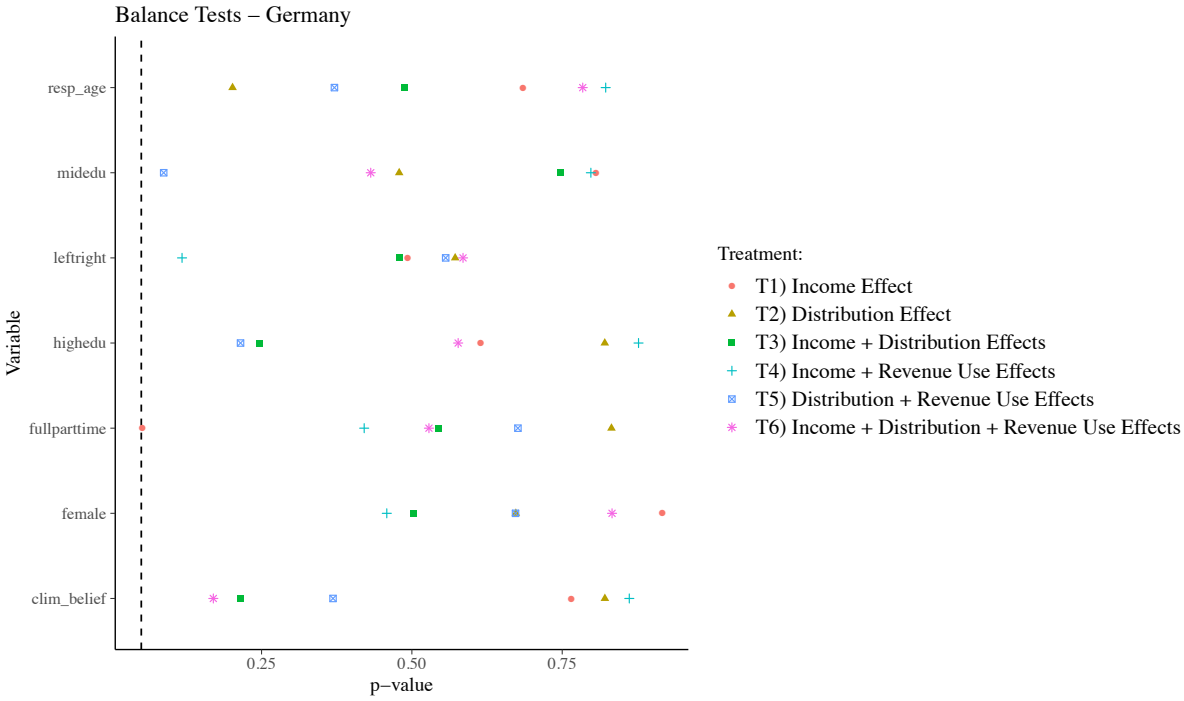
To ensure comparability between Germany and the United States, we base our information about the effect of a carbon tax in Germany on how a tax would look if it were to have the same impact on median incomes as in the USA. Given our focus on the economic effects of a carbon tax, this ensures better comparability between the two countries. To do so, we first calculate how much the USA rebate ($600), derived from the expected revenue of a carbon tax, is worth as a proportion of the median income

(≈ 0.02), and then calculate the German rebate value to be this proportion of German median income (0.02 × 28071 ≈ 540 Euro).

We then estimate how this information affects individuals' general support for carbon taxation, as well as support for carbon taxation that includes this tax rebate. This allows us to examine whether respondents are less supportive of carbon taxation when they learn that it would negatively impact their or others' incomes, and whether these effects diminish if individuals learn that revenue recycling will be used to lessen the impact upon themselves, or upon other people. Respondents are asked "To what extent do you support or oppose the proposed carbon tax?", with responses captured on a five-point Likert scale from Strongly Oppose to Strongly Support. They are then asked a similar question, about a carbon tax that would include a $600 rebate straight away, or if they are in a relevant treatment group, after receiving information about the effect of a tax rebate upon incomes.

