

The effect of information on public support for increased carbon taxes on transport fuels

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Abstract

This study examines how information about the effects of increased fuel taxes on fuel consumption, and with the possibility of compensating rural inhabitants (who use their cars more), impact the acceptance of fuel taxes and the psychological nature of the acceptance. Using a stratified survey in Sweden we analyze the support for increased carbon taxes for fuels. We find that 16 to 27 percent of the respondents support the proposed policy. A prime reason for this low support appears to be that most Swedes do not believe that higher fuel prices through taxation will lead to lower CO₂ emissions from road transport. Equity concerns have also been shown to be a major objection against such tax increases, with a strong correlation between equity concerns and non-support for the tax increase. Our results suggest that neither information about the expected effect from taxation on emissions, nor the potential for redistribution, had an effect on the support for the taxes. When controlling for treatment, socioeconomic variables and demographic variables, the psychological variables showed that the respondents willing to support the increased fuel tax also had a positive attitude towards the tax, and a strong belief of their capacity to perform the behavior, and also a belief that supporting the tax is up to them.

Keywords

Climate; Fuel tax; Pigouvian mechanism; Equity; Public support; Acceptance

JEL Codes

D72; D91; Q54

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1 Introduction

In 2023 the new European Union (EU) climate legislation called Fit for 55 was finalized. This legislation raises the ambition for the EU to become the world's first climate-neutral continent by 2050 (European Council, 2024). In the economic literature, there is consensus that carbon taxation is the most efficient policy to reduce carbon emissions (e.g. Akerlof, 2019; Stiglitz et al., 2017). However, public acceptance that might be essential for implementing such carbon taxes seems lacking (e.g. Carattini et al., 2018). This results in a political reluctance to introduce, or increase, taxes to address climate change out of fear of losing public support even when the measures are effective and can contribute to significant societal benefits over time (Ewald et al., 2022).

The lack of acceptance of carbon taxes raises the issue of whether measures to inform the public about the motives for the taxes, expected impact, and effectiveness, can help gain support (Carattini et al., 2018). Providing impartial and correct information on the effectiveness of different policies is not easy, though. However, the urgency of the climate problem calls for assessing how communication should be done. Moreover, in addition to effectiveness, perceived fairness has also been identified as underlying this discrepancy between desired effects and the perception of the appropriateness of the policy measure. Effectiveness and perceived fairness can, thus, be highlighted as central to understanding how information provision and complementary measures to handle distributional consequences of the taxes can influence acceptance (Bergquist et al., 2023; Ewald et al., 2022). Regarding fairness, the results from several recent studies have suggested that one of the public concerns associated with carbon taxes on fuels is that they may unfairly affect vulnerable households (Dechezleprêtre et al., 2023; Douenne and Fabre, 2022; Ewald et al., 2022). Other studies have indicated that inhabitants in rural areas use their cars more than urban residents and that some low-income households in rural areas may be more affected by increased carbon taxes (e.g. Chatterton et al., 2018; Eliasson et al., 2018). In addition, many citizens believe that higher fuel and road use prices have small or no effects on fuel and transport demand, and thus are ineffective measures (e.g. Kallbekken et al., 2013).

Dechezleprêtre et al. (2023) showed that the most important factor in predicting policy support is the perceived effectiveness of a policy, measured as the belief in both its ability to reduce emissions, or pollution, and its perceived distributional impacts. Hence, they conclude that providing information on the substitution effects of fuel taxes and the possibility of redistributing tax revenues to compensate low-income earners could increase the support. The findings from Dechezleprêtre et al. (2023) raise the question of whether there is a potential for informing citizens of different measures to reduce climate impacts, including the costs and benefits to the citizens themselves, and to what extent this information will influence their view of these measures.

This paper examines whether informing citizens about the potential effects of carbon taxation on fossil fuel usage will affect their preferences for an increased fuel taxation of SEK 3/liter¹, about 15 percent of the current price. This is done in two ways. The first way is to analyze if the support

¹ Average exchange rate for EUR/SEK in 2024: 1 EUR = ca 11,4 SEK (ECB, 2024) so 3 SEK corresponds to 0.26 EUR.

for fuel taxation could increase by providing information on the substitution effects of fuel taxes and/or the possibility of redistributing tax revenues in a compensatory fashion. The second way is to further examine factors influencing the motivations for support and non-support. We therefore introduced two approaches from psychology, a modification of the Transtheoretical model of change (Prochaska and DiClemente, 1983), which we call the Theory of acceptance transition (TAcT), and the Theory of planned behavior (TPB; Ajzen, 1991). The first model is introduced to reflect stages of readiness to accept, or support, increased fuel taxes, and the second model is to better understand the decision-making process to support or not support increased fuel taxation. We also control for the factors already known to influence the support for climate policy like education, income, residential area, and access to car and public transport. The study was conducted using a Swedish sample.

The main results are the following. The overall support for the increased fuel taxes in our survey was 27 percent. This is a reasonable outcome given that Swedish support for an increase in the carbon tax has been stable at around 30 percent from 2013 to 2019 (Jagers et al., 2020). The way we communicated the effectiveness of taxes and prices to reduce fuel consumption and that rural residents could be compensated, did not have any statistically significant effect on the support for increased fuel taxation. Neither did the information on the effectiveness of taxes to reduce emissions given in the treatment seem to have any effect on the respondents' beliefs on the effects of taxes. The results from the TAcT and TPB questions indicate that both the supportive and non-supportive responses to higher fuel tax are well correlated with the perception of the effectiveness of fuel taxes in attitudes and social norms. Our TAcT results, however, also indicate a degree of uncertainty in the support for increased fuel taxes due to the inconsistencies in the answers to different questions on support. Such an inconsistency could be due to the fact that some respondents support increased taxation for other motives than climate.

The main contribution of this paper is twofold. First, the paper analyses the effects of information on support for carbon taxes on transport induced by information on the substitution effects from taxes and by explaining the possibility of compensating car owners with low incomes in rural areas. The failure to induce such effects indicates that a more sophisticated method of providing information in communication is needed. Second, the paper examines a psychological approach to how stages of readiness to accept fuel taxes influence the support for taxation.

The paper is organized as follows. In the following section 2, we discuss findings from the literature. Thereafter section 3 describes the survey used to collect our data. In section 4 we present our findings. The paper ends with a discussion and some conclusions in sections 5 and 6, respectively.

2 Literature

The issue of public attitudes to climate change and what determines support for climate policies has been studied for some time now. Surveys can be found in Carattini et al. (2018), Drews and van den Bergh (2016), Maestre-Andrés (2019), and Whitmarsh and Capstick (2018). Heyen and Wicki (2024) and Kallbekken (2013) argue that research on public support for climate policy must broaden its scope and include factors that can affect the acceptability of policies.

Earlier studies of acceptance have revealed some important observations on factors determining support. The perceived consequences in terms of direct expenses for the individual and the perceived effectiveness of the policy are of central importance (Gerdes et al., 2023; Schuitema et al., 2010). The respondents in policy surveys have been found to overestimate the costs and underestimate the positive effects of policies (Dounne and Fabre 2022; Schuitema et al., 2010)

It has also been shown in several studies that the belief that increased taxes on motor fuels will not be effective in reducing fuel consumption, and hence lower emissions, has been correlated with less acceptance (e.g., Ewald et al. 2022 and Kallbekken et al. (2013). Individuals are also concerned that increased fuel taxes will be relatively more burdensome for rural inhabitants and low-income earners (e.g., Ewald et al., 2022; Kallbekken et al., 2013). This does not, however, appear to be strongly correlated with strong support for revenue redistribution (eg. Ewald et al., 2022; Maestre-Andres et al., 2019, 2021). There have even been findings of a negative correlation between the opinion that fuel taxes are unfair and the desire for redistribution efforts (Ewald et al., 2022).

Given the prevalence of misperceptions of expected policy effects, several studies have experimented with information provision to learn if such perceptions can be influenced. However, many of these have found that the information provision had small or no effects (e.g. Dounne and Fabre, 2022; Haaland et al., 2023). The lack of strong effects of information provision has led researchers to examine the psychology of barriers to changes in opinions and possible ways to influence them. One of these called motivated reasoning, is associated with reluctance to consider and accept new information when it contradicts their previously held assessment (Dounne and Fabre, 2022).

An important exception is the paper of Dechezleprêtre et al. (2023). They test the effect of showing respondents a video explaining the positive and negative consequences of a fuel tax combined with a progressive transfer of tax revenue to citizens. The result is that this information shifts exactly the beliefs that are most predictive of policy support, leading to a substantial shift in support compared to a control group that did not receive the information in the video. A further example is provided in Lindvall et al. (2024) where a question for support for increased taxes on fossil fuels is followed by questions where the question of support was combined with, for example, a support to low-income groups and rural inhabitants. In such a combination of policies the support for taxes increased substantially.

