Attitudes to carbon taxes across Europe: The role of perceived uncertainty and self-interest*

Resul Umit[†] Lena Schaffer[‡]

February 22, 2020

Abstract

While using carbon taxes to reduce greenhouse gas emissions may well be effective, this has recently proved too unpopular to put into practice in a number of countries. Yet, at a time when governments across the world are preparing their nationally determined contributions to the Paris Agreement, our knowledge of whether and why people oppose these taxes originates from a single or small number of cases. Drawing on the European Social Survey (n = 44,387), this article provides evidence on public attitudes towards increasing taxes on fossil fuels to reduce climate change from 23 countries, most of which have never featured in the literature before. The results point to a widespread aversion to carbon taxes. On the one hand, this worsens with the perceived costs of taxes, such as the case among consumers who depend highly on energy. On the other, it improves with political trust and external political efficacy—factors that help ease the uncertainty around policy proposals. Our estimations suggest that the effect of changes in these factors alone would be large enough to reverse the public resistance to carbon taxes in some countries. These results are robust to a number of alternative specifications and various checks.

*This manuscript has been accepted for publication in *Energy Policy*. It is part of the project 'Beyond Policy Adoption: Implications of Energy Policy on Parties, Publics, and Individuals', funded by the Swiss National Science Foundation (PYAPP1–173642/1).

[†]University of Lucerne (resul.umit@unilu.ch).

[‡]University of Lucerne (lena.schaffer@unilu.ch).

1 Introduction

Carbon taxes offer an effective choice of instrument for climate change policy (Goulder & Parry, 2008; N. Stern & Stiglitz, 2017). By increasing the cost of activities detrimental to the environment, taxes can lead to changes in the behaviour of masses for the better—towards innovative and greener alternatives that reduce pollution (Aldy & Stavins, 2012). When the French government proposed to increase the taxes on fossil fuels in 2019, for example, the plan was to help reduce carbon emissions dramatically and facilitate the transition to electric cars. Moreover, the revenues raised from these taxes offer further opportunities for governments, such as the ability to finance specific environmental purposes (Kallbekken & Aasen, 2010) or to reduce other taxes for a stronger and fairer economy (Ballard & Medema, 1993). Hence there are good reasons why governments may consider using taxes to reduce greenhouse gas emissions while preparing their nationally determined contributions to the Paris Agreement.

Yet taxes are not a popular choice—at least, not as much as their effectiveness would suggest. For example, as of April 2019, carbon taxes are implemented at national level in as few as 24 countries worldwide (World Bank, 2019). Many see the public resistance to taxes as the main reason behind the reluctance of governments to use this policy instrument (Carattini, Carvalho, et al., 2018),[1] pointing to the numerous occasions where tax proposals were rejected in popular votes, such as in Switzerland (Carattini et al., 2017; Thalmann, 2004) or Washington State. The proposal to increase the taxes was abandoned

[1]Negative attitudes are also common among the industry (Clinch & Dunne, 2006; Dresner et al., 2006; Klok et al., 2006), which contributes to the resistance to taxes (Farrell, 2016).

in France as well, amid the violent 'yellow vest' protests against the policy (Douenne & Fabre, 2019).

As a result, governments committed to fighting climate change face a difficult decision between effectiveness and popularity, and—as public opinion shapes policy (Shapiro, 2011)—the benefits of carbon taxes might remain outweighed in the near future. Understanding the resistance to carbon taxes could offer other ways out of this problem, and there is an urgency to know the determinants of individual attitudes to carbon taxes. This urgency has led to many studies on the public attitudes to carbon taxes in the last decade or so,[2] but the existing evidence comes from a limited number of countries and/or from studies that do not seek nationally representative samples—such as interviews, focus groups, and laboratory experiments. In this study, we heed the call to cover more cases (Fairbrother, 2017a, p. 6), and contribute to this influential literature by analysing cross-national individual preferences with data from 23 countries, most of which are yet to feature in the literature.

The main results are three-fold. First, there is a widespread aversion to carbon taxes in Europe. If governments are to introduce new taxes, as things stand they will face public resistance almost everywhere—although the unpopularity of taxes vary between individuals and countries. Second, we find the support for taxes improves significantly with individuals' political trust and efficacy. Third, however, it worsens among people who depend highly on energy. Substantively, their potential effects on the public attitudes to carbon taxes are large enough to be decisive at least in some countries.

[2]For recent reviews of this literature, see Maestre-Andrés et al. (2019) and Carattini, Carvalho, et al. (2018).

