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Is it hot in here? An experiment on how climate change and carbon taxation information affect carbon tax acceptance

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Climate change is an increasing issue around the world. The emissions of greenhouse gases need to be reduced and one of the more effective ways is by using carbon taxation. This thesis aims to investigate how information provision about climate change and carbon taxation could influence people's acceptance of a carbon tax. To test this, we sent out a survey to Swedish universities. By conducting an experiment, with one treatment group receiving climate change information and one treatment group receiving carbon tax information, we can compare and see if the respondent's getting information increased their acceptance compared to a control group. Our main result is based on proportion tests and conditional average treatment effect (CATE) analysis. The results from these are that the information we provided did not increase acceptance of a carbon tax.

Keywords: carbon pricing, climate change, CO2 emission, carbon tax acceptance

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Contents

1. INTRODUCTION

Climate change is one of the world's most urgent issues. By emitting carbon dioxide, we are causing an increase in the average temperature on the planet, which may have catastrophic consequences (IPCC, 2022). The fundamental problem from an economics perspective is that pollution generates a societal cost which is unaccounted for by economic activities (Andrew, 2008). One policy instrument to incorporate this cost into the decision making of economic agents is a carbon tax (Rocamora, 2017; Hagmann, Ho & Loewenstein 2019). With a carbon tax, the social cost would be internalized, and producers would seek cleaner technologies instead (Hájek, Zimmermannová, Helman & Rozenský, 2019) which would create more efficient market outcomes (Andrew, 2008).

Although a carbon tax is a way to reduce emissions, it has often been faced with protests and disapproval when being implemented. An example of this is the Yellow Vests in France (Driscoll, 2021). This disapproval will make it more challenging for governments to raise or implement carbon taxes, making it difficult for emissions to be further reduced (Ewald, J; Sterner, T & Sterner, E, 2021). The question then becomes, how can we raise citizens' acceptance of a carbon tax and in turn make it easier to implement a tax? This is what we want to investigate, how to increase acceptance of a carbon tax.

Firstly, we look at what makes people pay and accept taxes in general. Roberto (2009) and Luttmer & Singhal (2014) discuss that people's willingness to pay taxes is affected by their perception of the reasons for and intentions behind the tax. It is also affected by people’s tax morale, how the tax is recycled into society and if it is spent in ways that benefit the citizens. Additionally, it matters how the money is redistributed and its effect on inequality.

If we focus on carbon taxation specifically, Rhodes et al. (2014) describe the information deficit model as an explanation of how information provision can increase support for policy instruments. In line with this, Maestre-Andrés, Drews & van den Bergh (2021) finds that informing subjects about the mechanisms of a carbon tax increases their acceptance of the tax. So, one reason for low acceptance could be that people are badly informed about how a carbon tax works and how it would affect society. Another explanation might be that people do not accept a tax because they perceive the reasons for the tax as non-important or bad (Roberto, 2009; Luttmer & Singhal, 2014). One reason behind a carbon tax is to reduce emissions. If you do not know how emissions cause climate change and the consequences that will follow, you might not value a carbon tax and the incentives to accept it might be lower. Shi et al. (2016)

find a correlation that people who are aware of the causes and consequences of climate change also have a higher concern for climate change. So, another reason for low acceptance could be that people are badly informed, in this case, about the cause and consequences of climate change.

This thesis aims to contribute to the understanding of carbon tax implementation. This is done by investigating if information about carbon taxation or climate change affects people's acceptance of a carbon tax. To answer this, we ask the following research questions:

- What is the impact of the provision of climate change information on carbon tax acceptance?
- What is the impact of the provision of carbon taxation information on carbon tax acceptance?

We test this relationship by using an experimental approach, where we have a control group and two treatment groups. First, everybody will be asked several climate change questions and carbon tax questions. This is to assess the prior knowledge within the groups, and to control if they are equally knowledgeable. After that, the treatment groups will get information containing the answers to these questions. The first treatment group will be presented with information about climate change and the second treatment gets information about carbon taxation. The respondents will then be asked whether they want to implement a carbon tax or not. Then we compare our treatments with our control group and look if the provided information affected the respondents in accepting the carbon tax. To conduct this experiment, we sent out a survey to Swedish students in four different universities giving us a clean dataset of 355 observations. By doing an experiment we can control the environment so any differences in acceptance rate can be traced to the treatment info. This makes our method better to find a pattern and causal relationships between information provision and acceptance. The goal of using this method is to see if information provision about climate change or how a carbon tax works could increase people's acceptance of a tax. If this is true it can make it easier for policymakers to implement this carbon tax and by that make the market more efficient, reduce emissions and fight climate change.

Our results suggest otherwise. The acceptance rate for our sample was about 76.3% for control, about 76.9% for climate information and about 70.1% for carbon information. We did not find any statistically significant differences between the groups in their acceptance rate. Therefore, we conclude that information provision had no effect on acceptance.

Our overall acceptance rate was about 74%, this is like earlier studies with Hagmann et al. (2019) having 71% as overall acceptance rate. However, we differ from previous literature regarding the effect of treatment. We could not find any significant differences whereas for example Maestre-Andrés et al. (2021) find an effect of carbon information on acceptance. What this shows might be that information alone is not the reason for acceptance to change. One explanation may be connected to our sample. We have a homogenous pool of 355 Swedish students with high baseline knowledge. This means that the information we provide may not be new information to them, leading to a less effective treatment.

The structure of the paper is as follows: In section 2 we have a literature review of existing research. Continuing with section 3 we have our theoretical framework and hypothesis. In section 4 we explain our methodology and the data we use. After that, we have section 5 which is our results of the thesis. The paper ends with a discussion in section 6.

2. LITERATURE REVIEW

To begin with, one important factor to have in mind is why people pay taxes. This can be connected to tax evasion and Luttmer & Singhal (2014) discuss how it can be reduced by increasing tax morale. They say that it may be achieved by using nudges such as payment providers or making the information more accessible. This suggests that tax acceptance can be influenced by providing information, but it also matters how the government spends the tax, e.g., by revenue recycling and redistribution. Roberto (2009) also looks at how tax evasion can be affected by people's tax morale. His findings are that tax compliance is high when social stigma is high, which society achieves when people perceive the government as fair, effective and spend the tax money in a way to benefit the citizens.

Maestre-Andrés et al. (2021) conducted an experiment in Spain where they investigate people's acceptance of a carbon tax. They look at how acceptance is affected by initial knowledge, the information provided and how the tax revenue is recycled. They do a survey where they ask the respondents to answer some knowledge questions (to assess their initial knowledge) about carbon taxation. After this, they provided information about the tax to some respondents and asked how willing they are to accept the carbon tax. Their findings are that providing information about their carbon tax would affect the acceptance of the tax. The authors find that the respondents getting the information, to a higher degree accepted the tax, independent of the revenue use.

Another article by Hagmann et al. (2019) also writes about information provision regarding support for a carbon tax. The authors find that providing information affects support for the tax. This however is affected by the framing. In one case they framed the carbon tax as an instrument that would not affect the respondents so much (low pain) and in the other with "high pain" (highlighting the costs). They find a difference in support where it increases when framing it positive (low pain) and decreases using more painful descriptions. These findings are in line with what Carattini et al. (2017) have found. They point out that people in some cases have lower acceptability of a tax due to underestimating the effects. It is then mostly believed to be a mean for collecting public revenue. By providing detailed information the public may be more informed about the effects, leading to a higher acceptance.

If we continue looking at information provision, we have the articles by Rhodes, Axsen & Jaccard (2014) and Suldovsky (2017). They write about the information deficit model as the difference in knowledge between the experts and the public, and how the model assumes that this difference can be reduced by providing information to the public. This could be used regarding public policies to increase the general public's support. However, this chain of logic that information provision automatically causes higher knowledge and in turn higher support for science-based policies has been criticised as too simplistic. In the study by Rhodes et al. (2014), they did not find that providing information to the respondent that opposed a policy made them more willing to support it later. Nor did they find any relationship between citizen knowledge and policy support. Alternative factors that they suggest in their study are that your acceptance of a policy instead could be influenced by an egoistic mindset of how affected you will be. If you live in the countryside and are dependent on your car, taxes on fuel can make you oppose the tax even if you are aware of the benefits to the environment. Also, according to social psychologists, pre-held values or peer pressure can have a stronger impact on your acceptance compared to the knowledge of climate science (Rhodes et al., 2014).