SI.4 Balance Tests





SI.5 Additional Results Cited in Main Text

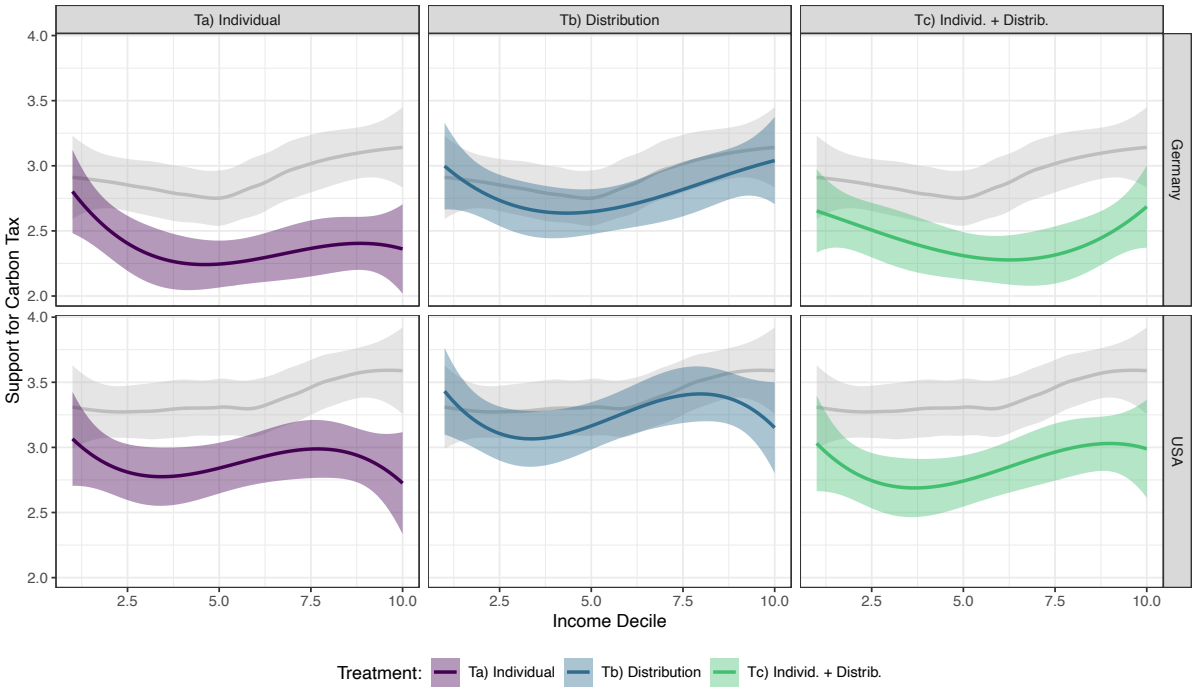


Figure A1: *Expected support levels for carbon taxation by treatment condition (T1-T3) and income. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the control group.*

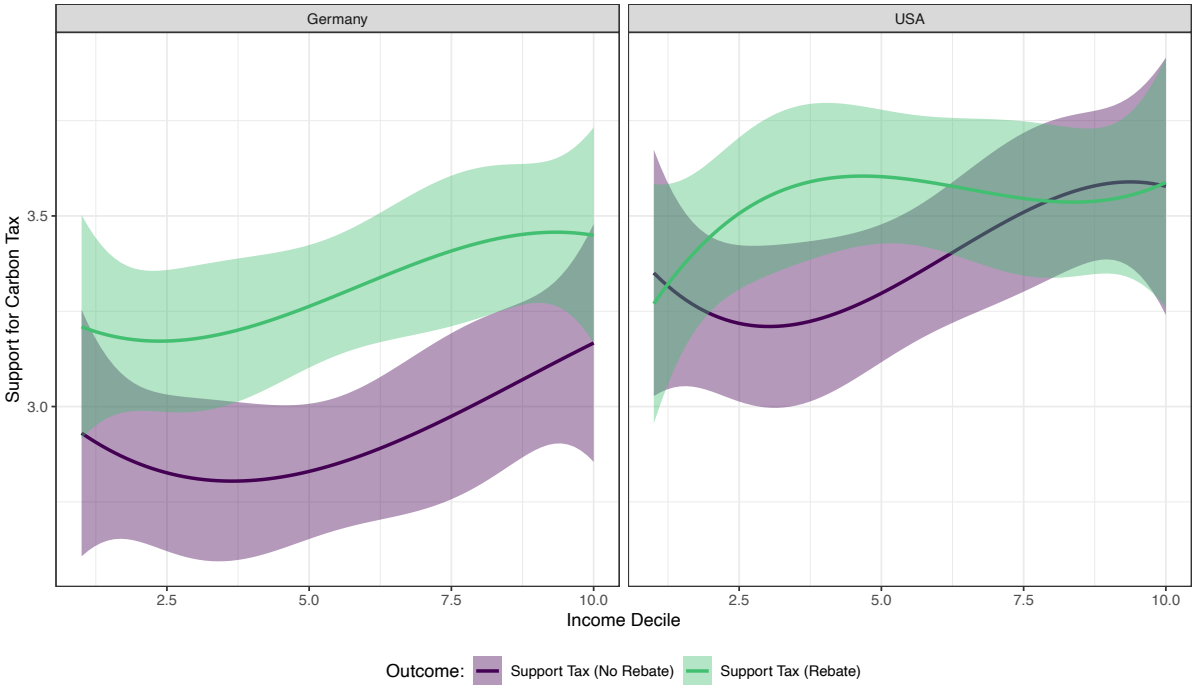


Figure A2: *Expected support levels for carbon taxation by rebate inclusion and income within the control group. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals.*