The remainder of the article proceeds as follows. The following section reviews the related literature, showing that concerns for the environmental and economic consequences of taxes drive the public resistance. Section 3 then details five hypotheses based on a rational-choice perspective. We briefly introduce the data, main variables, and the methods in Section 4, leaving the fine details to Supporting Information. Section 5 presents the descriptive analysis and multivariate tests of the hypotheses. Finally, the paper concludes with remarks on why the results of these tests might be politically significant.

2 Literature Review

There is a growing interest—scholarly or otherwise—on the public attitudes to carbon taxes, which reflects the importance of social acceptance for this policy instrument to be successfully implemented. However, what we already know points to a challenge for decision makers looking to implement carbon taxes to reduce climate change: against the overwhelming evidence of their superior effectiveness (Aldy & Stavins, 2012; Ballard & Medema, 1993; Baranzini & Carattini, 2017; Baumol & Oates, 1971; Goulder & Parry, 2008; Mankiw, 2009; Metcalf, 2009; Weitzman, 2017), the public support for carbon taxes remain low (Carattini et al., 2017; Dietz et al., 2007; Douenne & Fabre, 2019; Jagers & Hammar, 2009)—lower than the level of support for other policy instruments, such as subsidies (Cherry et al., 2012; De Groot & Schuitema, 2012; Heres et al., 2017; Kallbekken & Aasen, 2010; Steg et al., 2006) or regulations (Clinch & Dunne, 2006; Deroubaix & François, 2006). Studies on the causes of this resistance to carbon taxes suggest that environmental and economic consequences of taxes, as perceived by the people, are to blame.

To begin with, people do not seem to agree with the scientific evidence that taxes can be a solution to environmental problems. In part, this is a question of effectiveness, and many believe that increasing the cost of polluting would be ineffective to address the problems at hand (Baranzini & Carattini, 2017; Carattini et al., 2017; Clinch & Dunne, 2006; Dresner et al., 2006; Gaunt et al., 2007; Kallbekken & Aasen, 2010; Steg et al., 2006). Interviews and focus groups show that participants expect people would 'pay to pollute' even if governments introduce or increase taxes (Clinch & Dunne, 2006; Gaunt et al., 2007; Kallbekken & Aasen, 2010)—in other words, there is a widespread belief that the price elasticity of polluting activities is too low for taxes to change the behaviour of consumers. However, the level of support for carbon taxes increases if people experience—for example, in trials (Carattini, Baranzini, & Lalive, 2018; Cherry et al., 2014; Schuitema et al., 2010; Tiezzi & Xiao, 2016)—or simply believe (Hammar & Jagers, 2006) that these taxes work.

In part, it is a question of trust. Increasing the cost of polluting may well be an effective deterrent, but people are then suspicious that this is why governments are keen to introduce carbon taxes (Clinch & Dunne, 2006; Hammar & Jagers, 2006). Instead, they worry that governments use environmental problems 'as a cover for obtaining new revenues' (Klok et al., 2006, p. 913), which may not be spent for the environment or redistributed back to the people (Clinch & Dunne, 2006; Dresner et al., 2006; Hsu et al., 2008). Putting the two parts together, in short, there is an uncertainty that taxes could or would possibly be used to address environmental problems. This is why, as many studies show, earmarking helps (Baranzini & Carattini, 2017; Beiser-McGrath & Bernauer, 2019; Carattini et al., 2017; Carattini et al., 2019; Deroubaix & François, 2006; Dresner et al., 2006; Gevrek & Uyduranoglu, 2015; Kallbekken & Aasen, 2010; Steg et al., 2006): if governments designate the revenues, the level of support for taxes increases significantly as this practice provides some certainty that taxes can and will be used to address certain environmental problems.

Another group of reasons behind the public resistance relates to the perceived economic consequences of taxes. First and foremost, people are worried that carbon taxes will increase their personal costs (Brännlund & Persson, 2012; Clinch & Dunne, 2006; Douenne & Fabre, 2019; Jagers & Hammar, 2009). Studies repeatedly show that, for example, the opposition to taxes is significantly higher among car owners (Gaunt et al., 2007; Hammar & Jagers, 2006; Hsu et al., 2008; Thalmann, 2004), who are more likely to see their costs increase as a result of carbon taxes. Similarly, there is a negative relationship between tax rates and public support (Baranzini & Carattini, 2017; Cherry et al., 2012; Gevrek & Uyduranoglu, 2015; Kallbekken & Sælen, 2011; Thalmann, 2004) as people prefer taxes that would cost them as little as possible. However, calculating the personal costs of taxes is not always an easy task, and people seem to overestimate the personal costs associated with these (Douenne & Fabre, 2019; Schuitema et al., 2010)—unlike the environmental benefits of these taxes which, as discussed above, are often underestimated.