The two articles by Maestre-Andrés et al. (2021) and Hagmann et al. (2019) both investigate the link between carbon tax, information provision and the support for the carbon tax. They found that information can increase the support for the tax, but also that it differs depending on how you frame the information. This is also in line with the information deficit model, even though it has received some criticism (Rhodes et al., 2014). We will replicate the study of Maestre-Andrés et al. (2021), using their knowledge questions and information text. However, we will add a part about climate change which also may explain why people accept a tax or not.

Ewald et al. (2021) are researching people's attitudes toward carbon taxation and climate action. They have found that people with higher education (bachelor's and master's) think a carbon tax is quite or very efficient. The question is, does this correlation depend on their higher education or other factors? Even if you have a high education, it does not imply that you understand market inefficiencies and how a carbon tax can correct them. Kallbekken & Saelen (2011) also focus on factors increasing support for environmental taxes. They find that people who oppose taxes lack a fundamental understanding of the role of environmental taxes for redistribution and market efficiency.

Shi et al. (2016) investigate increased knowledge and compare it to people's perceptions about climate change. First, they ask different questions about climate change, divided into three categories, physical characteristics, causes and consequences. What they find is for example that 80% correctly know that burning oil generates CO2 but also that 31% falsely believe CO2 is harmful to plants. Regarding causes, most people are sure that CO2 levels have increased during the last 250 years, but many are very unsure about CO2 concentration and if today's levels have already occurred before. What they find is that people with more knowledge about the causes and consequences of climate change also have a higher risk perception. This means they feel a higher risk that the planet will face severe consequences due to climate change and they showed to be more willing to act to prevent them.

Alkawsi, Ali & Baashar (2019) have also been researching the link between knowledge and behaviour. In a survey in Malaysia, they examined the correlation between awareness and knowledge about energy saving and the acceptance of energy-saving gadgets, for example, smart meters. They found that people with higher awareness and knowledge about energy-saving are also more accepting of using these new methods. People with higher knowledge were more prone to test new things and change their behaviour. These articles establish a connection between knowledge and acceptance regarding their specific research field.

The articles by Ewald et al. (2021), Kallbekken & Saelen (2011), Shi et al. (2016) and Alkawsi et al. (2019) research knowledge in different forms, which is confirmed by Roberto (2009) and Luttmer & Singhal (2014) as an important factor in affecting acceptance. For example, Shi et al. (2016) research climate change perception and Ewald et al. (2021) see carbon taxation and its acceptability. The same goes for Kallbekken & Saelen (2011) who research support for environmental taxes and not so much knowledge. Lastly, Alkawsi et al. (2019) investigate the acceptance of smart meters and how people's knowledge affects that acceptance. What these

articles have in common is that they somewhat are investigating knowledge but not its connection to the acceptability of a carbon tax. We will look at this connection and perform an experiment where we give information to some respondents to see the effect of information on acceptability.

Overall, there is a gap in researching the impact of information provision on the acceptance of a carbon tax. Often the focus is on finding ways to explain increasing acceptability but nothing that investigates the effect of a knowledge increase on policies. We also see a lack of experiments to find a more casual relationship regarding information provision. By doing an experiment with control and treatment groups, we hope to better isolate the sole effect that information and knowledge have on acceptability.

3. THEORY AND HYPOTHESES

The foundation of this thesis is if information provision can change people's attitudes toward economic policies. Duflo et al. (2006) have done research on this topic in developing economies. They found that giving information to people, changes the people's beliefs. Duflo & Saez (2003) investigate a similar topic about financial decisions and found that people do not always seek the information on their own, so it´s preferable to give it to them.

The topic of information provision is also explained in the information deficit model, which is based on psychology but touches on the economic field. One assumption from the information deficit model is that there might exist a gap in beliefs between experts and the public, a gap that is caused by a lack of knowledge in the general public (Rhodes et al., 2014). A solution to reduce this is by spreading information and making them better informed, thus changing their beliefs to be more in line with the experts (Suldovsky, 2017, & Rhodes et al., 2014). So according to the model, in order to implement the policies needed to battle climate change, the policymakers need support from the public. Support that partly can be achieved by information provision.

In this thesis, we give people information about the causes of climate change and what consequences there might be. This type of information could make them feel responsible or alarmed. The feeling of responsibility may affect the respondents' support for a carbon tax because they feel that something must be done to fight climate change. We also give information about carbon taxation. This type of information may make the respondents more aware of the effectiveness and range that the carbon tax would have. For example, we say that

when the price of fossil fuels will go up, the production is stimulated to switch to renewables, which will make the emission go down without necessarily decreasing the output. If you learn this you may think the tax is more effective, which might lead to increased support.

3.1 Physical knowledge, knowledge of causes and consequences

In our paper, we will base our knowledge questions and information text about climate change on the paper by Shi et al. (2016) and Tobler, Visschers & Siegrist (2012). The authors are drawing a link between concern about climate change and value orientation. They have found that Biospheric values, socio-altruistic values and egoistic values affect the overall concern. To try to capture these values in their questions, they include questions about three (3) different categories, (1) physical characteristics, (2) causes and (3) consequences of climate change. Connecting these together we might see that Biospheric values are mainly linked to physical characteristics while socio-altruistic and egoistic values are linked to causes and consequences. So, by including questions about these categories, they will be able to cover what mainly affects the concern of climate change. In our study, we plan to follow the example of previous articles and authors, such as Shi et al. (2016) and Tobler et al. (2012). Regarding climate change questions we present questions where the three knowledge groups are represented, to get the overall view of the problem.

In our survey, we use for example the question "CO2 is a greenhouse gas (GHG)" to partly represent the physical knowledge. Since the problem with climate change mostly is due to the emitting of GHGs, the knowledge that carbon dioxide is a greenhouse gas may be important to understand the primary cause. Regarding knowledge of causes we use questions like "the global CO2 concentration in the atmosphere has increased during the past 250 years". We use this to test the respondent´s understanding that the high concentration of CO2 in the atmosphere is why we have global warming. To conclude this part, we lastly have knowledge questions about consequences and here we have focused on questions such as "for the next few decades, the majority of climate scientists expect an increase in extreme weather events, such as droughts, floods and storms". This is to test the respondent´s knowledge of the potential consequences of human actions. For a full description of all the questions related to climate, see appendix 1.

3.2 Knowledge about carbon taxation

The questions about the carbon tax as a policy are mainly based on the questions from Maestre-Andrés et al. (2021). The questions create a little broader view of the carbon tax but also how it will affect the person economically. For a full description of all the questions related to carbon, see appendix 1.

3.3 General hypothesis

Using the climate change and carbon taxation questions we firstly assess the respondent's knowledge. By then giving information about these topics, we hypothesise that the respondents will become more knowledgeable, and that this increased knowledge will lead to a higher acceptance of the carbon tax.

4. DATA AND METHODOLOGY

4.1 Method - survey design

We created a survey with three groups, one control group and two treatment groups, where the respondents were randomly split into these three groups. The first treatment gets climate change information, and the second treatment gets carbon tax information. In the control group, the respondents did not get any information, neither about climate change nor carbon taxation.

4.1.1 Baseline survey

At the beginning of the survey, we include a consent page where the respondents need to state that they promise to answer truthfully to proceed with the survey. The reason for this type of oath script is to reduce any hypothetical bias that may exist when dealing with questions in a survey compared to decisions in real life (Carlsson et al., 2013).

The first section of the survey is nine questions about climate change with the goal of assessing and control for the respondent's prior knowledge of climate change. The questions are divided into three (3) different categories (with three questions about each category), measuring knowledge from (1) physical characteristics, (2) the causes of climate change and (3) the consequences of climate change. The questions can be seen in table 1 in appendix 1.