In this study, we adopt two psychological models to examine the grounds for the opinions of our subjects. The first is the Transtheoretical model of change (TTM; Prochaska & DiClemente, 1983), which investigates the distinct stages people undergo before a new behavior is established. The stages most commonly used are 1) pre-contemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance (Sutton, 2001). As we are interested in the transition toward full *acceptance* of a policy, we modified the TTM model and called the new model the Theory of acceptance transition (TAcT). The highest level of acceptance was defined as where the individual sees the Swedish carbon dioxide emissions from road transport as a climate

problem and believes that a higher fuel tax that gives an increased fuel price by SEK 3 per liter will lead to a reduction in emissions and would support this increase in the fuel tax. The second is the Theory of planned behavior (TPB; Ajzen, 1991). According to the TPB, people's attitudes towards a behavior (here interpreted as support for a policy), the subjective norm, and perceived behavioral control determine their intention to perform the behavior in question. The intention, in turn, together with perceived behavioral control influences the behavior. In other words, the performance of a behavior is facilitated if the behavior is compatible with the individual's intention, which in turn is influenced by the individual's attitudes, subjective norm, and perceived behavior control, whereas conflict with any of these aspects may be a barrier for the behavior.

3 Survey method

3.1 Data collection procedure

The survey was conducted online in March 2024 using a commercial web panel supplier (Origo Group). The sample consists of respondents who voluntarily agreed to participate and was divided into four groups: one control group and three treatment groups receiving different information.² The respondents in each group were stratified to be equal in numbers from the three major area types concerning car use in Sweden: 1) the three largest cities in Sweden, 2) smaller cities, urban areas, and suburbs to the largest cities, and 3) rural areas. The geographical stratification was based on postcodes. Moreover, to ensure an even spread of age and gender in the treatment groups, the respondents were divided into 10 quota groups on gender and age³.

In total, the survey was answered by 4 057 respondents of which 14 answers were removed from the sample by Origo Group because of short response time (less than 1 minute) or irrelevant or unserious answers to the final open question. Hence, the final sample consists of 4 043 responses.

3.2 Questionnaire

The questionnaire consisted of five parts. In the first part, depending on whether belonging to the control group or one of the treatment groups, the respondents were presented with four different sets of information on the potential design and consequences of fuel taxes, followed by the main question if they would support an increase in the fuel tax. This part of the questionnaire is described in more detail in section 3.2.1. In the second part, the respondents were given the TAcT and TPB questions, described in more detail in section 3.2.2. In the third part, the respondents were asked about their perceptions of the effects of fuel taxes. In the fourth part, the respondents were asked about demographic and socioeconomic aspects, i.e., their age, sex, education, occupation, income, residential area, etc. In the fifth, and final, part, some questions on the respondents' general opinions and perceptions on fuel taxes and distribution policy were

² The respondents receive monetary compensation for each completed survey. The amount depends on the survey length, usually between 4 and 10 SEK. Average exchange rate for EUR/SEK in 2024: 1 EUR = ca 11,4 SEK (ECB, 2024)

³ Five age groups 18-34, 35-44, 45-54, 55-64, 65+, are interlocked with gender.

given to check the consistency. The complete questionnaire is available in the Supplementary material.

3.2.1 The information treatment

While all four treatment groups were given general background information about the survey's aim and the proposal to increase the fuel price by an additional SEK 3/liter, the first treatment group received a short description of likely price effects on car use and fuel consumption from fuel taxes. The second treatment group received information on a potential compensation design for low-income earners in rural areas to be associated with the tax. The third treatment group was given both information on the price effects and a potential compensation design, i.e., a combination of the second and third treatments. For the treatment design summary, see Table 1.

Table 1 Treatment design – control group and treatment groups

Information	CG	T1	T2	T3
General information	√	√	√	√
Effectiveness information		√		√
Compensation information			√	√

In Table 2, the information texts (freely translated from Swedish) are provided. The objective was to present the respondents with texts that were informative and perceived by the respondents as objective and neutral.

Table 2 The information given in the questionnaire

General information	
	“To achieve Sweden’s emission commitments to the EU, fuel taxes may need to be raised. In this study, we investigate attitudes toward a tax increase that would increase the price of fuel by an additional SEK 3 per liter, in addition to the price increase (due to, for example, increased oil prices) that is expected to occur by 2030.”
Effectiveness information	
	“The idea of taxing fossil fuels such as gasoline and diesel is to make it more costly to emit greenhouse gases, which has been shown to lead to changes in behavior and technology so that emissions decrease. The individual chooses alternatives that emit less, for example, energy-efficient products, or change their travel behavior using other alternatives than fossil-driven cars, e.g., public transport or electric vehicles. On the other hand, the companies drive technological development and offer more energy-efficient alternatives and solutions leading to lower emissions and costs. Research shows that increased fuel prices affect reduced car use and emissions even if the effect in the short term is quite small. However, we know that in the long term there will be a greater effect, even if we do not know exactly how large that effect will be.”
Compensation information	

	“Part of the tax revenues obtained through increased tax on fossil fuels can be used to compensate the car owners who are most affected by the tax. In relation to income, fuel costs are expected to increase more for car owners who have lower income than the average income and live in rural areas. One way to facilitate car owners belonging to this group is to use part of the tax revenues to compensate for the average additional cost this group has compared to the corresponding income group living in small rural towns. Given a tax increase that would increase the price of fuel by an additional SEK 3 (in addition to the price increase expected to occur by 2030), such compensation could, for example, result in payments of 1 400 SEK a year for car-owning low-income earners in rural areas.”
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The information treatment was followed by the main question:

”Would you support a fuel tax increase that would increase the price of fuel by an additional SEK 3/liter in addition to the (uncertain) price increase expected to occur by 2030?”

This question had three response alternatives: “Yes”, “No”, or “Do not know”. A dummy variable with 1 = “Yes” and 0 = “No”/”Do not know” was created and used in the logit analysis.

3.2.2 *Theory of acceptance transition (TAcT) and Theory of planned behavior (TPB)*

The second part of the questionnaire related to the respondents' support and attitudes toward the increased fuel tax, as well as their stage of acceptance measured by the TAcT and the TPB.

Theory of acceptance transition (TAcT)

Based on the Transtheoretical model of change (Prochaska and DiClemente, 1983), which measures a person's stage of change toward a specific behavior, we formulated a theory, or model, that we call the *Theory of acceptance transition (TAcT)*. This model is intended to measure a person's stage of acceptance regarding a specific policy instrument aimed to reduce carbon dioxide emissions from road transport. We make the assumption that if a person does not see carbon dioxide emissions from road transport as a climate problem at all, no acceptance of an increased tax will happen (stage 1). The first step towards an acceptance is to regard carbon dioxide emissions from road transport in Sweden as a climate problem (stage 2). The next step is to believe that an increased fuel price will reduce the emissions (stage 3). However, due to other circumstances, such as low income, large dependence of a (fossil) car, these beliefs do not always lead to a support of the increased tax. At stage 4, no such impeding beliefs exist, and the person is willing to support the increased tax. We call the stages towards support: 1) deny, 2) distrust, 3) unsupport, and 4) support.

The stage of acceptance was measured by the question “Which of the options below describes you best?”:

1 = *I do not see the Swedish carbon dioxide emissions from road transport as a climate problem;*

2 = *I see the Swedish carbon dioxide emissions from road transport as a climate problem but do not believe that a higher fuel tax that gives an increased fuel price by SEK 3 per liter*

will lead to a reduction in emissions;

3 = I see the Swedish carbon dioxide emissions from road transport as a climate problem and believe that a higher fuel tax that gives an increased fuel price by SEK 3 per liter will lead to a reduction in emissions but would not support this increase in the fuel tax;

4 = I see the Swedish carbon dioxide emissions from road transport as a climate problem and believe that a higher fuel tax that gives an increased fuel price by SEK 3 per liter will lead to a reduction in emissions and would support this increase in the fuel tax.

Theory of planned behavior (TPB)

In this study, we measure attitude towards supporting an increased fuel tax, subjective norm regarding the supportive behavior, and perceived behavioral control regarding the behavior. The intention to support the increased fuel tax is measured by the main question described above in 3.2.1.

Attitude was measured by three items (the same question but three different response scales):

Question: “That I would support a higher fuel tax that gives an increased fuel price by SEK 3 per liter would be”,

Response scale: 1 = *bad* to 7 = *good*; 1 = *unsatisfying* to 7 = *satisfying*; 1 = *unwise* to 7 = *wise*.