Then again, the worry about the economic consequences of taxes might go beyond self-interest, and to a certain extent it is also based on the consideration for 'others', such as low-income groups (Carattini et al., 2017; Kallbekken & Sælen, 2011). For example, Carattini et al. (2017) show that the vote against the non-renewable energy tax in the 2015 Swiss referendum can be explained largely by its perceived repercussions on low-income households and businesses. In general, the acceptability of carbon taxes decreases as they lead to regressive distributions (Berry, 2019; Brännlund & Persson, 2012; Gevrek & Uyduranoglu, 2015), posing a higher share of the burden to low-income rather than high-income earners.

3 Theory and Hypotheses

Our reading of the literature suggests that the uncertainty around carbon taxes and the self-interest of taxpayers are among the key determinants of personal attitudes towards carbon taxes. As a result, in the following, we will formulate and test four hypotheses related to the overall categories of uncertainty and self-interest. With the former—uncertainty—we refer to the findings that people are uncertain about whether carbon taxes could solve the problem (e.g., Baranzini & Carattini, 2017), how the revenues from these taxes would be used (e.g., Klok et al., 2006), and how much they would cost to individuals (e.g., Douenne & Fabre, 2019). With self-interest, we refer to the findings that people oppose carbon taxes out of worries for their own purchasing power (e.g., Douenne & Fabre, 2019).

We view the attitudes towards carbon taxes from a rational-choice perspective, where individuals support policy instruments that are likely to minimise their costs and/or maximise their benefits (P. C. Stern et al., 1993). However, these cost and benefit calculations take place amid uncertainty. Against this background, in the following subsections we develop two further sets of hypotheses based on factors that (1) decrease the uncertainty around carbon taxes and that (2) make the cost of taxes clearer for consumers.

3.1 Uncertainty

A first set of theoretical expectations is related to the uncertainty around carbon taxes. As reviewed above, there is mounting evidence that people are uncertain about whether taxes as policy instruments could or would be used to address environmental problems, and this uncertainty hinders the support for carbon taxes. If this is true, factors that decrease this uncertainty should at the same time contribute to the support. In fact, certainty likely improves the acceptance of any policy instrument, but as a result of the direct and coercive nature of taxes (Heres et al., 2017; Steg et al., 2006), we expect the improvement to be particularly prevalent for as salient an issue as taxes. In this article, we consider two such factors—political trust and efficacy.

Political trust is a crucial element of social capital for governments as 'institutional trust will matter for the support or rejection of *any* government activity' (Paxton & Knack, 2012, 174, emphasis in original). Consequently, it has become a concept that features often in studies over public attitudes—including environmental attitudes (Fairbrother, 2017a), which are associated with political trust in a large body of research (Baranzini & Carattini, 2017; Beuermann & Santarius, 2006; Dietz et al., 2007; Fairbrother, 2017b; Gaunt et al., 2007; Hammar & Jagers, 2006). When a government proposes to address as complex an issue as climate change with taxes, those who have higher levels of political trust should be more likely to believe that the government proposal could and would work, and therefore have a higher probability to support the proposal. This is why we expect political trust to correlate positively with the level of support for carbon taxes.

Hypothesis 1: *The level of support for carbon taxes is higher among people with high political trust.*

What is yet to establish itself in the literature on the acceptability of carbon taxes is political efficacy—specifically, *external* political efficacy, which refers to beliefs about government responsiveness to citizen demands (Craig et al., 1990). Irrespective of the political trust that governments have, their policy to tax carbon for environmental purposes might turn out to be a failure in the eyes of the citizens. Under high external efficacy—i.e. where people (are perceived to) have a say in what their governments do—the citizens can at least then expect these policies to be reformed or dropped altogether in line with their demands. However, where governments are not responsive to citizen demands, policies are more likely to remain untouched once enacted even if they prove unpopular in time. Hence we hypothesise the support for carbon taxes to increase with external efficacy.

Hypothesis 2: *The level of support for carbon taxes is higher among people with high external political efficacy.*

3.2 Self-interest

A second set of expectations is related to the personal cost of carbon taxes. As already suggested above, one of the main reasons behind the public resistance to carbon taxes is their *perceived* economic consequences to people,[3] who purposefully try to minimise their costs. For this assertion to hold, the resistance should be stronger among people who are more likely to be paying a higher cost of the taxes. Here we develop hypotheses based on two such groups of people.

First, as carbon taxes often aim at limiting the energy consumption behaviour, heavy consumers of energy share a higher burden of these taxes—a principle that has widespread support among the public (Hammar & Jagers, 2006; Jagers & Hammar, 2009)—unless they reduce their consumption levels. However, the elasticity of energy consumption is not the same for everyone, and consumers are more likely to lose if they could not use less energy despite a new or increased carbon tax. Therefore, we expect to find a negative relationship between the energy dependency of individuals and their support for taxes.