The second section consists of five knowledge questions about carbon taxation, where the respondents answered how they think a carbon tax would affect the price of travelling and other

consumer goods. The goal of these questions is to assess and control for the respondent's knowledge about carbon taxation. These questions can be seen in table 2 in appendix 1.

To control for order effects, half of our subject pool answered the questions about climate change first, followed by the ones about a carbon tax. While the other half of our subjects got the questions about carbon tax first, followed by the ones about climate change. By this, we can control for any difference between having one of the sections before the other.

The third section involves our dependent variable where we construct a scenario of the respondent being a decision-maker for a country without a well-developed climate policy. A proposal to implement a carbon tax for the country is presented and the respondents are asked whether they choose to implement the tax or not. The question that was asked:

"Imagine that you are a policymaker in a country that does not have a well-developed climate policy. You can choose whether to support the following policy:

Implement a carbon tax on companies and products based on how much emissions they create. Companies and individuals will pay 45 Euro/475 SEK per ton of carbon emitted, which is the estimated economic cost of such pollution.

The alternative, if this policy is not implemented, is that no other policy is implemented.

Would you like to implement the tax proposal above?

- *Yes, implement the carbon tax*
- *No. do not implement the carbon tax*"

This section is followed by four additional questions which are how a carbon tax would affect them personally, how fair they believe the tax is, if the tax affects low-income households and how effective they think the carbon tax is. In the end, we have demographic questions.

4.1.2 Treatment groups

In this survey we have two treatment groups. If you are in our first treatment group, climateinfo, you will receive an information text after the questions about climate change. This information text contains the answer to the climate questions. So, if a respondent got some of the questions wrong, they would read the answer in the information text and hopefully become more knowledgeable about climate change. This is the information text we used in the survey regarding climate change:

"Solar energy absorbed by the surface of the planet is radiated back into the atmosphere as heat. The greenhouse effect is the process by which gases in the atmosphere trap the sun's heat and warm the planet. Carbon dioxide (CO2) is the greenhouse gas that contributes the most to the greenhouse effect. Over the past 250 years, there has been a rapid increase in the concentration of CO2 in the atmosphere due to human activities, primarily the burning of fossil fuels, such as oil and gas. The resulting greenhouse effect has led to an overall increase in temperature, influencing climate at the global level, and increasing the frequency and intensity of extreme weather events. Climate change will not only affect weather patterns, but also threaten people with food and water scarcity, increased flooding, extreme heat, the spread of infectious diseases, and economic losses. The effects of climate change will be felt unevenly across the globe, with disproportionately negative impacts on low-income countries."

For our second treatment group, carboninfo, the respondents will receive an information text after the knowledge questions about a carbon tax. This information text contains the answer to the carbon questions and explains the mechanism behind a carbon tax, which hopefully will make the respondent more knowledgeable about carbon taxation. This is the used text:

"A carbon tax is a charge on fossil fuels in proportion to the amount of carbon they contain as this determines how many CO2 emissions result from their combustion. This will, for instance, raise the price of coal more than that of gasoline. Producers and consumers are then stimulated to switch to renewable energy, save energy on heating, alter fuel-based transport, etc. Because fuel prices change, the prices of other products and services throughout the economy will change as well: the ones that generate considerable CO2 (for example air travelling) will become more expensive, while prices are likely to change little or remain the same for products and services that cause little or no CO2 (for example train travelling). A carbon tax, that is high enough, would impact all firms and households to shift to goods and services that use fewer high-carbon energy sources during their production."

The goal of this increased knowledge, whether it is about climate change or carbon taxation, is to influence their decision to implement the tax.

4.2 Hypothesis

Our research questions are based on the assumption that information provision about climate change and carbon taxation may change people's perceptions about a carbon tax. We have two variables received from two treatment groups. They are "climateinfo" (people that got information about climate change) and "carboninfo" (got information about carbon taxation). To this, we have the control group as our baseline. The dependent variable is the implementation question asking the respondents if they want to implement a carbon tax or not.

Our hypothesis is that the respondents receiving the information to a higher degree will accept the carbon tax. This means that in the data analysis we believe that there would exist a

difference between climateinfo and carboninfo, compared to the control group. We test the following null hypothesis:

H0: *The information has no effect on the implementation of a carbon tax*

HA: *The respondents receiving the information will implement a carbon tax to a higher degree*

According to the theory, the information provided will give more knowledge to the respondents, which will increase their concern for the problem, leading to a higher implementation rate.

4.3 Data collection process

We sent out our survey by mail to students at the University of Gothenburg, Linkoping, Boras and Mid Sweden University in March 2022. About 2461 students were contacted at GU divided into 8 programs. 767 were sent to Boras divided into 10 programs, 1925 at Linkoping and 1000 at Mid Sweden University. In total, we sent out 6153 emails to the three groups where each group got approximately 2051 emails. 462 started the survey, however, 107 of those quit before answering the question about implementing the tax and were removed from the sample. An additional nine respondents dropped out before finishing the demographic questions but were included anyway. So, in total, we had 355 respondents in our sample pool which gives a response rate of 5.8%.

In total, our survey is based on a cross-sectional dataset containing the following groups in table 3:

Table 3. The distribution of respondents per group (Control, Climateinfo, Carboninfo) and order effects (Climate first and Carbon first)

	Control	*Climateinfo*	*Carboninfo*	**Total**
Climate first	72	70	57	199 (≈56%)
Carbon first	59	47	50	156 (≈44%)
Total	131 (≈37%)	117 (≈33%)	107 (≈30%)	355

4.4 Empirical model and key variables

Our dependent variable is "*Tax*". This is a binary variable based on the question of implementing a carbon tax. In our data, the variable takes the value 1 if the respondent said "Yes" to implementation and the value 0 if they said "No" to the question.

Regarding our main independent variables of interest, we have three. The first is "*climateinfo*". This is a binary variable where it takes the value 1 if the respondent received the information part about climate change and 0 if they did not. The same went for "*carboninfo*" where the value is 1 if the respondent received carbon tax information and otherwise 0. In addition to these, we also include a "treatment" variable that measures the effect of getting information at all. It means that the variables take the value 1 if the respondent got information, no matter which kind (climate or carbon).

To extend the analysis, we also have variables about fairness, effectiveness and economic impact. We asked four questions, where the respondents decided on a scale between 1 - 5 on how fair they think a carbon tax is, how effective it is, how they will be economically affected and how they think low-income households would be affected. This is to analyse the effect of information on any of these variables. For example, if the respondent perceived the tax as fairer after reading the information.

Regarding the knowledge questions, we divide the climate change questions into three variables that specifically point out the physical characteristics, the causes and lastly the consequences. This is to better see what kind of climate change information affects acceptance the most. We also test if there exists an effect of treatment on those with low prior knowledge. To do this, we divide the respondents in half, with the respondents having fewer correct answers than the median as a variable. This was done for climate and carbon treatment separately giving us the variables "*climatewrong*" and "*carbonwrong*".

Beyond these, we also include some demographic variables in our regressions. Examples of these exogenous variables are gender, age and living area.

4.5 Descriptive statistics

4.5.1 Sample

We begin by looking at our entire sample. Regarding gender we have more females than males in total. Our sample is young where approximately half of our respondents are younger than 25 and in total the vast majority are between 0 - 39 years, which might not be a coincidence since we sent out the survey to universities students. Regarding education, most of our sample have finished high school or have a bachelor's degree. They tend to live in cities or towns (about 70%). The respondents are mostly not members of an environmental organisation and do not have children. Lastly, we asked the respondents about their concerns about climate change and

opinions about national climate policy. In the whole sample the respondents have a high concern for the climate (average 4.35 on a scale of 5) and regarding how they consider the national climate policy they are a little more sceptical (average 2.89 on a scale of 5).

4.5.2 Randomness

When looking at the descriptive statistics between the control group and our two treatments, in table 4 in appendix 1, we want the proportions e.g., females to be as similar as possible. This would increase our internal validity. For the carbon treatment, we observe that they have fewer females compared to the control group. Otherwise, we find no major differences between the two. Regarding climate treatment, on the other hand, this group consists of more females, fewer young people (24 or younger), fewer students and more people from the countryside compared to the control group. For the rest of the variables, the results between the groups are similar.