An index was calculated by taking the mean of the three items, with a Cronbach’s alpha value of 0.95. Cronbach’s alpha is a measure of the internal consistency, that is, the degree to which the items are all measuring the same underlying attribute (Pallant, 2001). The statistic can vary from 0 to 1, where higher values indicate greater reliability or a larger average correlation among the included items (Pallant, 2001).

Subjective norm was measured by two items:

Question: “Most people who are important to me would think that it is good that I support a fuel tax that gives an increased fuel price by SEK 3 per liter” (injunctive norm) and “Most people who are like me would support an increased fuel tax that gives an increased fuel price by SEK 3 per liter” (descriptive norm),

Response scale: 1 = *totally disagree* to 7 = *totally agree*.

In some studies, the injunctive norm and the descriptive norm are presented separately, and in some studies, an index is created. In this study, the Pearson correlation coefficient between the two items was 0.80. Therefore, we chose to merge the two norm aspects. An index was calculated by taking the mean of the two items, with a Cronbach’s alpha value of 0.89.

Perceived behavioral control was measured by two items:

Question: “I am sure that I could support a fuel tax that gives an increased fuel price by SEK 3 per liter” (capacity) and “That I would support a fuel tax that gives an increased fuel price by SEK 3 per liter is up to me” (autonomy),

Response scale: 1 = *totally disagree* to 7 = *totally agree*.

The Pearson correlation coefficient between the two items was 0.41 and therefore we decided to analyze the two control aspects separately.

3.3 Statistical analyses

In the result section, we present the outcome of the survey in terms of the characteristics and responses of the respondents. First, we present descriptive statistics for the variables used in the logit model of support regarding increased tax/fuel price. Second, we summarize the responses for the treatment groups compared to the control group and test for no difference regarding support by means of Chi-square test. This test is used when we have categorical data and tests if there is any relationship between the two variables, or maybe more correct, if the distribution of one variable is dependent of the other variable. Third, we describe the results from the TAcT and TPB responses. We compare the differences in willingness to support for each TPB item/indexes by means of Analysis of Variance (ANOVA) and Bonferroni post hoc analyses. ANOVA is used to test if there is any difference between the mean values for three or more groups on some specific variables. Because the ANOVA only can tell us if there is any significant difference – but not which groups who differ – a post hoc analysis with Bonferroni correction is performed. In that analysis, pairwise comparisons between the group means are made. When using an ANOVA, the data should be on an interval or ratio level of measurement. In our study, the data in question is on an ordinal level. However, we think that in this case it is possible to assume that there is an underlying continuous scale which the ordinal response scale is an indicator of, and therefore we use parametric tests on the Likert scales in the study. Also, the differences in the TAcT stages for each TPB item/indexes were analyzed by means of ANOVA and Bonferroni post hoc analyses. Fourth, we describe responses to effects on contexts, i.e., consequences of the tax, and consistency questions. Here, we perform an exploratory factor analysis of the seven consequence items, which results in two factors which we calculated the means of and get two indexes. In an exploratory factor analysis, we try to identify underlying factors that best account for the correlation between items, and via factor rotations find the most plausible and interpretable factor solution. Here, we used a principal factor extraction and rotated the factors by Varimax orthogonal rotation because we did not assume any correlation between the factors. Then we compare the differences in willingness to support for each of the two consequence indexes by means of ANOVA and Bonferroni post hoc analyses. Because the consequence items had a large share of “do not know” answers, these answers were imputed by the middle alternative, i.e., the number four. Fifth, we analyze the consistency between some of the questions, e.g., responses to the main support question, the TAcT question, and a question on the effects of taxes on fuel consumption by means of a Venn diagram. Some of the consistency questions were analyzed by means of the Phi coefficient, which is a kind of correlation analysis used when we have two categorical variables where both variables only have two levels. In the sixth step, we estimate a logit model with the treatment groups, the characteristics of the individual, the TPB responses, and the two consequence indexes as explanatory variables. This allows us to see which explanatory variables strongly influence the support response. The logistic model has only two possible outcomes, that is, the dependent variable can only adopt either of two values, in this case 1 = “Yes” or 0 = “No”/“Do not know”.

4 Results

4.1 Descriptive statistics

Table 3 presents the format, mean value, and standard deviation for the variables used in the estimated logit function model for discrete choice in section 4.7. The same variables are used to describe how the control and treatment groups differ by variable (See Table A5 in the Supplementary material). The first variables are the respondent's treatment groups (with the control group as a reference). Then there are variables describing respondent characteristics. The last group consists of the TPB variables. These variables represent the individual's attitude, subjective norm (perception of peer attitudes), and perceived behavior control (PBC) with a focus on capacity and autonomy respectively.

Table 3. Descriptive statistics

Variable name	Description	Mean (Std.Dev.)
Control	Dummy = 1 if the respondent belongs to the CG	0.25
Information	Information on the effect of taxes. Dummy = 1 if the respondent belongs to T1	0.25
Compensation	Information on possible compensation. Dummy = 1 if the respondent belongs to T2	0.25
Double information	Both information pieces. Dummy = 1 if the respondent belongs to T3	0.25
Female	Dummy = 1 if the respondent answered female	0.50
Age	Age of respondent	49.80 (17.42)
Rural	Dummy = 1 if the respondent lives in a rural area	0.30
Large city	Dummy = 1 if the respondent lives in the inner parts of 3 largest cities	0.23
Student	Dummy = 1 if the respondent is a student	0.08
Pensioner	Dummy = 1 if the respondent is a pensioner	0.25
Secondary school	Dummy = 1 if the respondent's highest level of completed education is secondary school	0.45
University degree	Dummy = 1 if the respondent's highest level of completed education is a university degree	0.30
Low gross income	Dummy = 1 if the respondent has a monthly income below 25 thousand SEK	0.33
High gross income	Dummy = 1 if the respondent has a monthly income above 45 thousand SEK	0.15
Driving license for car	Dummy = 1 if the respondent has a driver's license	0.88

Access to car	Dummy = 1 if the respondents as access to car	0.88
Renewable energy	Dummy = 1 if the respondent drives an electric or hybrid car	0.17
Car independency work	A 1–7-point Likert scale on car dependence going to and from school/work. From completely car-dependent to not car-dependent at all	4.12 (2.54)
Car independency day-to-day	A 1–7-point Likert scale on car dependence to carry out everyday errands (shopping, visiting healthcare, etc.) From completely car-dependent to not car-dependent at all	3.09 (2.24)
Car independency leisure	A 1–7-point Likert scale on car dependence for Carry out leisure activities (visiting friends/family, participating in activities, etc.). From completely car-dependent to not car-dependent at all	2.72 (1.88)
Public transport	Access to public transport. Dummy = 1 if the respondent has good access to public transport	0.45
Effect	Dummy = 1 if the respondent believes the fuel consumption will decrease by an increase in the fuel tax	0.35
Attitude	Mean value of the responses to questions on subjective attitude on a 7-point Likers scale from bad to good, unsatisfying to satisfying, and unwise to wise	3.01 (1.94)
Subjective norm	Mean value of the responses to questions on subjective norm, on a 7-point Likers scale on the importance of others on their decision (important others, like me)	2.86 (1.76)
PBC capacity	Perceived Behavior Control. Capacity question. A 1–7-point Likert scale	2.90 (2.05)
PBC autonomy	Perceived Behavior Control. Autonomy question. A 1–7-point Likert scale	4.28 (2.29)
Climate consequences	Mean value of the responses to questions on statements of positive effects of a fuel tax increase. A 1–7-point Likert scale	3.89 (1.51)
Consumption consequences	Mean value of the responses to questions on statements of negative effects of a fuel tax increase. A 1–7-point Likert scale	4.73 (1.54)
Observations	Total number of observations in the analysis	4043

4.2 The support in the respective treatment groups

Before being asked to answer the main question on support, the respondents were presented with their respective general and treatment texts (as described in Table 2). The results of the main question are presented in Table 4 and show that in total 26.6 percent of respondents supported the proposal for tax increases (i.e., answering “Yes” to the main question if they would support a fuel tax increase that would increase the price of fuel by an additional SEK 3/liter in addition to the (uncertain) price increase expected to occur by 2030).

As can be seen in Table 4, the shares of respondents who stated they would, or would not, support a fuel tax increase were similar between the treatment groups. We tested for homogeneity with a Chi-square test and could not reject the null hypothesis of equal distribution (see Supplementary material) ($\chi^2(6) = 3.42$; $p = 0.76$). The treatments, therefore, do not appear to have had any effect on the willingness to support the fuel tax increase.