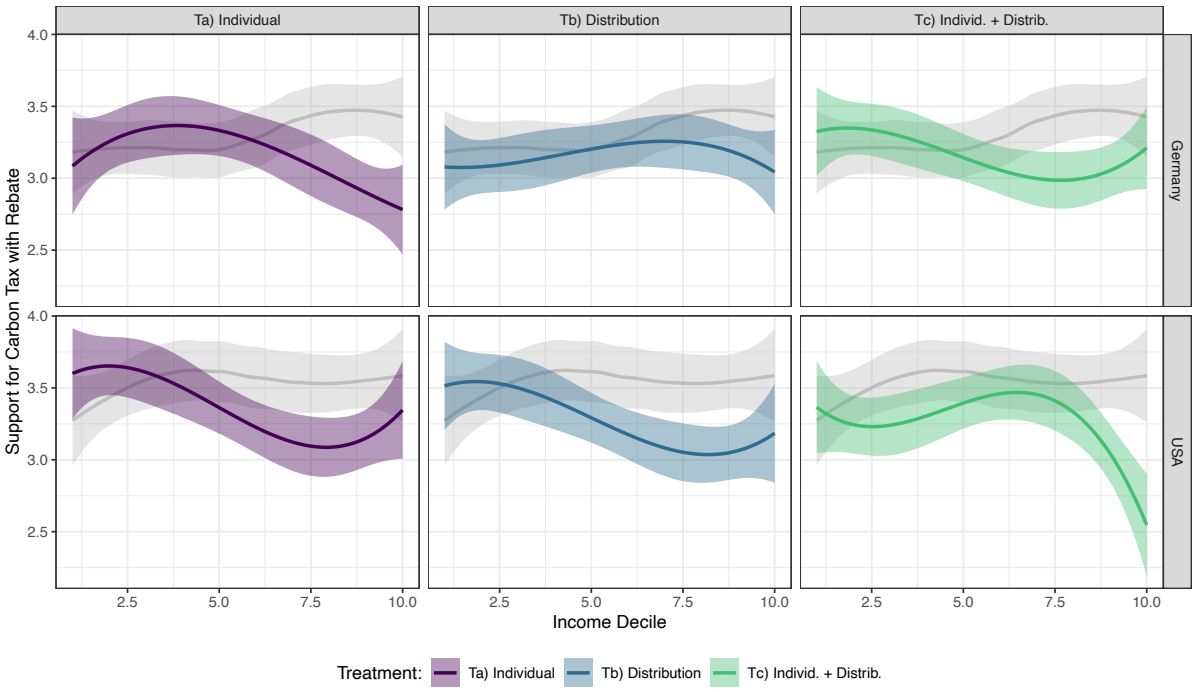


Figure A3: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6) and income. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the control group.*

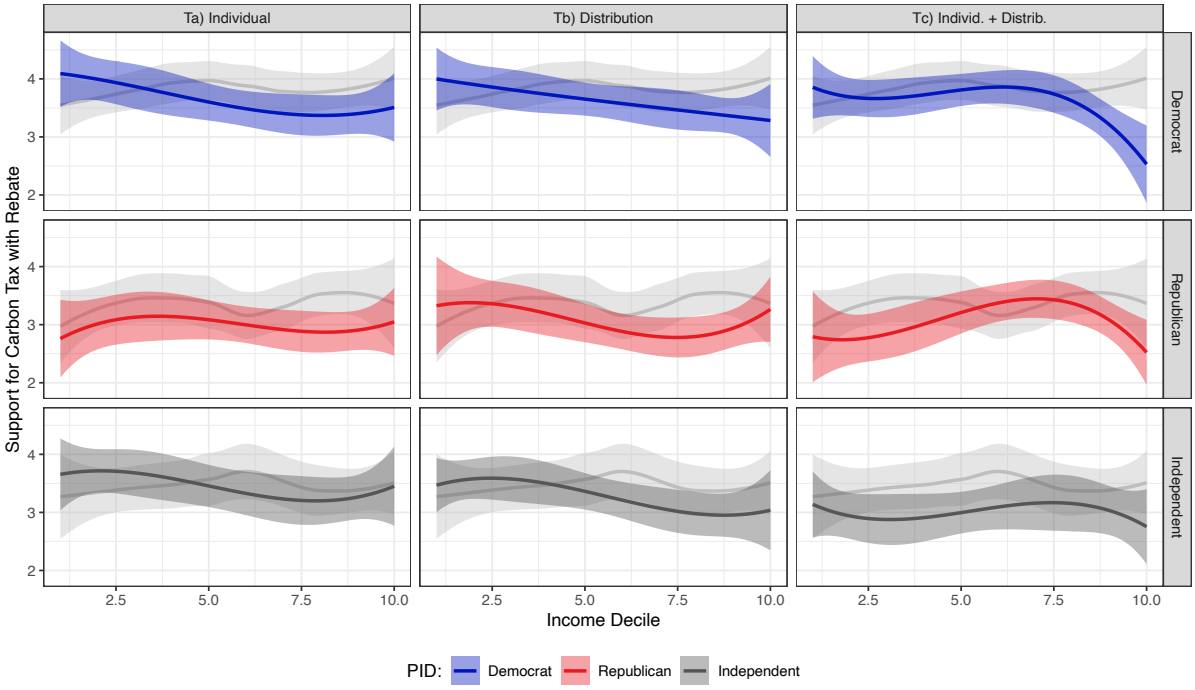


Figure A4: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6), income, and party identification in the USA. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the control group.*