4.5.3 Knowledge questions

In this section, we will show and analyse the distribution of the answers. Table 5 in appendix 1 shows the distribution regarding climate change questions and table 6 in appendix 1 shows the distribution regarding carbon taxation.

If we first look at climate change in table 5, the three first questions test physical knowledge. These statements are all true and the respondents have answered these correctly to a very high degree (average 90%). However, of the subjects not stating the correct answer, most of them were answering doesn't know. The next three questions test knowledge about the causes of climate change. The first two are true statements and the last one is a question if climate change is mainly caused by "Natural causes", "Human activities" or "Don't know" with human activities as the correct answer. Again, most of the respondents answered these questions correctly (about 80-90%). The knowledge of consequences is represented by the last three questions. Overall, we can see that the respondents are more unsure about these. On the question "if climate change will affect the world evenly", 59% correctly stated it did not. The last one is nearly a 50/50 split between the respondents where 54% got the correct answer. However, summarising the nine climate questions we conclude that there is a high number of correct answers on average.

In table 6 below we can see how our respondents answered the questions about carbon taxation. For the first four questions, the vast majority (~80%) had it right and knew that the carbon tax will be imposed on the carbon content of fossil fuels and that this will increase the price of

coal, gasoline and air travel, but not solar energy. For the last question, only 18% correctly stated that the price of train travel will increase since this also will induce emissions even though it is quite small.

One interesting aspect to see is the difference between our three groups (control, climate treatment and carbon treatment). In table 7 below, we see the average number of correct answers with the extra division into physical knowledge, knowledge about causes and consequences. Overall, the number of correct answers is quite similar between all three groups. However, for the knowledge about consequences, the control group has a slightly lower average than both treatments. The same can be seen for carbon taxation questions, where control is lower, especially compared to the carbon treatment.

Table 7. Average correct answers for the knowledge questions

	Control	ClimateInfo	CarbonInfo
Climate change knowledge (max 9)	7.31 points	7.55 points	7.49 points
Physical knowledge (max 3)	2.69 points	2.69 points	2.69 points
Knowledge about causes (max 3)	2.61 points	2.67 points	2.68 points
Knowledge about consequences (max 3)	2.01 points	2.19 points	2.11 points
Carbon knowledge (max 5)	3.32 points	3.41 points	3.57 points

5. RESULTS AND ANALYSIS

For the acceptance of a carbon tax to increase, our information text would need to make the respondents more knowledgeable, and this increased knowledge would need to make them more inclined to implement the tax. Below we will look at the relationship between increased knowledge and a higher willingness to implement a tax.

Our variable climateknow takes values between 0-9 and is a measure of how many correct answers you had on our nine questions about climate change. We find a relationship between having more correct answers and willingness to accept the tax, as seen in the table 8. However, we cannot find this relationship when including the variables national_policy and climate_importance. These tell us what the respondent thinks of the current climate policy in their country and if they think climate change is an important problem for society or not. Our variable carbonknow is similar to climateknow and takes values between 0-5 depending on how many correct answers you had on the carbon tax questions. We do not find any relationship between being more knowledgeable about a carbon tax and being more willing to implement a

tax, no matter if we include climate_importance and national_policy or not. We also find that women tend to accept the tax to a higher degree than males.

Table 8. Marginal effects after probit regression using only knowledge question and again including climate_importance and national_policy.

	Only climate knowledge		With opinion and national policy		Only carbon knowledge		With opinion and national policy	
Climate knowledge (0-9)	0.0898	*	-0.0050					
	(0.052)		(0.059)					
Carbon knowledge (0-5)					0.0246		0.0533	
					(0.063)		(0.065)	
Female, 1 if female	0.5286	***	0.2562		0.5600	***	0.2586	
	(0.148)		(0.163)		(0.148)		(0.164)	
Young, 1 if young	-0.1752		-0.1391		-0.1542		-0.1479	
	(0.229)		(0.245)		(0.231)		(0.249)	
National policy, rank 1-5			0.1125				0.1103	
			(0.091)				(0.092)	
Climate change is an important societal problem, rank 1-5			0.6028	***			0.6052	***
			(0.093)				(0.090)	
_cons	-0.1348		-2.2013	***	0.4081		-2.4161	***
	(0.443)		(0.576)		(0.307)		(0.527)	
N	355		355		355		355	

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

About finding potential relationships, we can see that our respondents, to a high degree, answered the questions correctly with an average of 7.4 of 9 on the climate questions and 3.4 of 5 on the carbon questions. This means that few of our respondents may be considered to have low knowledge while the majority have high knowledge, which makes it more difficult to find an eventual relationship between knowledge and the acceptance of a tax.

5.1 Effect of treatment

If we look at the acceptance rate, in the control group, 76.3% voted to implement the carbon tax. For the climate treatment, 76.9% wanted the tax while 70.1% in the carbon treatment chose it. To measure if there is an effect of treatment, we conduct proportion tests. When testing the effect of receiving climate information compared to the control group we see no statistical difference in the acceptance of a carbon tax, as seen in table 9a below. Further on, we tested the effect of receiving carbon treatment but did not find any statistical differences here either. Worth mentioning is that the acceptance rate was lower for the group who received carbon treatment, even though this difference is not statistically significant. See table 9b below. We also did a test where we looked at the effect of any treatment, lumping the two treatments into

one, to get a bigger subject pool and compare it to the control group. No differences were found here either, as seen in table 9c.

Table 9. P-values for proportion tests regarding a) control vs climate treatment, b) control vs carbon treatment and c) control vs both treatment

Proportion test	P-value: diff < 0	P-value: diff ≠ 0	P-value: diff > 0
a) Control - climate treatment	0.4566	0.9132	0.5434
b) Control - carbon treatment	0.8612	0.2775	0.1388
c) Control - treatment	0.7119	0.5761	0.2881

5.2 Conditional average treatment effects

To see if there is an effect from receiving information on specific subgroups, we will also analyse the conditional average treatment effect (CATE). CATE is using interaction terms and by this, we can look at the effect that treatments have on a smaller group instead of the entire sample. For example, if there is an effect of treatment on females, or the ones not knowing that climate change is caused by humans. To find the effect of treatment on the subgroup, we run a probit regression followed by a Wald-test to see if there is a significant difference in accepting the tax.

The foundation of the CATE regressions follow equation 1:

$$tax = B_0 + B_1 \cdot treatment_i + B_2 \cdot subgroup_i + B_3 \cdot (treatment_i \cdot subgroup_i) + V_i + \varepsilon \quad (1)$$

The variable "treatment" indicates for which type of treatment the respondent got (either carbon or climate). "Subgroup" will be which subgroup we analyse, for example, females or wrong on question 5. Lastly, we have the interaction term between treatment and the subgroup. "V" is a set of exogenous variables and "ε" is the error term.

5.2.1 Results from CATE

We split our sample into subgroups to analyse them separately. For every knowledge question we created a subgroup for the ones who answered it incorrectly. For example, the ones who did not state that climate change is caused by humans became a subgroup and then we looked at the effect of the climate treatment for this specific group. By doing this the idea is to see if there might be some question that is of greater importance for the acceptance. This was done for all nine questions about climate change. We did not find an effect of the climate treatment

on any of these subgroups. For the five questions about the carbon tax, we also created one subgroup for each question but now looked at the effect of the carbon treatment. We did not find an effect of the carbon treatment. The results can be seen in table 10 (appendix 1).

Furthermore, we assessed the median correct answer on all the nine questions about climate change. Then we created a subgroup, called climate wrong, for the ones scoring below the median, i.e., having seven or fewer correct answers to the nine questions. The idea is to test if the treatment influenced those with low prior knowledge, since the ones having many correct answers perhaps already knew the information. However, we did not find an effect of the climate treatment on this subgroup. For the five questions about the carbon tax, we did the same, and the ones having three or fewer correct answers became the subgroup called carbon wrong. We did not find an effect of carbon treatment on this subgroup. The results can be seen in table 10 (appendix 1).