Table 4 Responses in the control and treatment groups to the main question of support for the tax increase.

	Total	CG	T1	T2	T3
Yes (%)	26.6	27.6	28.2	25.5	26.2
No (%)	62.5	62.1	61.9	63.9	62.9
Don't know (%)	11.0	10.3	11.0	10.9	11.3
N	4043	1013	1005	1011	1014

4.3 Description of the Theory of planned behavior results

In Table 5, the mean values and the standard deviations of the items and indexes in the TPB are presented separately depending on the respondents' answers to the main question regarding support. High values in the attitude variable mean that the respondents think that supporting a fuel tax increasing the price of gasoline and diesel by SEK 3/liter is good, satisfying, or wise. High values in the variable subjective norm mean that the respondents think that people who are important to them approve of the support and that people like themselves would support the tax increase, i.e., the respondents hold a positive norm to support it. A high value in the variable PBC capacity means that the respondents are sure that they could support the increased tax/fuel price, whereas a high value in the PBC autonomy variable means that they think whether they support it or not is completely up to them. The responses to these questions suggest that respondents have responded to the question of support for the taxes in line with their attitudes, subjective norm, and perceived behavioral control.

Table 5 Mean values and standard deviations of the items in the TPB separated depending on respondents' answer to the main question regarding support.

TPB items	Yes	No	Do not know
Attitude	5.32 (1.41)	1.91 (1.17)	3.71 (1.17)
Subjective norm	4.74 (1.43)	1.95 (1.21)	3.45 (1.20)
PBC capacity	5.36 (1.53)	1.75 (1.21)	3.49 (1.31)
PBC autonomy	5.53 (1.57)	3.73 (2.43)	4.38 (1.66)

Note. An analysis of variance for each of the TPB items, with Bonferroni post hoc analyses, shows that the differences between each category in the main question are all statistically significant at .001 percent.

Not surprisingly, the respondents willing to support the increased fuel tax (intention) also have a positive attitude towards the tax, a highly positive subjective norm to engage in the supporting behavior, and a strong belief that they could perform the behavior. The respondents not willing to support the increased tax were more negative regarding all items in the TPB, whereas the unsure respondents, who answered “Do not know” to the main question on support, were somewhere in the middle of the other groups of respondents. The item that differs most from the other TPB items is the autonomy part of the perceived behavior control. For each group of respondents, this item seems to have the highest mean value. The difference to the other items is largest in the group who answered that they are not willing to support the increased tax. In other words, independently of the willingness to support the increased tax, the respondents felt that the decision was up to them. Another thing that can be mentioned is that subjective norm seems to have less importance than the other TPB aspects for the respondents in the “Yes”-group, i.e., their attitude seems more important than others' behavior or opinions and own perceived behavior control.

4.4 Description of the Theory of Acceptance Transition results

The distribution of the answers to the TAcT question is presented in Table 6.

Table 6 The distribution of responses to the question of stages

Stages of acceptance transition (TAcT)	Frequency	Percent
There is no climate effect. Do not support. (deny)	836	20.68
There is a climate effect, but tax has no effect. Do not support. (distrust)	1,991	49.25
Climate effect and tax effect but no support. (unsupport)	578	14.30
Climate and tax effect. Support. (support)	638	15.78
Total	4,043	100.00

Note that most of the respondents (79 percent) agree that there is a climate effect from the transport sector, but 49 percent do not trust the increased tax to reduce emissions and climate problems. Far fewer (30 percent) accept that the tax has an effect. Of these about half (53 percent) support the tax. A Chi-square test was performed to see if there was any relationship between treatment and stage of acceptance in the TAcT. The test gave a non-significant result, that is, no relationship could be proved.

In Table 7, we present the means for each TPB item separated by the different stages in the TAcT. A more positive attitude to support an increase in tax/fuel price is correlated with a higher stage

in the TAcT. Also, subjective norm, i.e., others' opinion towards the behavior and others' behavior, has a significant relationship with the stage in the TAcT. So is also the case with perceived behavior control, and capacity, i.e., a stronger perception of capacity to support an increased tax/fuel price is correlated with a higher stage in the TAcT. The only TPB item that does not show this stepwise increase is perceived behavior control regarding whether it is up to the respondent to support the increase in tax/fuel price or not, where no statistically significant difference was found between Distrust and Support. Even if there were statistically significant differences between the other stages in the TAcT for this item, already at the first stage, Deny, the mean was quite high.

Table 7 Mean values and standard deviations of the items in the TPB separated depending on respondents' stage in the TAcT.

TPB items	Stage in the TAcT			
	Deny	Distrust	Unsupport	Support
Attitude	1.94 (1.51)	2.51 (1.52)	3.38 (1.57)	5.63 (1.44)
Subjective norm	2.01 (1.52)	2.47 (1.47)	3.22 (1.56)	4.87 (1.45)
PBC capacity	1.95 (1.63)	2.35 (1.63)	3.14 (1.77)	5.64 (1.53)
PBC autonomy	3.54 (2.47)	4.12 (2.26)	4.24 (1.98)	5.81 (1.64)

Note. An analysis of variance for each of the TPB items, with Bonferroni post hoc analyses, shows that the differences between each TAcT stage are all statistically significant at .001 percent, except for the difference between Distrust and Unsupport in the PBC autonomy which was not statistically significant at all.

4.5 Description of context effect and consistency results

In the third part of the questionnaire, we asked our respondents for their assessment of seven potential consequences of an increased tax/fuel price. The consequences and their means and standard deviations are given in Table 8.

Table 8 Seven potential consequences of an increased tax/fuel price

Consequence	Mean (std.dev)
Reduced carbon emissions	3.95 (1.88)
Swedish industry is greened	4.18 (1.80)
Increased fuel taxes in other countries	3.65 (1.76)
Higher living standard in Sweden in the future	3.53 (1.89)
Better climate in the future	4.12 (1.90)
Reduced Swedish consumption	4.86 (1.82)
Sweden loses competitiveness	4.60 (1.75)

The response alternatives were given as a seven-point Likert scale from totally disagree to totally agree with indifference as the middle and a do not know alternative. In the analysis, the “do not know” alternative is imputed as the middle alternative, number four, indifference. An exploratory factor analysis with principal factor extraction and Varimax orthogonal rotation showed that a two-factor structure was the most appropriate. The first factor included the first five items in Table 8 and the second factor included the two last items. Two indexes were therefore created, with Cronbach’s alpha of 0.89 respective 0,69. We call the first factor *climate consequences* and the second *consumption consequences*. A high value on the first factor means that an increased tax/fuel price is supposed to have a positive effect on the climate, whereas a high value on the second factor means that an increased tax/fuel price is supposed to have a negative effect on the consumption possibilities. The average responses of the two factors by the response to the main question are given in Table 9.

Table 9 The average responses to context by the response to the main question.

Factors	Yes	No	Do not know
Climate consequences	5.27 (1.05)	3.23 (1.30)	4.25 (1.06)
Consumption consequences	4.29 (1.38)	4.97 (1.62)	4.44 (1.05)

Note. An analysis of variance for each of the two consequence factors, with Bonferroni post hoc analyses, shows that the differences between each category in the main question are all statistically significant at .001 percent, except for the difference between the “Yes” and the “Do not know” groups regarding Consumption consequences, which was not statistically significant at all.

We then asked three questions about the perception of the effects of increased taxes on fuel consumption and the preferences for redistribution. The first question was introduced to allow for analysis of consistency in the response to the main question on support and the TAcT

question which is further pursued in the next section. The following two questions were asked to get background information on the preferences for general redistribution and compensation contingent on increased fuel taxes.

Table 10 shows that most respondents do not believe that taxes reduce fuel consumption. This result is compared to the TAcT response in the following section. The results for the two further questions show solid support for general income equalization as well as for compensation to rural inhabitants conditional on the tax increase.

Table 10 Aggregate responses, percentage

Effect of tax increase on fuel consumption	Sample %
Increase	6
No effect	56.6
Decrease	37.4
Desirability of further income equalization	
Yes	65.6
No	20.6
Do not know	13.8
Should tax increase be accompanied by compensation for rural inhabitants?	
Yes	68.7
No	17.2
Do not know	14.1

Table 11 clarifies the relationship between the wish for equalization and the conditional wish for compensation if taxes increase. The Phi-coefficient was $\phi = .23$, showing a modest correlation between the variables, however statistically significant ($p < .001$).