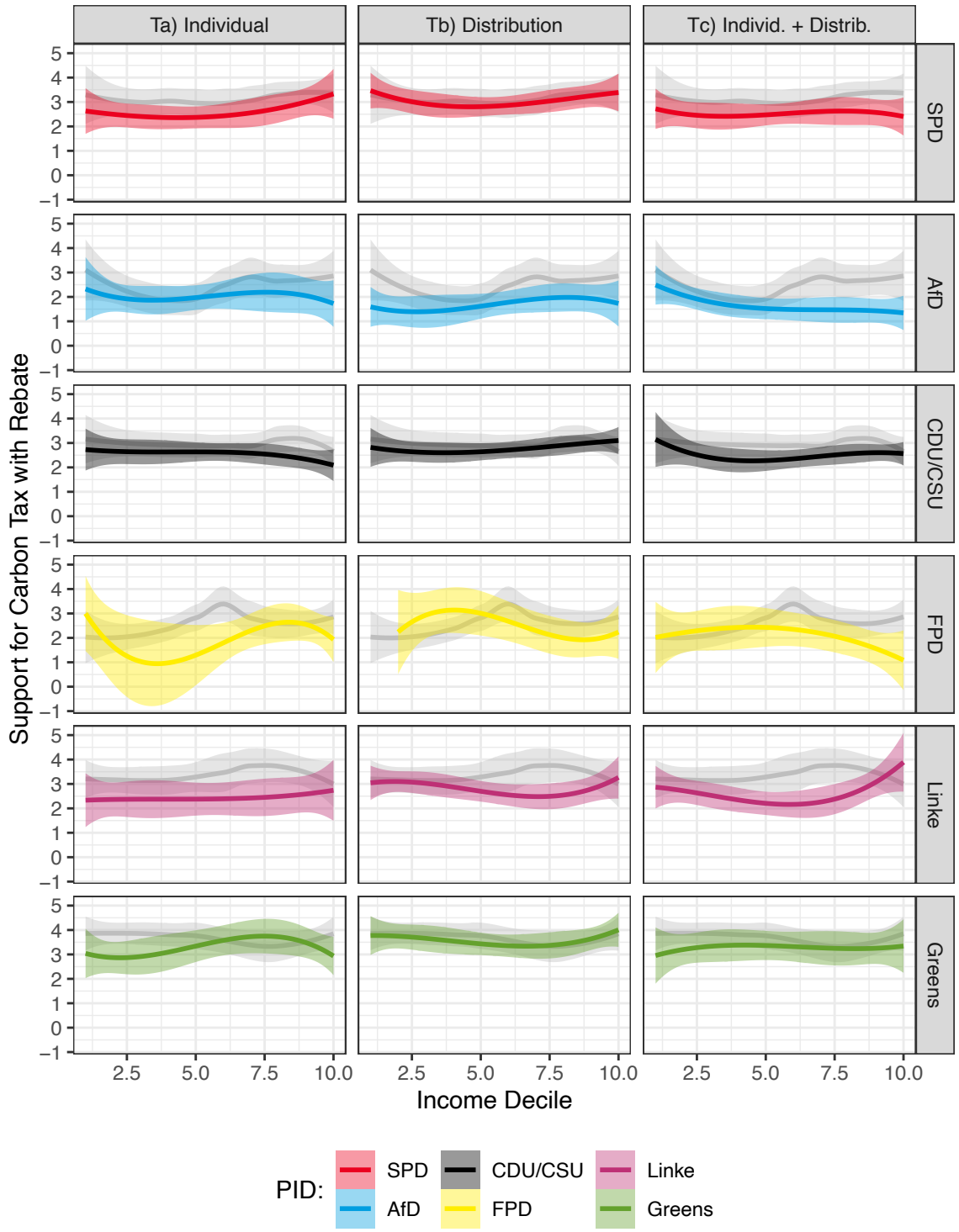


Figure A5: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6), income, and party identification in Germany. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the control group.*

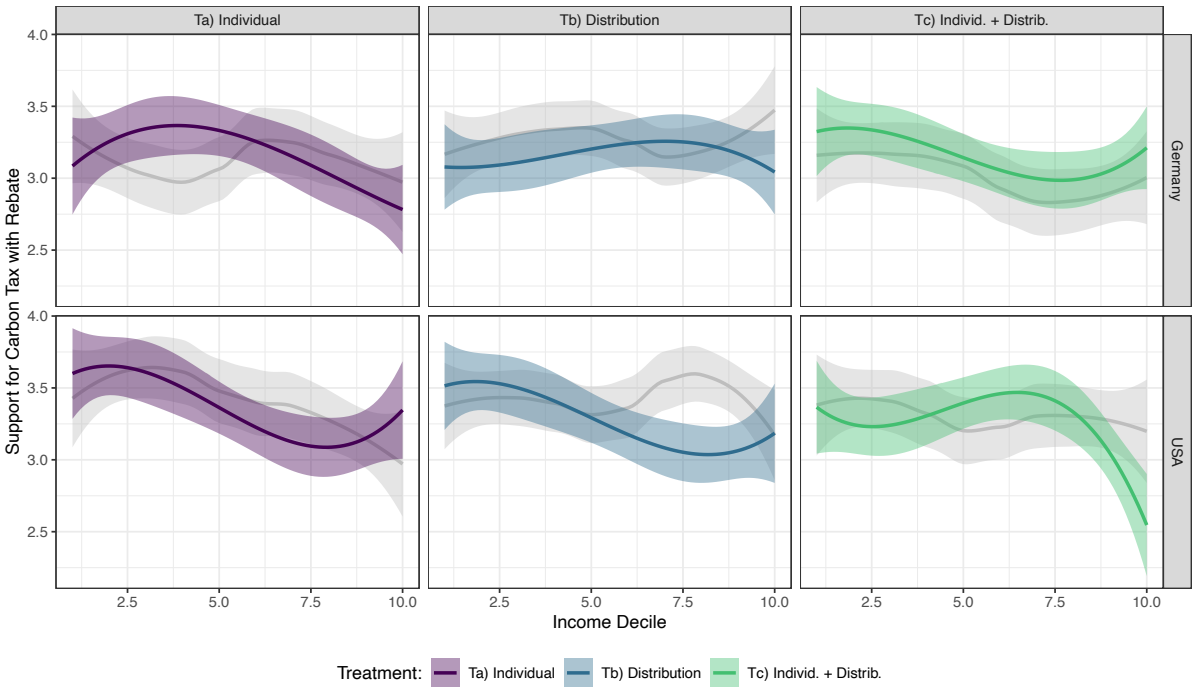


Figure A6: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6), compared to non-rebate treatment information (T1-T3), and income. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the paired non-rebate information treatment condition (T1-T3).*