Like the process above, we also created three subgroups called physical wrong, cause wrong and consequences wrong, which were the ones scoring below the median on the three questions from each category. By this, we can measure the effect of treatment on these specific subgroups and see if, for example, the ones not knowing about the consequences of climate change might be affected by the treatment and accept the tax more often. However, we did not find an effect of climate treatment on any of these subgroups. The results can be seen in table 10 (appendix 1).

5.2.2 Remaining subgroups

In addition, we created a subgroup for the ones stating that they consider climate change as a very important societal problem and one group for the ones stating otherwise. For these two subgroups, we did not find an effect of neither the climate nor the carbon treatment. We also made a subgroup who thought the climate policy in their country was bad and one group who was neutral or believed it was good. Again, we cannot find any significant treatment effects, except for carbon treatment on bad national policy. This finding means that people who believe we have bad climate policies became less accepting of a tax when getting carbon information. Results can be seen in table 11 (appendix 1).

We also produced subgroups for our demographic questions. When looking at the variable's female, young, member, child and living in the city we do not find any treatment effect on these, as seen in table 12 (appendix 1).

5.3 Other variables

Previously we looked at the effect of treatment on tax acceptance. In the survey, we also included four (4) other questions that we thought may relate to the acceptance of a carbon tax. These are if the respondent thinks (1) a carbon tax is fair, (2) if it is effective, (3) if the tax affects their personal economy and lastly (4) potential impact on low-income households. Instead of tax acceptance, we will now use these four as dependent variables and look for an effect of treatment.

The questions are on a scale of 1-5 but for simplicity, we divide them into three categories. We then do an ordinal probit and regress with the predicted outcome 3 (high), 2 (moderate) and lastly 1 (low).

5.3.1 Fairness

If we begin with fairness, we analyse the effect of treatment on perceived fairness. It is done separately for a) the climate and b) carbon treatment and the result are seen in table 13 (appendix 1). What we find is that there is an effect of climate treatment on perceived fairness, which means that by reading the climate information text, people perceive the carbon tax as more fair. The interpretation is that if you received the climate treatment there is about an 8.5% higher chance that you think a carbon tax is fair compared to the control group. For the carbon treatment, we did not find an effect.

5.3.2 Effective

Like the case with fairness, we also look at the effectiveness of a carbon tax, seen in table 14 (appendix 1). We tested for the effect of treatment if you perceive a tax as effective or not. We did not find any effect for either the climate or the carbon treatment. Besides this, we can see that if you are female there is a higher chance you also stated that carbon tax is very effective.

5.3.3 Personal economy

The third variable is how affected the respondent thinks their personal economy will be. In table 15 (appendix 1) we can see as before the marginal effects of the oprobit regression and here we cannot see any effect of any of the two treatments on the personal economy.

5.3.4 Low-income

Lastly, we have low-income households, where the respondents stated how much low-income households would be affected by a carbon tax. In table 16 (appendix 1) below we can see that

there is no effect of climate or carbon treatment on how you think low-income households will be affected.

6. DISCUSSION AND CONCLUSIONS

By doing an experiment the idea with the climate as well as the carbon treatment is 1) to make the respondents more knowledgeable and 2) that this increased climate/carbon knowledge will make you more prone to accept the tax. However, if any of these assumptions are not met, theory indicates that there would not be an effect of treatment.

The first result we have in the thesis is in terms of correlations. We see that there exists a positive relationship between the number of correct answers to the climate questions and acceptance of a carbon tax. This effect, however, disappears when adding variables measuring concern about climate change and their thoughts on national policy.

This first correlation suggests that those who know the answers to our climate questions also accept the tax to a higher degree. So, at this stage, we do not see any reason to question our second assumption, that the climate knowledge from treatment will make you accept the tax. However, since the correlation disappears when adding "climate change is an important problem" and "good national policy", it makes us question the real relationship. What we see is that the direct correlation between climate knowledge and acceptance changes to a relationship between concern and acceptance. We believe that there might instead be an indirect relationship between climate knowledge and acceptance of tax. When getting more knowledge, you become more concerned which in turn leads to higher acceptance. To conclude, even with this potential relationship, we still believe that attaining the climate information we provide makes you more prone to accept the tax.

For our carbon questions, we find no correlation between carbon knowledge and accepting the tax to a higher degree. This suggests that knowing the answers to our carbon question does not make you more inclined to accept a tax, which makes us question if our second assumption holds for carbon knowledge. If this would not hold, we would not expect to find an effect of the carbon treatment either.

When we now have stated the potential existence of relationships between knowledge and acceptance, we continue with our treatment effects. This is done through the proportion tests. In these, we cannot find any significant impacts of treatment on the respondents. The people

getting more information do not accept the carbon tax to a higher degree, no matter if it is climate info or carbon info.

If we begin analysing the climate treatment, one explanation for this insignificant difference may be due to prior knowledge. Our respondents to a high degree already knew the answers to the questions. On the nine climate questions, our respondents had on average 7.44 correct answers. This high knowledge could be due to the fact climate change has been discussed in society and a lot of information is already available to most people. Overall, this makes us question if our information text significantly increased their knowledge, since the information we provided to a high degree already was known by our respondents. For the climate treatment, it appears that the first assumption about making the respondents more knowledgeable is fulfilled.

Regarding the five carbon questions, we have an average of 3.43 correct answers. In this section, the respondents had a bit lower knowledge compared to the climate group but are still on average quite high. However, the carbon treatment provided some additional information apart from the answers to the questions. This means that even though you have many correct answers the people in treatment could learn extra information, making it difficult for us to exclude that the treatment made the respondents more knowledgeable. Here compared to the climate we feel a little more confident that we provided information that the respondents did not already know, thus having a higher chance of making them more knowledgeable. So, we believe that our assumption of making the respondents more knowledgeable holds for the carbon treatment even though we found no significant increase in acceptance following treatment. This result can be contrasted to that of Maestre-Andrés et al. (2021), who found that acceptance increased when receiving information about carbon taxation.

To develop the research further we continue with the CATE analysis. Here we split the sample into subgroups to investigate if there would be an effect of treatment on these specific groups. For example, if you don't know the answer to the question if humans are responsible for climate change and then learn that from the climate information, you might be more affected by the information, leading to different acceptance.

Since the respondents on average have high knowledge, we were extra interested in two subgroups, those with low climate knowledge (climate wrong) and low carbon knowledge (carbon wrong). This is useful since there is a higher chance that the respondents with few correct answers became more knowledgeable by the treatment, potentially avoiding the

problem of "not making the respondents more knowledgeable". However, we did not find an effect of treatment for either the climate wrong or the carbon wrong group. One explanation for this could be that for the group climate wrong, which was the bottom half, the respondents still averaged 6.18 out of nine for the climate questions. This is still quite high, and the problem of knowledgeable respondents might still exist. In this case, it might have been more preferred to split the sample further, creating groups with even lower knowledge. However, this would give us even fewer observations and with the current sample size, this was not an option. For the carbon subgroup, they averaged 2.29 out of five so it is reasonable that they gained knowledge from receiving the carbon treatment, and the lack of an effect of treatment may have been due to other reasons.

One interesting point we found was the connection between carbon treatment and bad national policy. In this case, we saw that people that believe that the nation had a bad climate policy were negatively affected by the carbon treatment. Many of the respondents live in Sweden which already has a quite high carbon tax. Providing information about the purpose of the tax to those who disliked it, made them want it even less, which is not what we expected. However, this may be since your prior beliefs of what you dislike with a tax are confirmed, for example, getting reminded of the higher cost.

To conclude the CATE analysis, when analysing the remaining subgroups, we did not find any significant effect of treatment on these. No matter if you are female, young, or have many wrong answers, the treatment did not have any effect on you, changing your acceptance.

If we go back to our assumptions, we believe we might have failed in significantly increasing the knowledge of the climate treatment group since the information to a high degree already was known. We found a correlation between more correct answers and accepting the tax. So, even if we can't know this for sure, we suspect that the treatment contained information that would affect the acceptance rate positively. However, if we failed with making the treatment group more knowledgeable, we would not find an effect anyway.