Table 11 The result of equalization and compensation questions frequencies and relative shares

	State that compensation for rural inhabitants is desirable if taxes increase	State that compensation for rural inhabitants is not desirable if taxes increase	Total
State that general equalization is desirable	2033 (50%)	621 (15%)	2654
State that general equalization is not desirable	746 (18%)	643 (16%)	1389
Total	2779	1264	4043

Note that most respondents who wish for equalization also find compensation desirable if taxes increase. Among those who think general equalization is **not** desirable, still 54 percent think compensation would be desirable.

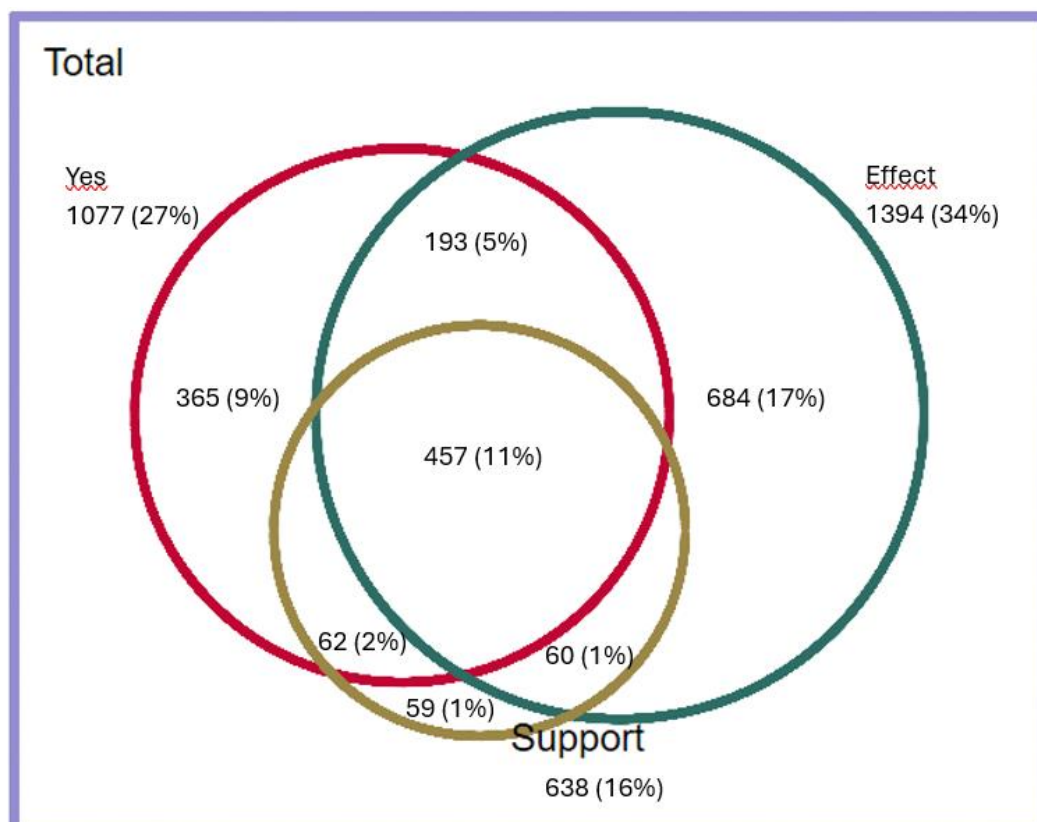
4.6 Analysis of consistency between questions

In Figure 1, we compare the responses to the main question on support for increased taxation, the TAcT question on support, and the separate question on the effects of taxes on fuel consumption.

The introduction of the questions motivated by the Theory of acceptance transition (TAcT) makes it possible for the individual to answer in contradiction to the answer to the main question. In Figure 1, we present a Venn diagram of the 'overlap of support' between the main question (Yes), red circle, and TAcT-question (Support) mustard circle. Of the 27 percent of the total sample that gave an affirmative answer to the main question, only 13 percentage points remained in support in the TAcT-question (stage 4). This indicates that respondents perceived this question differently and as 14 percentage points withdrew their support in the TAcT-question. A further 2 percentage points gave their support in the TAcT-question while not giving it in the main question.

Consider now the effect-question (Effect) green circle, which asks the respondents about their perception of the effect of fuel taxes on fuel consumption, we see that many of those who perceive taxes to have an effect on consumption (16 percentage points out of 34 percent) also support the taxes in the main question.

Figure 1 A Venn diagram of support and belief in the reducing effects of taxes on fuel consumption



We also asked questions to check the attention and consistency of the respondents. The first question was about the respondent's perception of the effectiveness of fuel taxes in reducing fuel consumption. Among those who believed that taxes would have no effect, the support for taxation was very low (0.1 percent). Among those 1216 respondents that believe taxes have effects, i.e., chose response alternative 3 or 4 in the TAcT-question, 10 percent answered that they do not believe taxes have effects on fuel consumption in the consistency question.

We also compared support for the main question to the consistency question in the previous section. Among those who believe that taxes reduce fuel consumption, 47 percent support the tax increase. Among those that do not believe tax increases to reduce fuel consumption only 16 percent support the tax increase. A Phi-coefficient was calculated to measure the correlation between these two variables and shows a value of $\phi = .33$, which implies a statistically significant relationship ($p < .001$).

The second consistency question was if the individual supported further income equalization in Sweden. A majority (66 percent) responded yes to this question. If individuals believe that tax revenues would be used to compensate vulnerable households, they would perhaps be positive to taxation. The wish for redistribution is however not strongly correlated with support for taxation, as only a slightly larger share (32 percent) of this group was positive to fuel taxation.

In the third consistency question, we asked if the respondents would support compensating residents in rural areas given that the tax would be implemented. This question also received strong support (69 percent). Nevertheless, this group was only slightly more supportive of taxes (28 percent) than the whole sample.

4.7 Results of estimation of logit models for the choice to support taxes

To assess the relative influence on support of the information treatments and all different characteristics of respondents and their stated opinions on taxation and redistribution together, we estimated a logit model for support of the taxation policy (Table 12).

The regression analyses confirm the findings presented above of no treatment effects on the support of the policy. This is robust between different regression models, i.e., we find the same results when controlling for different individual characteristics, attitudes, and behavior. The variables indicated to be most important for influencing support in Model 2 appear to be the perception of the effectiveness of taxes to reduce fuel consumption, share of ownership of environmentally friendly cars, and access to public transport. In Model 3 the TPB variables are introduced together with the two consequence factor variables (climate and consumption). Then all the above variables cease to be statistically significant. Instead, the individual's attitude and perceived behavior control, especially the capacity aspect, and both the consequence factor variables gain statistical significance. This indicates that a positive attitude towards supporting an increased tax/fuel price and a belief in one's capacity and autonomy to do so, increase an individual's willingness to support the increased tax/fuel price. Also, the perception that an increased tax/fuel price will have a positive effect on the climate and a positive effect on Swedish consumption possibilities increases an individual's willingness to support the increased tax/fuel price.

Concerning the consistency variables, we find that individuals who are men, are younger, have higher incomes, reside in large cities, drive environmentally friendly cars, and are more independent of car use in day-to-day use and for leisure are more likely to support a tax increase.

Surprisingly, holding a driver's license increases the likelihood of the individual supporting a tax increase. We cannot come up with an explanation for this result.

Table 12. Logistic regression on the effect of information treatments (1), respondents' characteristics (2), and variables of attitude, norms, and behavior control (3) on support.

VARIABLES	Model 1		Model 2		Model 3	
	Corr	Std.err	Corr	Std.err	Corr	Std.err
Information	0.016	(0.099)	-0.006	(0.112)	0.207	(0.167)
Compensation	-0.124	(0.101)	-0.174	(0.113)	0.009	(0.168)
Double information	-0.0972	(0.100)	-0.001	(0.113)	0.0683	(0.168)
Female			-0.464***	(0.083)	-0.838***	(0.123)
Age			-0.018***	(0.004)	-0.017***	(0.005)
Rural			-0.165	(1.109)	-0.261	(0.165)
Large city			0.252**	(0.099)	0.290**	(0.143)
Student			0.230	(0.153)	0.297	(0.205)
Pensioner			0.228	(0.144)	0.089	(0.226)
Secondary school			-0.024	(0.145)	-0.141	(0.211)
University degree			0.241	(0.148)	-0.101	(0.217)
Low income			-0.039	(0.098)	-0.040	(0.142)
High income			0.319***	(0.114)	0.556***	(0.176)
Drivers license			0.449***	(0.136)	0.739***	(0.193)
Renewable energy			0.534***	(0.100)	-0.255*	(0.154)
Car independency work			-0.003	(0.023)	-0.082*	(0.036)
Car independency day-to-day			0.085***	(0.031)	0.044	(0.048)
Car independency leisure			0.154***	(0.030)	0.066	(0.046)
Public transport			0.268***	(0.093)	-0.000	(0.133)
Effect			1.407***	(0.082)	-0.037	(0.131)
Attitude					0.793***	(0.064)
Subjective norm					-0.057	(0.067)
PBC capacity					0.565***	(0.057)
PBC autonomy					0.068*	(0.040)
Climate consequences					0.337***	(0.074)
Consumption consequences					-0.205***	(0.057)
Constant	-0.962***	(0.070)	-2.176***	(0.279)	-6.246***	(0.535)
Observations	4 043		4 043		4 043	

5 Discussion

This work was inspired by the study by Dechezleprêtre et al. (2023), suggesting that well-formulated information could positively influence support for carbon taxes given that it influenced beliefs that taxes were effective and that they could be combined with a redistribution of revenues such that the most urgent distributional effects of the taxes could be relieved. This points to the theme of how authorities (and other policy-influencing

organizations), with high ambitions for credibility from all citizens, in countries with a high degree of polarization, could communicate on climate policy without losing credibility.