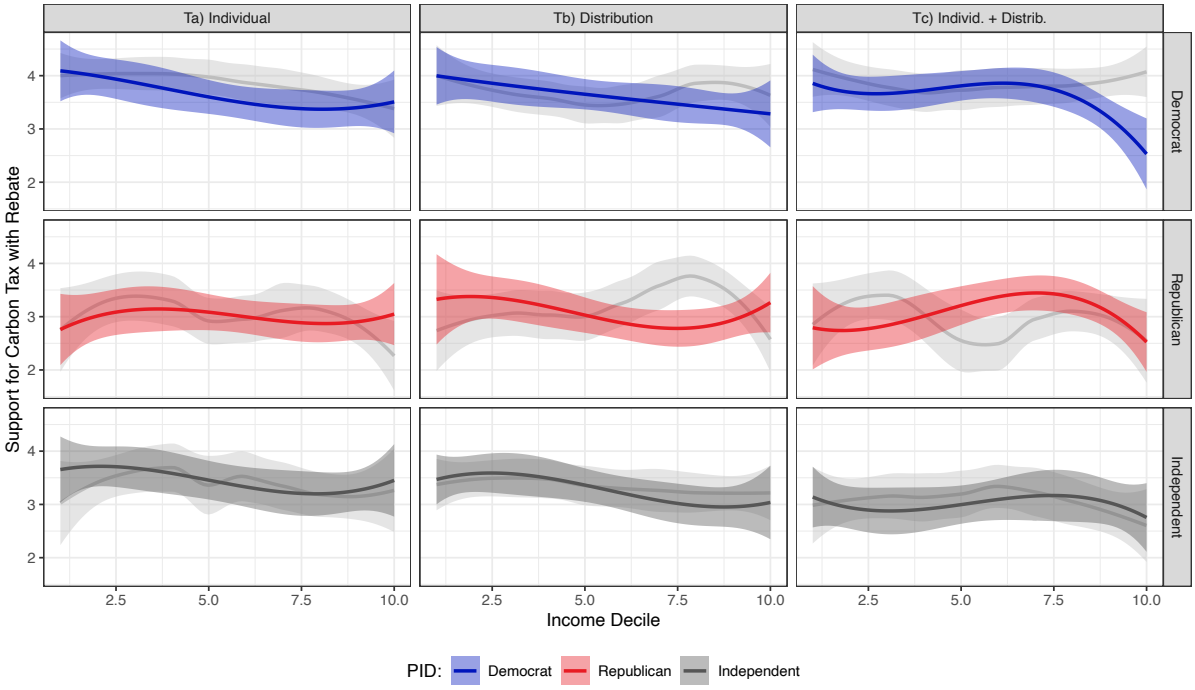


Figure A7: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6), compared to non-rebate treatment information (T1-T3), by income and PID in the USA. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the paired non-rebate information treatment condition (T1-T3).*