For the carbon treatment, it might have been the other way around. We believe that the treatment presented information that the respondents did not already know, and thus had a good chance of making them more knowledgeable. However, we are uncertain if the information provided would make the respondents more prone to accept the tax since we could not find any correlation between carbon knowledge and accepting the tax.

We conclude that information alone might not be sufficient to increase people´s acceptance of a carbon tax. As mentioned previously about the willingness to accept a tax it is also affected by what taxes are meant for and how they are used. Although, in our thesis we exclude how the revenues from taxes will be recycled into society.

In the analysis, we also extended the research to include dependent variables fairness, effective, personal economy and low-income households. We did not find any effect of treatment on these variables except for the climate treatment on the perception of fairness. So, if you received the climate information you considered the carbon tax fairer.

When reading about how climate change is uneven and affects low-income countries more, you may feel that this is unfair especially since climate change mainly is driven by the rich countries. So, if you consider a carbon tax, which aims to reduce the effect of climate change by charging the polluters, this might seem like a fair policy. Another explanation for this could be that our sample mainly consists of people from Sweden, which is a rich country, and when reading about how the damage affects low-income countries you may feel responsible for this, and thus consider the tax as fairer.

6.1 Conclusion

This thesis is based on two research questions:

- What is the impact of the provision of climate change information on carbon tax acceptance?
- What is the impact of the provision of carbon taxation information on carbon tax acceptance?

The main conclusion we can draw from this research is that we cannot say that extra information provision about either climate change or carbon taxation does affect people's acceptance.

6.2 Limitations

In this section, we will discuss some of the limitations we see in this thesis. The first part is regarding internal validity. This explains how certain we can be about our results, connected to for example sample size and randomness between the groups. One problem we have seen throughout the thesis is a problem with the sample size. In total, we have 355 observations to analyse. When we then split the sample into control, climate treatment and carbon treatment

the size decreases ending up with 107 - 131 observations per group. If we continue with the CATE analysis, we again split the sample. The size is different for different subgroups and for some groups the sample size was not higher than 20 - 30 observations. When the sample size gets smaller, it needs to be compensated by a greater difference between the groups to find an effect. This has made it more difficult for us to draw any specific conclusions since we both have small differences and a small sample size.

Another problem connected to the sample size is also the variation. If we look at the knowledge questions there is a low variation in the answers where most of the respondents got a high knowledge, both for carbon and climate. With such a low difference, the sample size would need to be a lot bigger for us to see any significant difference between the groups. The response rate for the survey was 5.8%, so we may have a problem with self-selection bias. This means that those who answered may not have been representative of everybody we sent the survey to. So it could be that the ones answering were more interested in climate change from the beginning and thus had a high knowledge already, which may explain this low variation. This in turn made it more challenging to make them more knowledgeable.

This problem with representativeness is also connected to external validity. In our case, the easiest way to reach many people was through Swedish universities. We send the surveys to students giving us a quite homogenous sample. As expected, they were a young group, but they showed to have higher knowledge than we anticipated. Again, this could have been due to the low response rate, with students who may be extra interested in the climate answering the survey. Another point is that we only have younger students. External validity is about how representative the sample is of the whole population, which we now do not have. To increase this, we would have needed a more differentiated group with more older people, more employed and living in both city and rural areas. Without these groups and some more, we will mostly get one perspective, decreasing the external validity.

Another problem is that Sweden today already has one of the highest carbon taxes in the world and to only ask people here might make the answers biased. It could be that the respondents did not think we should have more taxes since we already have a high carbon tax. However, we tried to solve this problem by making the question more hypothetical, so that they would think they are in a country with no previous carbon tax. But overall, it can be difficult to control if they had that in mind or not.

Lastly, one limitation is the information texts. When writing our treatment information, we tried to base the questions and answers on the previous research. However, in this case, it is hard to know what could be classified as "right" information. What information would have the most impact on people for them to accept a tax? This limitation might be more difficult to solve, mostly it makes us narrower in our conclusions and it only is connected to the information we provide. For example, in our case, we did not find any direct effect of treatment on the acceptance of the tax. This does not mean that information provision is not effective, it might just be that the information we provided was not effective.

6.3 Further research and development

For further research, we think the first thing to develop is the sample. In the most ideal world, the sample would be heterogeneous with different age groups with not only students but more pensioners, employed, unemployed and so on. In some cases, we have a quite good internal validity but where the external validity and comparison with the population are failing. So, a higher number of observations with a more variation of the respondents are things to have in mind.

Another point that might be good for improvement is to do a pilot study. We based our choice of knowledge questions on previous studies that have conducted similar analyses. In our case, however, it appears that many of the questions were "easy", as most respondents answered them correctly. To get a more variation in the sample we believe some more difficult questions would be needed which could have been found through the pilot study. Connected to this is that it would also be good to include a way to control if the respondents attained the knowledge presented to them. The goal of this thesis is to analyse if an increase in knowledge, through information, would affect acceptance. However, we cannot know for certain if the respondents got more knowledgeable even though they got treatment.

REFERENCES

Alkawsi, G; Ali, N & Baashar, Y. 2019. An empirical study of the acceptance of IoT-based smart meters in Malaysia: The effect of electricity-saving knowledge and environmental awareness. *IEEE Access*, 8, 42794-42804

Andrew, B., 2008. Market failure, government failure and externalities in climate change mitigation: The case for a carbon tax. *Public administration and development*, 28(5), pp.393–401.

Carattini, S. et al., 2017. Green taxes in a Post-Paris World: Are millions of Nays inevitable? *Environmental & resource economics*, 68(1), pp.97-128.

Carlsson, F. et al., 2013. The truth, the whole truth, and nothing but the truth—A multiple country test of an oath script. Journal of economic behavior & organization, 89, pp.105–121.

Driscoll, D., 2021. Populism and Carbon Tax Justice: The Yellow Vest Movement in France. Social problems (Berkeley, Calif.), pp. 2021–08-18.

Duflo et al., 2006. Saving incentives for low- and middle-income families: evidence from a field experiment with H&R block. The Quarterly Journal of Economics, 121(4), pp. 1311-1346.

Duflo, E & Saez, E. 2003. The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment. The Quarterly Journal of Economics, 118(3), pp. 815-842.

Ewald, J; Sterner, T & Sterner, E. 2021. *Understanding the resistance to carbon taxes: a case study of Sweden*. Working paper. Washington D.C: Resources for the future

Hagmann, D; Ho, E.h & Loewenstein, G. 2019. Nudging out support for a carbon tax. *Nature climate change*, 9(6), pp.484-489.

Hájek, M. et al., 2019. Analysis of carbon tax efficiency in energy industries of selected EU countries. Energy policy, 134, p.110955.

Intergovernmental panel on climate change. 2022. *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Genève: IPCC

Kallbekken, S & Saelen, H. 2011. Public acceptance for environmental taxes: Self-interest, environmental and distributional concerns. *Energy Policy*, 39(5), pp. 2966 – 2973

Luttmer, E.F.P. & Singhal, M., 2014. Tax Morale. *The Journal of economic perspectives*, 28(4), pp.149–168.

Maestre-Andrés, S; Drews, S & van den Bergh, J. 2021. Carbon tax acceptability with information provision and mixed revenue uses. *Nature Communications*, 12(1), pp.1-10.

Rhodes, E., Axsen, J. & Jaccard, M., 2014. *Global environmental change*, 29, pp.92–104.

Roberto, D.A., 2009. Tax evasion, tax morale and policy maker's effectiveness. *The Journal of socio-economics,* 38(6), pp.988–997.

Rocamora, A. 2017. The rise of carbon taxation in France: From environmental protection to low-carbon transition. *Institute for Global Environmental Strategies*.

Shi, J; Visschers, V; Siegrist, M & Arvai, A. 2016. Knowledge as a driver of public perceptions about climate change reassessed. *Nature Climate Change*, 6, 759 – 762

Suldovsky, B., 2017. The Information Deficit Model and Climate Change Communication. Oxford: Oxford university press.