The aim with the present study was to investigate whether information on the effects of increased fuel taxes on fuel consumption and the possibility of compensating rural inhabitants (who use their cars more) influence the acceptance of such increases in Sweden, and the psychological nature of the preferences. Our first result is that our treatments were shown not to influence the respondents' support of the increased carbon tax. With our questionnaire design, we did not find effects of information like those of Dechezleprêtre et al (2023) and Lindvall et al. (2024).

The second result is that many respondents may be quite skeptical of the message in the treatment on price effects. As in our study, previous studies have shown that many respondents do not believe higher fuel prices will lead to lower fuel consumption (Ewald et al., 2022; Douenne and Fabre, 2022; and Kallbekken et al., 2011). In addition, at the time this survey was conducted, in March 2024, the respondents had recently experienced a drastic hike of fuel prices in Sweden due to a simultaneous increase in world market prices and an increase in the price of biofuels mandated to be mixed into gasoline and diesel. This mandate was abolished in January 2024 leading to drastic price decreases. Experiencing these price fluctuations may have influenced the respondents' perception of adaptation to the high fuel prices.

Nevertheless, the results from our survey give some potentially useful insights for policymakers. To the extent that reaching climate targets is of high importance, support for efficient policies requires a good understanding of some fundamental economics insights, it may be crucial for policymakers to communicate these. In other words, to inform citizens that higher prices influence demand and that pricing of externalities, when feasible, is a cost-efficient way to reduce emissions. It may also be important to design compensatory schemes and to inform the public about this.

If we think of the readiness to accept increased fuel taxes as progressive stages where the first stage is denial that CO₂ emissions from Swedish road transport is a climate problem, the second stage is acceptance that CO₂ emissions from Swedish road transport is a climate problem, but that fuel taxes will not reduce emissions, the third stage is that it is possible to reduce CO₂ emissions by taxes, but that the respondent does not support increased fuel taxes and the fourth stage is that Swedish emissions from road transport is a problem, that taxes do reduce emissions and that the respondent supports fuel taxes. This does not exclude the possibility that a respondent supported taxes for other reasons than that they have the potential to reduce CO₂-emissions. We found that support was higher among those respondents stating that prices would affect fuel consumption (47 percent of the respondents who believed that taxes would reduce fuel consumption supported the tax in the main question compared to 27 percent in the whole population and 37 percent of those that supported the tax in the TAcT-question). We consider this understanding as a factor supporting the propensity to accept CO₂-pricing. We assess that respondents who believe that taxes reduce emissions are closer to acceptance than those who do not.

The psychological aspects in this study, i.e., responses to the TAcT and the TPB give the following indications: If the respondents in the group that believe taxes to have effect but still do not

support it could be convinced that the adverse effects of taxes could be alleviated then support could almost double. In the large group that do not believe that taxes would have effects, convincing them that taxes do have effect could make, at least some of them, change their minds to support. Before designing such measurement, policies and the corresponding information it could be useful to further investigate the individual perceived objections to the taxes and individuals' attitudes, subjective norms, and perceived capacity to support the tax, which in this study were shown to have an impact on willingness to support. Of special interest is to investigate the factors that hinder individuals to support increased fuel taxes although they think that the taxes have an effect. Earlier studies referenced in this paper indicate that personal costs and equity for low-income earners and inhabitants in rural areas are important reasons for non-support. Speculating, further obstacles could be for example negative attitude towards taxes in general or significant others who are strongly against the support.

An understanding of these basic facts may increase the likelihood of approval of CO₂-pricing but not necessarily be sufficient for all. This is also confirmed in the recent papers by Dechezleprêtre et al. (2023) and Lindvall et al. (2024). These studies indicate that providing arguments on compensation may increase support for taxation. In a separate section of the survey, the examination of subjective norms and perceived control shows that respondents appear to feel free in the choice to support their preferred policy.

As we showed in the results section, a large part of our respondents does not answer questions of approval to CO₂-taxes consistently. We have not found similar contradictory answers reported in earlier studies. This can be due to either a pure mistake, carelessness, or negligence or that the respondents are truly ambivalent in their response. If we interpret only those who answer consistently, the overall approval rate reduces from 27 percent to 11 percent. If, on the other hand, we interpret ambiguity as a first step towards recognition that pricing of CO₂ emissions may be necessary, we can count also the ambiguous respondents that state support in either the main question or the second question on the stage of acceptance (TAcT) as potential supporters. The number of potential supporters then increases to 29 percent. If we count all respondents who believe that prices affect emissions, then the number of potential supporters increases to 46 percent.

Examining how the socioeconomic characteristics of the individuals and their opinions correlate to support, we found significant effects from good access to public transport on support and a negative effect of the respondents' self-assessed dependence on fuel-powered cars for leisure in one model. These results ceased to be statistically significant on another version introducing the attitude variables.

A first general qualification relates to all presentations of contingent responses, correlations, and model estimates. While these methods allow us to produce indications of causes, none of them allows for conclusions on causality. As discussed above, there may be several different causes for observed results, sometimes even in opposite directions. A second qualification relates to the duration or persistence of changes in support induced by information. This study did not aim to analyze the long-term persistence of changes in support⁴.

⁴ For studies of the persistence of changes in opinions see Haaland et al. (2023).

The outcome of this survey also calls for further reflection on the method. One reason for the missing effect of the treatments may be that the respondents skipped or were inattentive to this reading. The respondents in the web panel might have practiced answering questions quickly to receive their reward. It therefore appears possible that some respondents may have skipped reading the introductory texts, hence skipped the treatments. Another reason mentioned by earlier studies (e.g. Douenne and Fabre, 2022) is that strong opinions on taxes may lead to motivated reasoning, implying that respondents may become less open to new evidence that does not confirm previously held beliefs. If belief in the effectiveness of carbon taxes is associated with commitment to environmental protection, the opposite may be true for skepticism. A lack of commitment to environmental protection may be associated with a lack of belief in the assessment of the appropriateness of carbon taxes. Douenne and Fabre (2022) also find small effects of information treatments.

This paper focuses on a national perspective and what policies are relevant on a national level given national goals. This may have important implications regarding what kinds (and levels) of effort are justified. If national efforts have important effects on other nations, larger efforts may be justified⁵. Our interpretation of this international perspective is not that it fundamentally changes the relative importance of national taxes as instruments for reduced emissions but that it may influence the appropriate level of ambition chosen by a country. Therefore, to the extent that citizens perceive that their country's levels of ambition are set on inappropriate levels from an international perspective, this may spill over on the way they think of the correctness of carbon taxes domestically.

6 Conclusion

This study examines whether there is a potential to increase the support for carbon taxes on fuels from Swedish citizens by giving simple information about i) the effects of carbon taxation on fuel use and carbon emissions, and ii) information on the possibility of redistributing tax revenues in a compensatory fashion. We also further examine and control for factors influencing the motivations for support and non-support.

We find no statistically significant effects from treatments informing the respondents on the effects of carbon taxation, or of information on the possibility of redistributing tax revenues in the simple form given in our survey.

In the main question, 27 percent of respondents stated that they would support a tax increase for gasoline and diesel. In the second, more elaborate question, 16 percent of respondents stated that they believe that CO₂ emissions from road transport are a problem, that the proposed tax increase will reduce emissions, and that they would support this tax increase. Disregarding any other reasons behind supporting an increased tax, this indicates some degree of uncertainty on behalf of the respondents; only 13 percent give support in both questions. If all respondents who expressed support in either of the questions were included this number counts to 29 percent. This may indicate insufficient short-term memory or genuine ambiguity or other reasons for supporting taxes on fuels. The responses according to the Theory of Acceptance Transition indicates further closeness to acceptance as some of those who believe

⁵ For a discussion of this issue see for example Tirole (2017).

that taxes have effect may be persuaded by information on potential compensation and some of those that do not believe taxes have effects may be persuaded by information on effects of taxes.