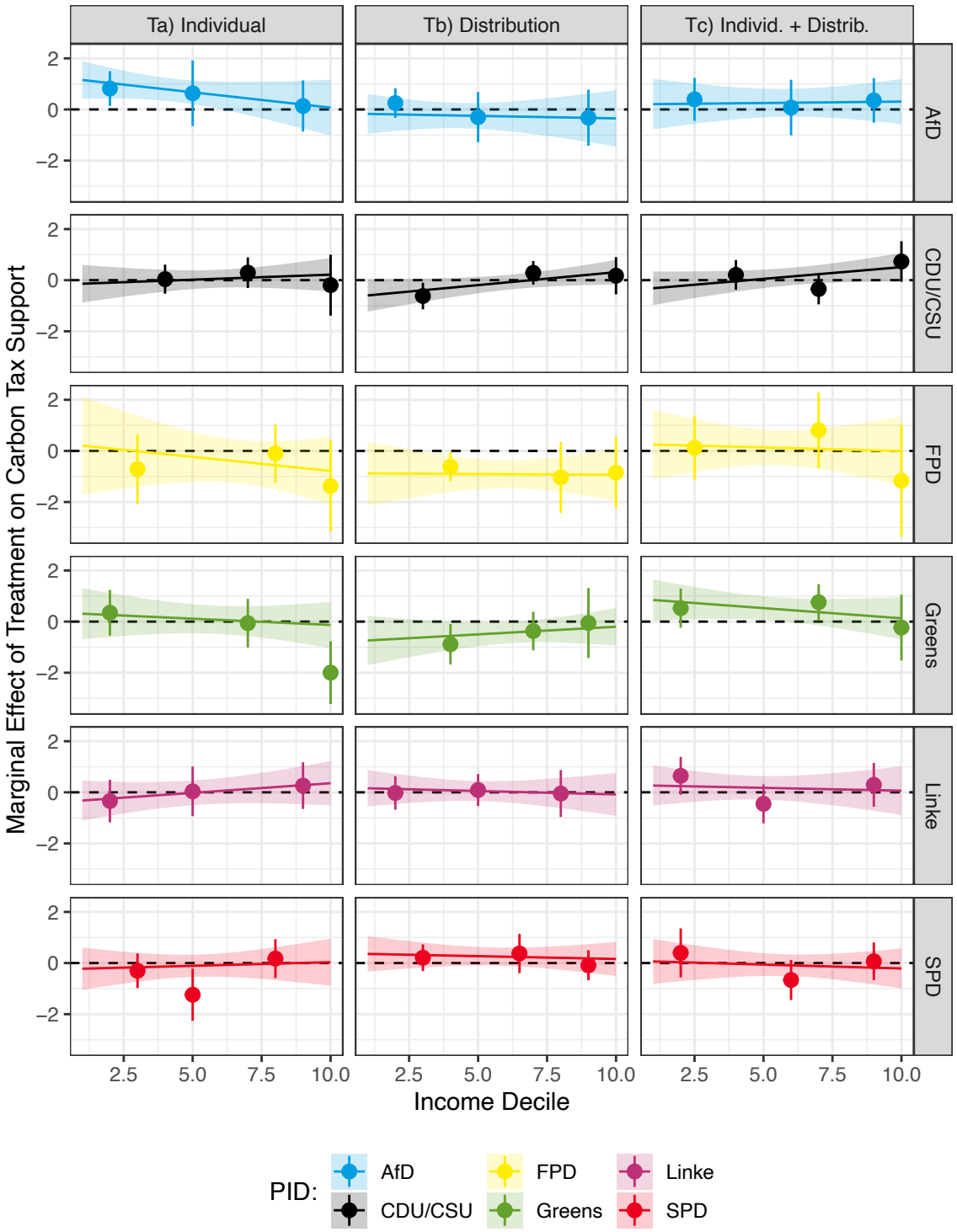


Figure A8: How information about the effect of carbon taxation rebates upon incomes, relative to information about carbon taxation without a rebate, affects support for carbon taxation with rebates, conditional upon income and PID in the Germany. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals. Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals.

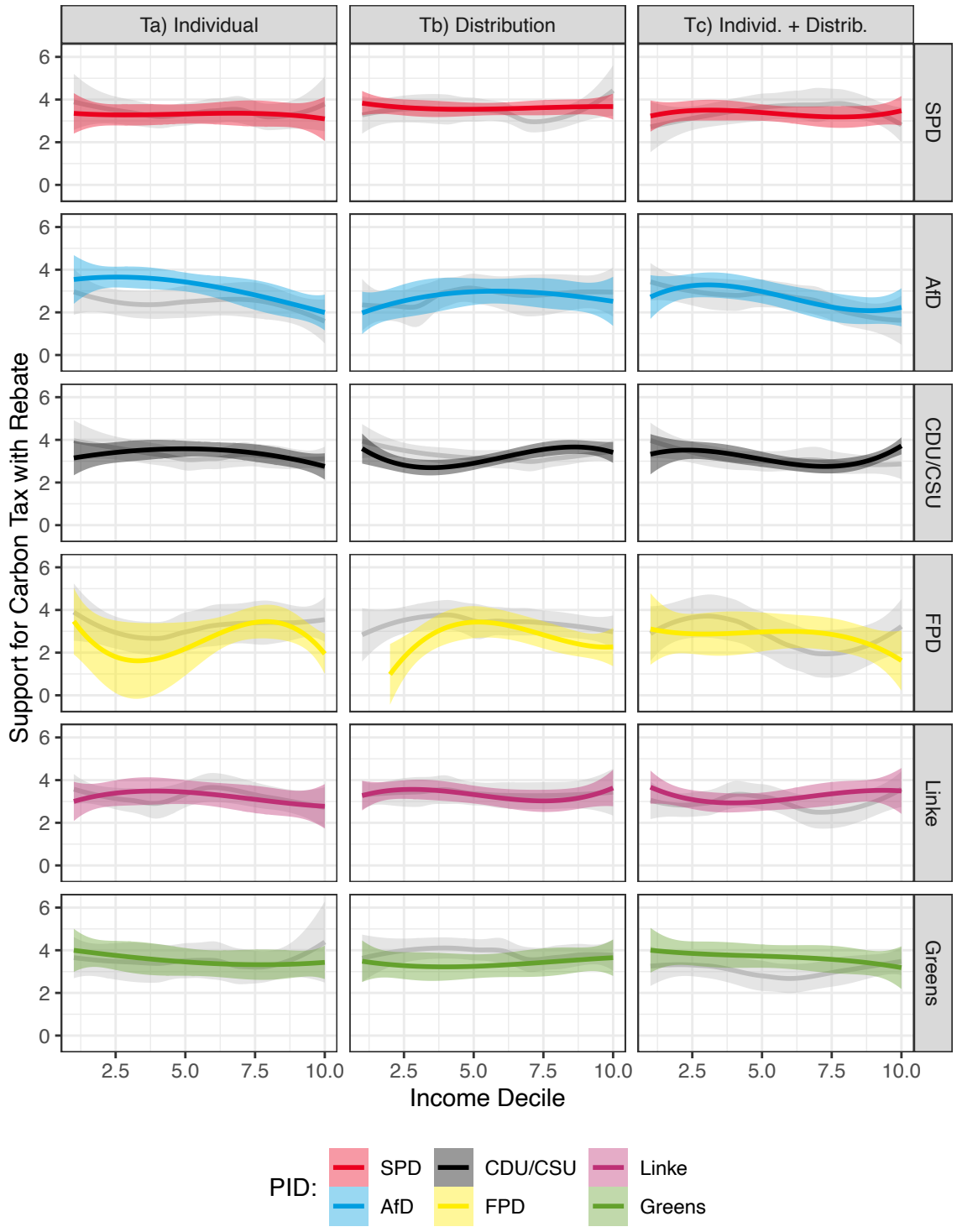


Figure A9: *Expected support levels for carbon taxation with a rebate by treatment condition (T4-T6), compared to non-rebate treatment information (T1-T3), by income and PID in Germany. Expected values estimated with a third-degree polynomial for income. Coloured lines indicated the expected value and coloured shaded areas indicate 95% confidence intervals for the treatment conditions. The grey background line and confidence intervals is the expected level of support in the paired non-rebate information treatment condition (T1-T3).*