Tobler, C; Visschers, V & Siegrist, M. 2012. Consumers´ knowledge about climate change. Climatic Change, 114, pp. 189 - 209

APPENDIX 1

Table 1. Questions to assess climate change knowledge, divided into three groups

Physical knowledge	Correct	Incorrect	Don´t know	Variable name
Burning oil, among other things, produces carbon dioxide (CO2)				physical_1
CO2 is a greenhouse gas (GHG)				physical_2
Greenhouse gases (GHGs) partly retain the heat radiation of planet Earth				physical_3
Knowledge about causes	Correct	Incorrect	Don´t know	Variable name
The global CO2 concentration in the atmosphere has increased during the past 250 years				cause_1
With a high probability, the increase of CO2 is the main cause of climate change				cause_2
What do you think is the primary cause of climate change	Natural causes	Human activities	Don´t know	cause_3
Knowledge about consequences	Correct	Incorrect	Don´t know	Variable name
For the next few decades, the majority of climate scientists expect an increase in extreme weather events, such as droughts, floods and storms				cons_1
For the next few decades, the majority of climate scientists expect the climate to change evenly all over the world				cons_2
For the next few decades, the majority of climate scientists expect that a warmer climate will foster the spread of infectious diseases (such as yellow fever or malaria) in the northern regions				cons_3

Table 2. Questions to assess knowledge about carbon taxation

Carbon taxation	Correct	Incorrect	Don´t know	Variable name
A carbon tax is imposed on the carbon content of fossil fuels, such as coal and oil				carbon_1
A carbon tax makes renewable energy sources, such as solar electricity, more expensive than fossil fuels				carbon_2
A carbon tax will raise the price of coal and the price of gasoline				carbon_3
A carbon tax will raise the price of air travel				carbon_4
A carbon tax will not increase the price of train travel				carbon_5

Table 4. Sample distribution and randomness between Control, Climateinfo and Carboninfo

	Control	Climateinfo	Carboninfo	Total
Gender				
Female	59.54%	65.81%	51.40%	58.92%
Male	35.11%	29.91%	42.06%	35.69%
Other	5.35%	4.28%	6.54%	5.39%
Age				
- *24*	52.67%	41.88%	57.01%	50.52%
25 - 39	35.11%	44.44%	31.78%	37.11%
40 - 59	9.92%	10.26%	7.48%	9.22%
60 - 79	-	-	0.93%	0.31%
80 -	-	-	-	-
Prefer not to say	2.30%	3.42%	2.80%	2.84%
Occupation				
Student	91.41%	84.21%	91.35%	88.99%
Employed	7.81%	14.91%	7.69%	10.14%
Pensioner	-	0.88%	-	0.29%
Unemployed	-	-	-	-
Other	0.78%	-	0.96%	0.58%
Educational level				
Elementary	0.78%	-	2.88%	1.22%
High school	59.38%	56.14%	62.50%	59.34%
Bachelor	30.47%	33.33%	25%	29.60%

Master	7.03%	5.26%	8.65%	6.98%
Postgraduate	0.78%	0.88%	-	0.55%
Other	1.56%	4.39%	0.96%	2.31%
Area				
Countryside	14.06%	21.93%	11.54%	15.84%
Village	11.72%	8.77%	11.54%	10.68%
Town	41.41%	34.21%	45.19%	40.27%
City	32.81%	35.09%	31.73%	33.21%
Member of environmental organisation				
Yes	21.88%	16.67%	19.23%	19.26%
No	78.13%	83.33%	80.77%	80.74%
Children in household				
No	81.68%	78.63%	82.24%	80.85%
Yes	18.32%	21.37%	17.76%	19.15%
Concern about climate change				
Average concern (low - high)	4.44	4.36	4.25	4.35
Opinion about national climate policy				
Average opinion (bad - good)	2.86	2.95	2.85	2.89

Table 5. Distribution of the answers to climate change knowledge questions.

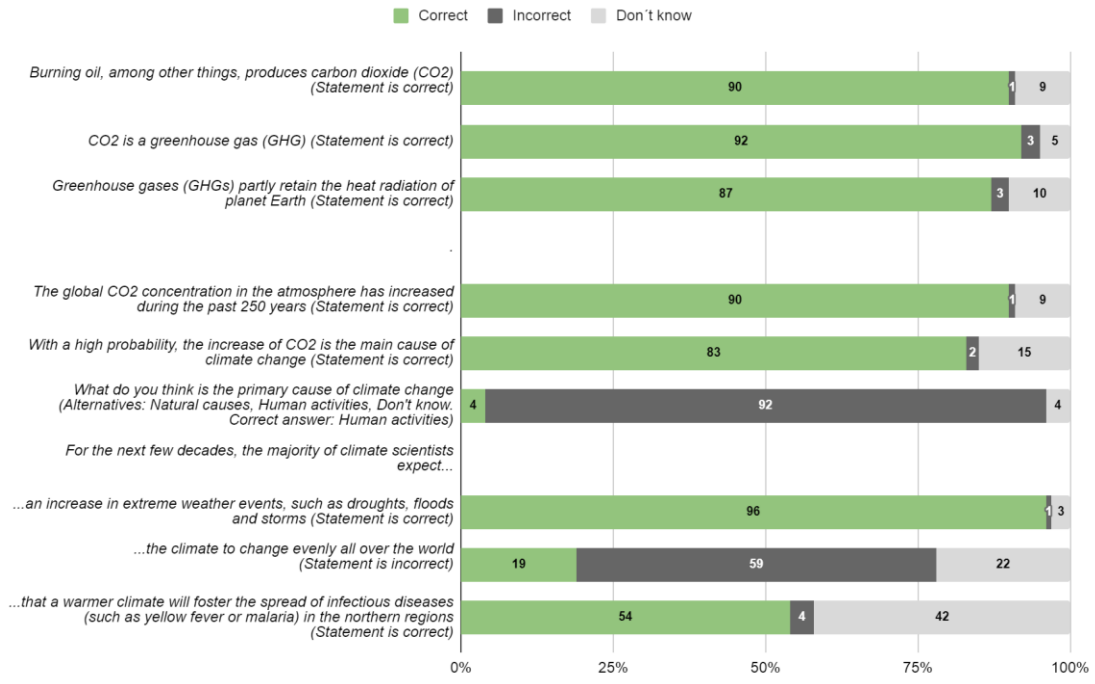

Table 6. Distribution of the answers to carbon taxation knowledge questions.