As in earlier studies, a quite large share of respondents (49 percent or 57 percent in two different questions), state that they do not believe that the fuel taxes will be effective in reducing CO₂ emissions. Belief in the effectiveness of the fuel taxes (as measured by 57 percent) is positively correlated with support; 47 percent of those believing in effectiveness also support it. A parallel observation in Douenne and Fabre (2022), and their analysis, led them to conclude that if belief in effectiveness could be influenced then support could also be increased. The study of Dechezleprêtre et al. (2023) indicates that well-formulated information could influence such beliefs. Unfortunately, neither our nor their study give much guidance on the issue of how such information should be given. Further testing of how communication should be done appears to be needed.

In upcoming studies, we would like to test more elaborate forms of information and ask more directly about the respondent's perception of consequences for personal budgets, and underlying motivations for support or lack of support.

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Supplementary materials

A1 Questionnaire

Research study on attitudes toward higher fuel taxes

We would like to ask you to participate in a research study on higher fuel taxes. Below, information about the study and what it means to participate is presented.

What kind of study is this and why do you want me to participate?

The purpose of this study is to examine Swedish voters' attitudes toward higher fuel taxes and what influences these attitudes. The results of the study are intended to be used as a basis for decision-makers when designing Swedish climate policy.

You have been asked to participate in the study because you are over 18 years old and part of the Origo Group's web panel.

The principal for the project is the Swedish National Road and Transport Institute (VTI), conducting the study with funding from the Swedish Transport Administration. By research principal, we mean the organization responsible for the study.

How is the study conducted?

Your participation involves answering a short (about 10 minutes) online survey regarding you and your attitude towards increased fuel tax. You can access the survey through the link below. Your participation is, of course, voluntary, and you can withdraw at any time without providing a reason. Your responses will be treated confidentially, and no unauthorized person will have access to them. No personal data will be collected, and no one will know how you specifically responded.

How do I get information about the study results?

The study is expected to be completed by the end of 2024, and a report on the study will be available to download for free at www.vti.se.

Responsible for the study

If you have any questions regarding the study, please contact the project manager Roger Pyddoke, VTI, Box 55685, 102 15 Stockholm. No. 08-55 57 70 20. E-post: roger.pyddoke@vti.se

[LINK TO THE SURVEY](#)

Research study on attitudes toward higher fuel taxes

Background:

To achieve Sweden's emission commitments to the EU, fuel taxes may need to be raised. In this study, we investigate attitudes toward a tax increase that would increase the price of fuel by an additional 3 crowns (SEK) per liter, in addition to the price increase (due to, for example, increased oil prices) that is expected to occur by 2030.

Group 1 receives none of the text below, Group 2 receives only the information text on effectiveness, Group 3 only receives the information text on compensation, and Group 4 receives both information text below.

Information text on effectiveness – given to Groups 2 and 4:

The idea of taxing fossil fuels such as gasoline and diesel is to make it more costly to emit greenhouse gases, which has been shown to lead to changes in behavior and technology so that emissions decrease. The individual chooses alternatives that emit less, for example, energy-efficient products, or change their travel behavior using other alternatives than fossil-driven cars, e.g., public transport or electric vehicles. The companies, on the other hand, drive technological development and offer more energy-efficient alternatives and solutions leading to lower emissions and lower costs. Research shows that increased fuel prices affect reduced car use and emissions even if the effect in the short term is quite small. However, we know that in the long term there will be a greater effect, even if we do not know exactly how large that effect will be.

Information text on compensation– given to Groups 3 and 4:

Part of the tax revenues obtained through increased tax on fossil fuels can be used to compensate the car owners who are most affected by the tax. In relation to income, fuel costs are expected to increase more for car owners who have lower income than the average income and live in rural areas. One way to facilitate for car owners of this group is to use part of the tax revenues to compensate for the average additional cost this group has compared to the corresponding income group living in small rural towns. Given a tax increase that would increase the price of fuel by an additional 3 SEK (in addition to the price increase expected to occur by 2030), such compensation could, for example, result in payments of 1 400 SEK a year for car-owning low-income earners in rural areas.

To start, we would like you to answer the following question:

1. *Would you support a tax increase that would increase the price of fuel by an additional 3 SEK/liter in addition to the (uncertain) price increase expected to occur by 2030?*

- ☐ Yes
- ☐ No
- ☐ Do not know

Please note that even in the following questions, where we ask about an increase in fuel prices from an increased fuel tax, it is in addition to the price increase expected to occur by 2030.

2. Which of the following options best describes you?

- ☐ I do not consider the Swedish carbon emission from road transport as a climate problem.
- ☐ I consider the Swedish carbon emission from road transport as a climate problem but I do not believe that an increased fuel tax, which results in a fuel price increase of 3 SEK per liter, will lead to a reduction in emissions.
- ☐ I consider the Swedish carbon emission from road transport as a climate problem, and I believe that an increased fuel tax, which results in a fuel price increase of 3 SEK per liter, will lead to a reduction in emissions. However, I would not support this increase in fuel tax.
- ☐ I consider the Swedish carbon emission from road transport as a climate problem, and I believe that an increased fuel tax, which results in a fuel price increase of 3 SEK per liter, will lead to a reduction in emissions and would support this increase in fuel tax.

Please rate your attitude towards the following statements about increased fuel taxes.

3. That I would support a fuel tax increasing the price of gasoline and diesel by 3 SEK per liter would be:

- | | | | | | | | | |
|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------------|
| a) Bad | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Good |
| b) Unsatisfying | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Satisfying |
| c) Unwise | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Wise |

4. Most people who are important to me would think that it is good that I support a fuel tax increasing the price of gasoline and diesel by 3 SEK per liter

Totally reject ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totally agree

5. Most people who are like me would support an increased fuel tax increasing the price of gasoline and diesel by 3 SEK per liter

Totally reject ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totally agree

6. I am sure that I could support a fuel tax increasing the price of gasoline and diesel by 3 SEK per liter.

Totally reject ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totally agree

7. That I would support a fuel tax increasing the price of gasoline and diesel by 3 SEK per liter is completely up to me.

Totally reject ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totally agree

8. *I think that a fuel tax increasing the price of gasoline and diesel by 3 SEK per liter would lead to:*

	Totally reject							Totally agree	Do not know
a) Reduced consumption opportunities for residents in Sweden.	☐	☐	☐	☐	☐	☐	☐	☐	☐
b) Other countries also raise their fuel tax.	☐	☐	☐	☐	☐	☐	☐	☐	☐
c) Less carbon dioxide emissions.	☐	☐	☐	☐	☐	☐	☐	☐	☐
d) Sweden is losing international competitiveness.	☐	☐	☐	☐	☐	☐	☐	☐	☐
e) A positive effect on the climate in the long run.	☐	☐	☐	☐	☐	☐	☐	☐	☐
f) Sweden's industry is adapting to greener production.	☐	☐	☐	☐	☐	☐	☐	☐	☐
g) Higher living standards in Sweden in the long run.	☐	☐	☐	☐	☐	☐	☐	☐	☐

Following are some questions about yourself.

9. *Gender:*

- ☐ Female
☐ Male
☐ Other option
☐ Do not know/Do not wish to answer

10. *What year were you born?*

Please choose the year from the list below. [List](#)

11. *Where do you live?*

- ☐ Big city (major cities Stockholm, Gothenburg and Malmö)
☐ Smaller city, urban area, or suburb to the major cities.

☐ Countryside (including smaller urban areas in the countryside)

12. *What is your highest level of completed education?*

☐ Comprehensive schooling

☐ Secondary school

☐ University degree

☐ Other: _____

13. *What is your main occupation?*

☐ Employed

☐ Student

☐ Sick/ parental leave/ job seeker

☐ Pensioner

☐ Other: _____

14. *What is your monthly gross income level?*

Income refers to salary, pension, student aid, compensation from the insurance fund including child/care allowance, or income from own capital, business or agriculture.