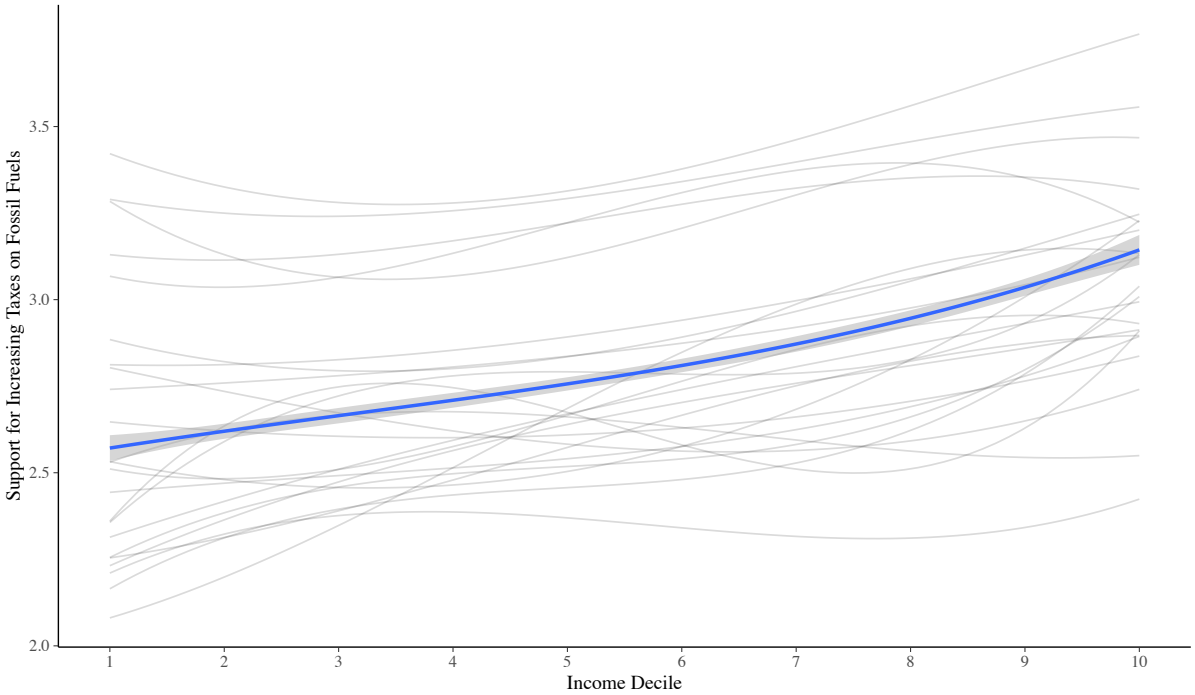


Figure A10: *Support for taxing fossil fuels is positively associated with income. The light lines display non-linear regressions for each country, while the dark line with a 95% confidence interval plots the relationship averaging across all countries. Data taken from the 8th Wave of the European Social Survey.*