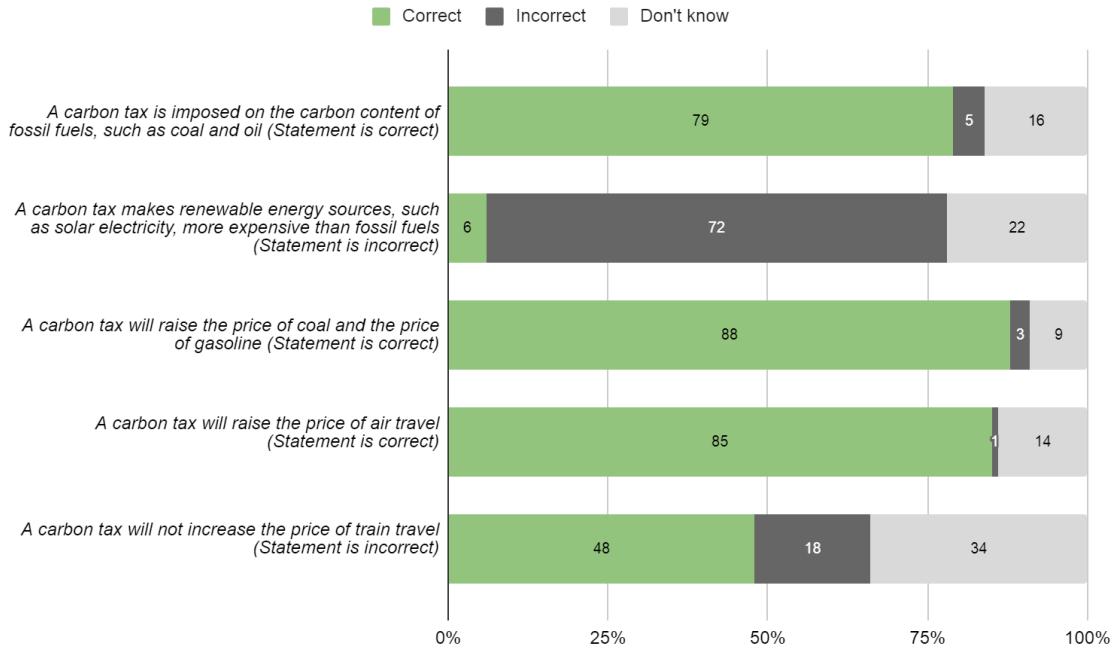

Table 10. CATE for knowledge questions including p-value from Wald test

Knowledge questions	Treatment (climate/carbon)	Interaction term		P-value Wald test (H0:treatment+interaction=0)
Total correct answers				
Climate wrong	-0,001	-0,033		0.6538
	(0.078)	(0.114)		
Carbon wrong	-0,101	0.106		0.8609
	(0.076)	(0.096)		
Categories (climate)				
Physical wrong	-0,005	-0,009		0.8990
	(0.061)	(0.129)		
Causes wrong	-0,028	0.029		0.9795
	(0.067)	(0.107)		
Consequences wrong	-0,093	0.115		0.6371
	(0.097)	(0.102)		
Individual questions				
Climate questions				
Burning oil, wrong	0.004	-0,099		0.5834
	(0.057)	(0.198)		
CO2 is a GHG, wrong	-0,012	0.088		0.6708
	(0.056)	(0.163)		
GHG retain heat, wrong	-0,020	0.146		0.3458
	(0.056)	(0.104)		
CO2 concentration last 250 years, wrong	-0,019	0.054		0.7886
	(0.058)	(0.135)		
CO2 is main cause of climate change	-0,014	-0,001		0.9076
	(0.060)	(0.137)		
Human activites, wrong	-0,018	0.111		0.5259
	(0.058)	(0.127)		
Increase in extreme weather, wrong	-0,017	0.182	*	0.3309
	(0.055)	(0.097)		
Climate change hit evenly, wrong	-0,103	0.158	**	0.2883
	(0.073)	(0.074)		
Spread of diseses, wrong	-0,021	0.042		0.7806
	(0.074)	(0.104)		
Carbon questions				
Carbon tax on carbon content, wrong	-0,016	-0,139		0.2316
	(0.066)	(0.161)		
Renewable energy more expensive, wrong	-0,101	0.123		0.6916
	(0.071)	(0.093)		
Raise price on coal and gasoline, wrong	-0,039	-0,032		0.6862
	(0.061)	(0.195)		
Raise price on air travel, wrong	-0,026	-0,138		0.3322
	(0.062)	(0.199)		
Raise price in train travel	-0,056	0.021		0.5959
	(0.123)	(0.136)		

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 11. CATE for climate_importance and national_policy including p-value from wald test

	Treatment (climate/carbon)	Interaction term		P-value Wald test (H0:treatment+interaction=0)
Climate				
Climate important problem	0.058	-0,109		0.5596
	(0.074)	(0.121)		
Climate not important problem	-0,045	0.096		0.4321
	(0.077)	(0.088)		
Good national policy	-0,085	0.102		0.7402
	(0.098)	(0.106)		
Bad national policy	0.021	-0,116		0.3815
	(0.064)	(0.137)		
Carbon				
Climate important problem	-0,029	0.024		0.9520
	(0.077)	(0.112)		
Climate not important problem	-0,005	-0,025		0.6990
	(0.087)	(0.120)		
Good national policy	-0,239	0.247	***	0.5348
	(0.104)	(0.095)		
Bad national policy	0.044	-0,322	***	0.0214
	(0.069)	(0.150)		

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 12. CATE for demographic variables including p-value from wald test

Demographics	Treatment (climate/carbon)		Interaction term		P-value Wald test (H0:treatment+interaction=0)
Climate					
Female	0.028		-0,062		0.6509
	(0.082)		(0.115)		
Young	0.000		-0,008		0.8927
	(0.175)		(0.185)		
Member	0.005		0.037		0.8050
	(0.057)		(0.169)		
Child	-0,047		0.169	**	0.1672
	(0.059)		(0.075)		
Live in the city	-0,037		0.051		0.8055
	(0.093)		(0.107)		
Carbon					
Female	-0,071		0.049		0.8206
	(0.081)		(0.109)		
Young	-0,335	*	0.296	*	0.8992
	(0.176)		(0.155)		
Member	-0,026		-0,085		0.5019
	(0.062)		(0.190)		
Child	-0,052		0.026		0.8384
	(0.065)		(0.137)		
Live in the city	0.027		-0,106		0.2624
	(0.108)		(0.136)		

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 13. Marginal effects after an ordinal probit for a) climate treatment and b) carbon treatment. Using fairness as the dependent variable.

a)	High fair		Moderate fair		Low fair	
Climateinfo	0.085	*	0.005		-0,090	*
	(0.049)		(0.006)		(0.053)	
Female	0.036		0.002		-0,038	
	(0.052)		(0.004)		(0.056)	
Young	-0,099		-0,006		0.105	
	(0.078)		(0.008)		(0.083)	

b)	High fair		Moderate fair		Low fair	
Carboninfo	0.019		0.003		-0,022	
	(0.047)		(0.008)		(0.055)	
Female	0.084	*	0.015		-0,098	*
	(0.048)		(0.011)		(0.057)	
Young	-0,064		-0,011		0.075	
	(0.081)		(0.015)		(0.095)	

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 14. Marginal effects after an ordinal probit for a) climate treatment and b) carbon treatment. Using effectiveness as the dependent variable.

a)	Very effective		Moderate effective		Not effective	
Climateinfo	-0,023		0.005		0.018	
	(0.055)		(0.012)		(0.044)	
Female	0.143	**	-0,030	**	-0,113	**
	(0.057)		(0.014)		(0.046)	
Young	-0,045		0.009		0.035	
	(0.084)		(0.018)		(0.067)	

b)	Very effective		Moderate effective		Not effective	
Carboninfo	0.028		-0,006		-0,022	
	(0.057)		(0.012)		(0.045)	
Female	0.180	***	-0,038	***	-0,142	***
	(0.055)		(0.014)		(0.046)	
Young	-0,011		0.002		0.008	
	(0.089)		(0.019)		(0.071)	

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 15. Marginal effects after an ordinal probit for a) climate treatment and b) carbon treatment. Using the personal economy as the dependent variable.

a)	Very affected	Moderate affected	Not affected
Climateinfo	0.031	-0,002	-0,029
	(0.053)	(0.004)	(0.049)
Female	0.014	-0,001	-0,013
	(0.055)	(0.004)	(0.051)
Young	-0,030	0.002	0.028
	(0.079)	(0.006)	(0.074)

b)	Very affected	Moderate affected	Not affected
Carboninfo	0.053	-0,004	-0,049
	(0.055)	(0.005)	(0.051)
Female	0.071	-0,005	-0,066
	(0.056)	(0.006)	(0.052)
Young	-0,041	0.003	0.038
	(0.092)	(0.007)	(0.085)

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets

Table 16. Marginal effects after an ordinal probit for a) climate treatment and b) carbon treatment. Using the low-income households as the dependent variable.

a)	Very affected		Moderate affected		Not affected	
Climateinfo	-0,069		0.047		0.022	
	(0.053)		(0.036)		(0.018)	
Female	0.074		-0,049		-0,024	
	(0.056)		(0.037)		(0.019)	
Young	0.194	**	-0,132	**	-0,063	**
	(0.079)		(0.053)		(0.030)	

b)	Very affected	Moderate affected	Not affected
Carboninfo	-0,007	0.004	0.002
	(0.054)	(0.036)	(0.019)
Female	0.003	-0,002	-0,001
	(0.055)	(0.036)	(0.189)
Young	0.098	-0,064	-0,033
	(0.081)	(0.054)	(0.029)

Significance level: *:10%, **: 5%, ***: 1%. Standard errors in brackets