☐ Less than 15 001 kr

☐ 15 001 – 25 000 kr

☐ 25 001 – 35 000 kr

☐ 35 001 – 45 000 kr

☐ 45 001 – 55 000 kr

☐ More than 55 000 kr

15. *Do you have a driving license for a passenger car?*

☐ Yes

☐ No

16. *Do you have access to a passenger car?*

☐ Yes, in my household

☐ Yes, I can borrow or rent when I need one

☐ Yes, by carpool

☐ Yes, I can travel with others

☐ No

If answering yes on the previous question (otherwise skip to question 19):

17. What kind of fuel is used when driving the(se) car(s)? It is possible to mark several options if you have access to different kinds of cars.

- ☐ Diesel
- ☐ Gasoline
- ☐ Electric
- ☐ Other, for example hybrid car
- ☐ Do not know

18. How car-dependent are you to be able to:

		Completely car- dependent						Not car- dependent at all
a)	Go to and from school/work.	☐	☐	☐	☐	☐	☐	☐
b)	Carry out everyday errands (shopping, visiting healthcare, etc.)	☐	☐	☐	☐	☐	☐	☐
c)	Carry out leisure activities (visiting friends/family, participating in	☐	☐	☐	☐	☐	☐	☐

19. Do you have access to public transport?

- ☐ Yes, good access
- ☐ Yes, but it could be better
- ☐ No, no access
- ☐ Do not know

Finally, some closing questions. Here we want to know what you think and believe.

20. How do you think an increase in the fuel tax can be expected to affect fuel consumption in total in Sweden?

- ☐ Increase the fuel consumption
- ☐ No effect
- ☐ Decrease the fuel consumption
- ☐ Do not know

21. Do you think the Swedish government should do more to equalize differences in income levels between individuals in Sweden?

- ☐ Yes
- ☐ No
- ☐ Do not know

22. *Given an increase in the fuel tax and the fact that rural residents generally drive more than urban residents, do you think the Swedish government should compensate rural residents for this?*

☐ Yes

☐ No

☐ Do not know

Other comments:

Thank you for your participation!

A2 Chi-square tests of homogeneity of the responses to the main question from the control group and the treatment groups

Then tables below are the results from tests of the homogeneity. First pairwise between the control group and the treatment groups

Table A1 Pairwise Chi-square test of comparison of control group to treatment group 1 with the null hypothesis that the distributions are equal.

	TG		
Support (Q1)	Control	Treatment 1	Total
Yes	280	281	561
No	629	613	1,242
Do not know	104	111	215
Total	1,013	1,005	2,018
Pearson $\chi^2(2) = 0.4041$			Pr = 0.817

Table A2 Pairwise Chi-square test of comparison of control group to treatment group 2 with the null hypothesis that the distributions are equal.

	TG		
Support (Q1)	Control	Treatment 2	Total
Yes	280	255	535
No	629	646	1,275
Do not know	104	110	214
Total	1,013	1,011	2,024
Pearson $\chi^2(2) = 1.5611$			Pr = 0.458

Table A3 Pairwise Chi-square test of comparison of control group to treatment group 3 with the null hypothesis that the distributions are equal.

	TG		
Support (Q1)	Control	Treatment 3	Total
Yes	280	261	541
No	629	638	1,267
Do not know	104	115	219
Total	1,013	1,014	2,027
	Pearson chi2(2) = 1.2832		Pr = 0.526

Table A3 Chi-square homogeneity test of all groups with the null hypothesis that the distributions are equal.

Group	Ja	Nej	Vet ej	Total
1	280	629	104	1,013
2	281	613	111	1,005
3	255	646	110	1,011
4	261	638	115	1,014
Total	1,077	2,526	440	4,043
		Pearson chi2(6) = 3.4183	Pr = 0.755	

A3 Further descriptive statistics

Table A4. Descriptive statistics of the treatment groups and total sample

	Control group, N = 1013	Treatment group 1, N = 1005	Treatment group 2, N = 1011	Treatment group 3, N = 1014	Total Sample, N = 4043
Gender					
Female	49.56%	50.55%	50.84%	50.00%	50.23
Male	50.05%	49.15%	48.47%	49.80%	49.37
Other	0.4%	0.3%	0.69%	0.2%	0.4
Age					
Mean	49.90	49.41	49.62	50.09	49.76
Education share of stage					
Comprehensive schooling	7.80	8.26	8.61	10.06	8.68

Secondary school	42.65	44.48	46.19	45.66	44.74
University degree	48.27	44.78	43.42	41.42	44.47
Other	1.28	2.49	1.78	2.86	2.10
Occupation					
Employed	54.59	52.74	52.23	51.58	52.78
Student	7.40	8.76	9.30	6.51	7.99
Pensioner	24.09	24.98	24.04	26.73	24.96
Sick/parental leave or job seeker	9.67	9.35	9.20	11.14	9.84
Other	4.24	4.18	5.24	4.04	4.43
Income level gross per month					
Less than 15 001 SEK	11.15	10.25	11.47	13.51	11.6
15 001 – 25 000 SEK	19.84	22.29	21.07	22.98	21.54
25 001 – 35 000 kr	24.19	26.97	26.01	24.65	25.45
35 001 – 45 000 kr	20.43	18.01	17.21	16.77	18.11
45 001 – 55 000 kr	9.67	8.26	8.70	9.07	8.93
Mer än 55 000 kr	6.22	6.57	7.12	5.13	6.26
N/a	8.49	7.66	8.41	7.89	8.11
Area type of residence					
Inner parts of 3 largest cities	25.07	24.08	23.44	21.20	23.5
Suburbs, smaller cities, and other urban areas	44.72	46.27	47.58	49.61	47
Rural	30.21	29.65	28.98	29.19	29.5
Driving license					
Yes	89.34	87.86	88.23	87.48	88.23
No	10.66	12.14	11.77	12.52	11.77
Access to car					
Owned by household	83.02	80.50	82.00	80.57	81.52
Borrow or hire	5.43	4.78	4.85	4.93	5.00
Carpool	0.59	1.19	0.89	0.79	0.87
Travel with others	3.16	4.88	4.45	5.23	4.43
No	7.80	8.66	7.81	8.48	8.19
Energy type					
Petrol	55.08	50.85	53.02	53.85	53.20
Diesel	19.45	20.40	19.68	22.19	20.43
Electric	7.31	8.26	8.51	6.41	7.62
Other, e.g, hybrid	9.58	11.04	10.29	8.09	9.75
Do not know	0.79	0.80	0.69	0.99	0.82
Access to public transport					
Good	45.01	43.88	48.37	44.38	45.41
Acceptable	43.14	44.58	40.85	44.18	43.19
No	11.25	10.05	9.69	10.45	10.36
Do not know	0.59	1.49	1.09	0.99	1.04

Table A5 Crosstabulations of respondent characteristics to support the taxation policy.

	Support % of total within the group	Total in the group
Statement of consent		
Yes	26.6	
No	62.5	
Do not know	11	
Treatment		
Control	27.6	1 013
Information on effectiveness	28.2	1 005
Information on compensation	25.5	1 011
Double information	26.2	1 014
Gender		
Female	22	2 031
Male	31.7	1 996
Other/Na	50	16
Age group		
18–30	34.2	622
31–45	29.8	1 149
46–65	23.1	1 324
66+	22.8	948
Education		
Comprehensive schooling	21.7	351
Secondary school	22.3	1 809
University degree	32.2	1 798
Other	22.4	85
Occupation		
Employed	28.6	2 134
Student	35	323
Pensioner	22.2	1 009
Sick/parental leave or job seeker	22.9	983
Other	21.2	323
Income level gross per month		
Less than 15 001 SEK	21	469
15 001 – 25 000 SEK	24.9	871
25 001 – 35 000 kr	25.6	1 029
35 001 – 45 000 kr	29.6	732
45 001 – 55 000 kr	42.4	361
More than 55 000 kr	35.7	235
N/a	14.3	328
Area type of residence		

Inner parts of 3 largest cities	39.6	948
Suburbs, smaller cities, other urban areas	26.9	1902
Rural	15.9	1193
Driving license		
Yes	26.3	3 567
No	29.2	476
Access to car		
Owned by household	24.2	3 296
Borrow or hire	47	202
Car pool	71.4	35
Other	27.9	179
No	33.5	331
Energy type		
Gasoline	23.1	2 151
Diesel	22.6	826
Electric	43.8	308
Other	34.3	394
Access to public transport		
Good	36.7	1 836
Acceptable	19.4	1 746
No	13.6	419
Do not know	16.7	42
Effect of tax increase on fuel consumption		
Increase	68.6	223
No effect	0.1	2 426
Decrease	46.6	1 394
Desirability of further income equalization		
Yes	32.1	2 654
No	16.8	833
Do not know	15.3	556
Should tax increase be accompanied by compensation for rural inhabitants		
Yes	27.8	2 779
No	27.9	696
Do not know	19.5	568