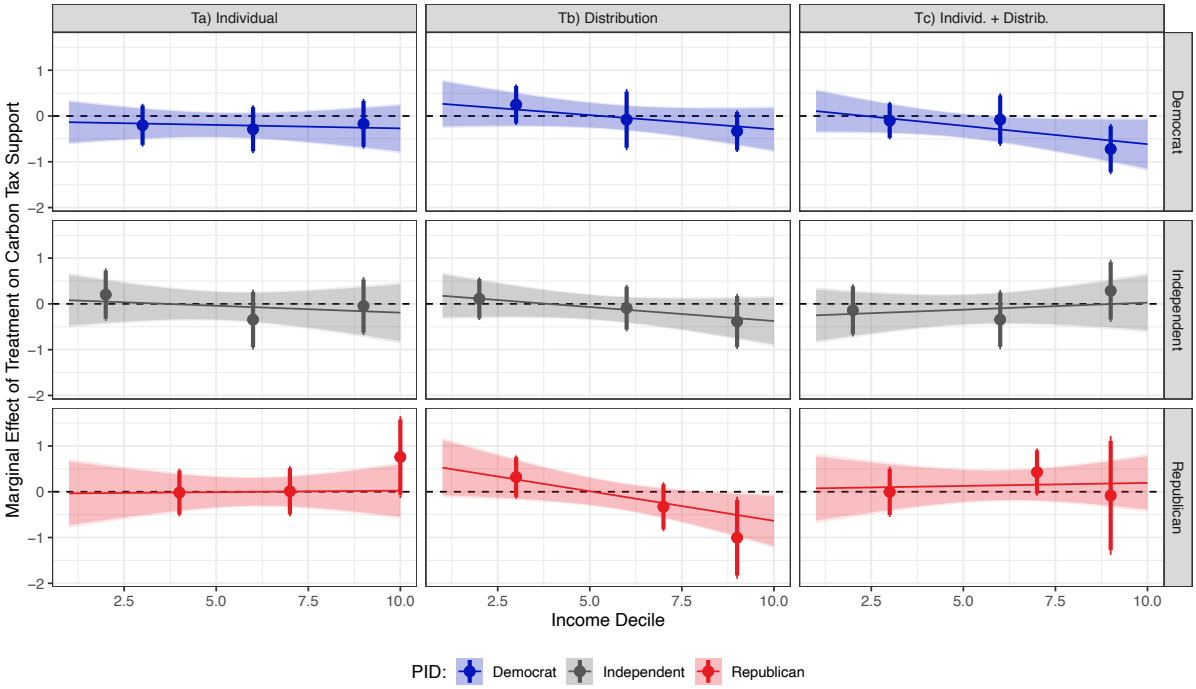


Figure A11 How information about the effect of carbon taxation rebates upon incomes (T4-T6), relative to information about carbon taxation without a rebate (T1-T3), affects support for carbon taxation with rebates, conditional upon income and PID in the USA. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals, with lighter shading indicating 95% confidence when applying a Bonferroni correction (number of hypotheses equal to number of parties). Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals and thinner lines indicating 95% confidence when applying a Bonferroni correction (number of hypotheses equal to number of parties).

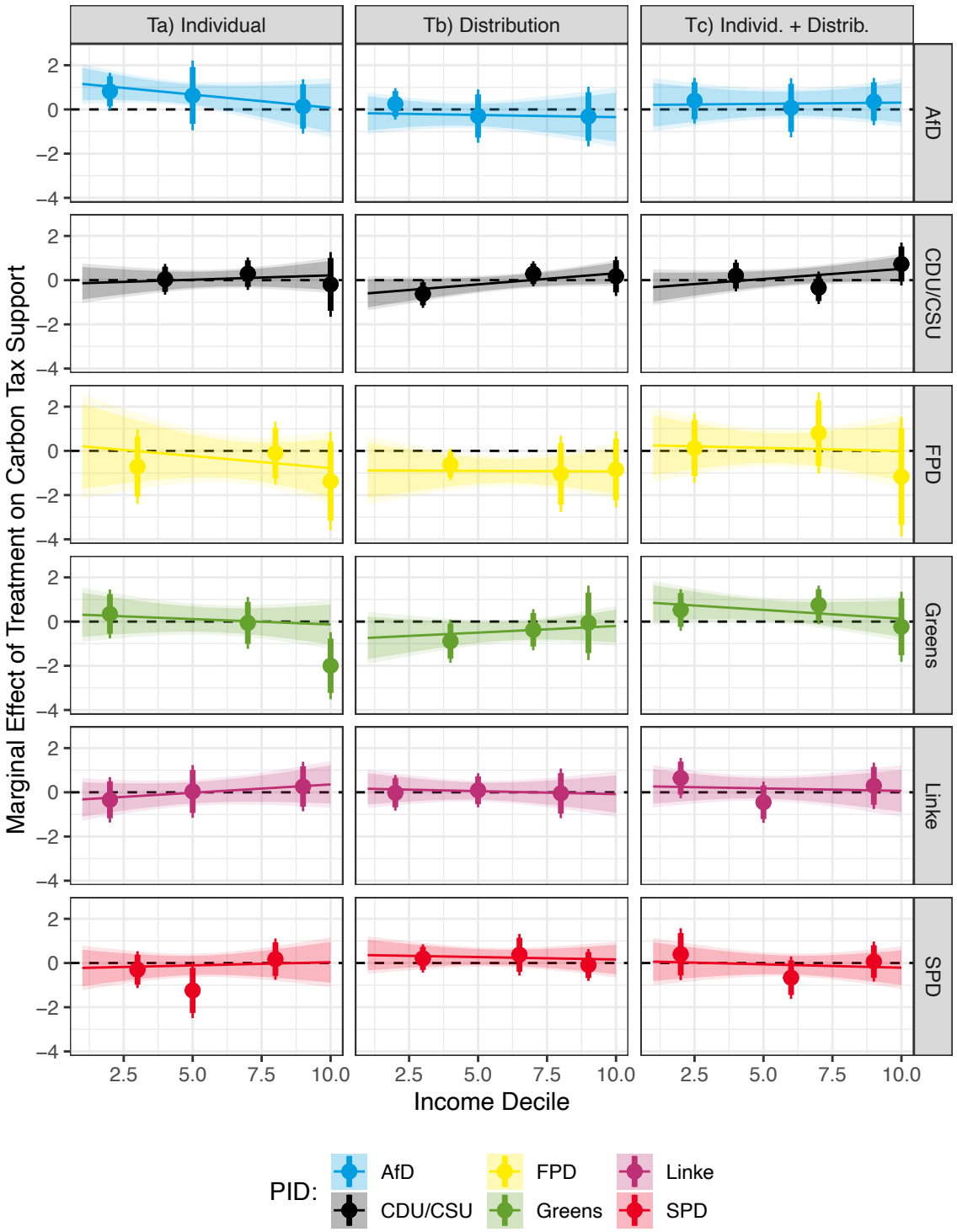


Figure A12: How information about the effect of carbon taxation rebates upon incomes, relative to information about carbon taxation without a rebate, affects support for carbon taxation with rebates, conditional upon income and PID in the Germany. Lines indicate linear interaction effect estimates, with shaded 95% confidence intervals, with lighter shading indicating 95% confidence when applying a Bonferroni correction (number of hypotheses equal to number of parties). Points indicate estimates from the binning estimator, where treatment effects are allowed to vary by three partitions of the income, with vertical lines indicating 95% confidence intervals and thinner lines indicating 95% confidence when applying a Bonferroni correction (number of hypotheses equal to number of parties).