> **Hypothesis 3:** *The level of support for carbon taxes is lower among people with high energy dependency.*

Second, one special case of energy dependency emerges in rural areas, where people rely more heavily on energy for mobility (due to relative lack of public transport amid larger distances) and heating (due to characteristically less energy-efficient housing) than people living in urban areas (Berry, 2019; Broz & Maliniak, 2010; Ewing & Rong, 2008; Kallbekken & Sælen, 2011). As a result, carbon taxes are likely to have more repercussions on rural areas. This effect is not limited to those rural habitants who personally depend on energy. If carbon taxes mean less money to remain in local economy, all residents

[3] Perceptions about the economic consequences of carbon taxes may not always match the reality. In fact, surveying a representative sample of the French population, Douenne and Fabre (2019) show that, as many as 89% of people overestimate how much carbon taxes would affect them personally.

would have to shoulder the burden of these taxes disproportionately. This leads us to hypothesise the support for carbon taxes to be lower in rural than in urban areas.

> **Hypothesis 4:** *The level of support for carbon taxes is lower among people living in rural areas.*

4 Data and Design

Our analysis draws on data from the European Social Survey (ESS). Including for the first time a module on energy attitudes, Round 8 of the ESS (2016) provides a unique opportunity to test the hypotheses above across 23 countries (n = 44,387). The majority of these countries are in the European Union (EU) or European Free Trade Association (EFTA)—Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom—while the survey includes also Israel and the Russian Federation. This allows us to provide cross-national evidence for individual preferences for carbon taxes in a range of countries larger than it has ever been possible before.

The data for our dependent variable comes from the following survey question: 'To what extent are you in favour or against ... increasing taxes on fossil fuels, such as oil, gas, and coal ... in [country] to reduce climate change?' The response options were 1 = 'strongly in favour', 2 = 'somewhat in favour', 3 = 'neither in favour nor against', 4 = 'somewhat against', and 5 = 'strongly against'. We have reversed the original scale so that higher values indicate increasing favour. To provide easily interpretable results, we treat this dependent variable as continuous in the main body of the article although the measure is ordinal. In the Supporting Information, however, we provide a robustness test on this modelling choice by treating the dependent variable as ordinal. Our conclusions remain the same. Finally, because our data has an hierarchical structure (where respondents are nested in countries), we use *multilevel* regression models.

For the independent variables of interest, we use data from the survey items measuring (a) how much, on average, the respondents trust their country's parliament, political parties, and politicians (*Political Trust*), (b) how much they believe the political system in their country allows people like them to have a say in what the government does (*Political Efficacy*), (c) how confident they are that they could use less energy than they do now (*Energy Dependence*), and finally (d) how rural is the area they live in (*Rural Area*). While *Political Trust* and *Energy Dependence* range from zero to ten, *Political Efficacy* and *Rural Area* range from one to five. We treat these independent variables as continuous.

To show that our results are not driven by inclusion or exclusion of co-variates, we report models with and without control variables.[4] At the individual level, these variables include the respondents' age, gender, left-right orientation, climate change worries, energy cost worries, and energy saving behaviours (efficiency and curtailment). In addition, whether there is already a carbon tax in place, average party position on green energy, and gross domestic product are the country-level controls. For more details on the data and variables, see the Supporting Information.

[4]Note that this also allows us to provide evidence from all 23 countries at least in some models, as the number of countries decreases to 18 with the country-level control variables due to missing data.

5 Results

5.1 Country-level analysis

To begin with analysis, Figure 1 plots the mean levels of public support for increasing taxes on fossil fuels to reduce climate change, in countries with and without existing carbon taxes. Overall, it shows that people are rather negative about increasing these taxes, with the average preference (2.72, standard error = 0.01) under the neutral mid-point of the scale—'neither in favour nor against'. This is indeed the situation in most countries; the public attitude towards this policy is on average negative in 17 out of 23 cases. The support turns only slightly positive in no more than five countries in the survey. In Germany, the public seems divided almost equally between being against and in favour of increasing taxes on fossil fuels.

At the time of data collection, carbon taxes existed in 13 of the 23 countries in the survey. Figure 1 shows that most of these countries are clustered at either ends of the level of support for increasing taxes on fossil fuels. On the one hand, we see that in all five countries where the attitude towards increasing taxes are positive, carbon taxes are already in place. Notice also that, with the exception of Switzerland, these are all Nordic countries (Sweden, Finland, Iceland, and Norway). On the other hand, carbon taxes exist in Poland, Estonia, Portugal, and France as well, but the public support for increasing taxes on fossil fuels are at its lowest level in this set of countries. This suggests that, at least at the country level, there is no linear relationship between having carbon taxes already in place and the public attitude towards these taxes.

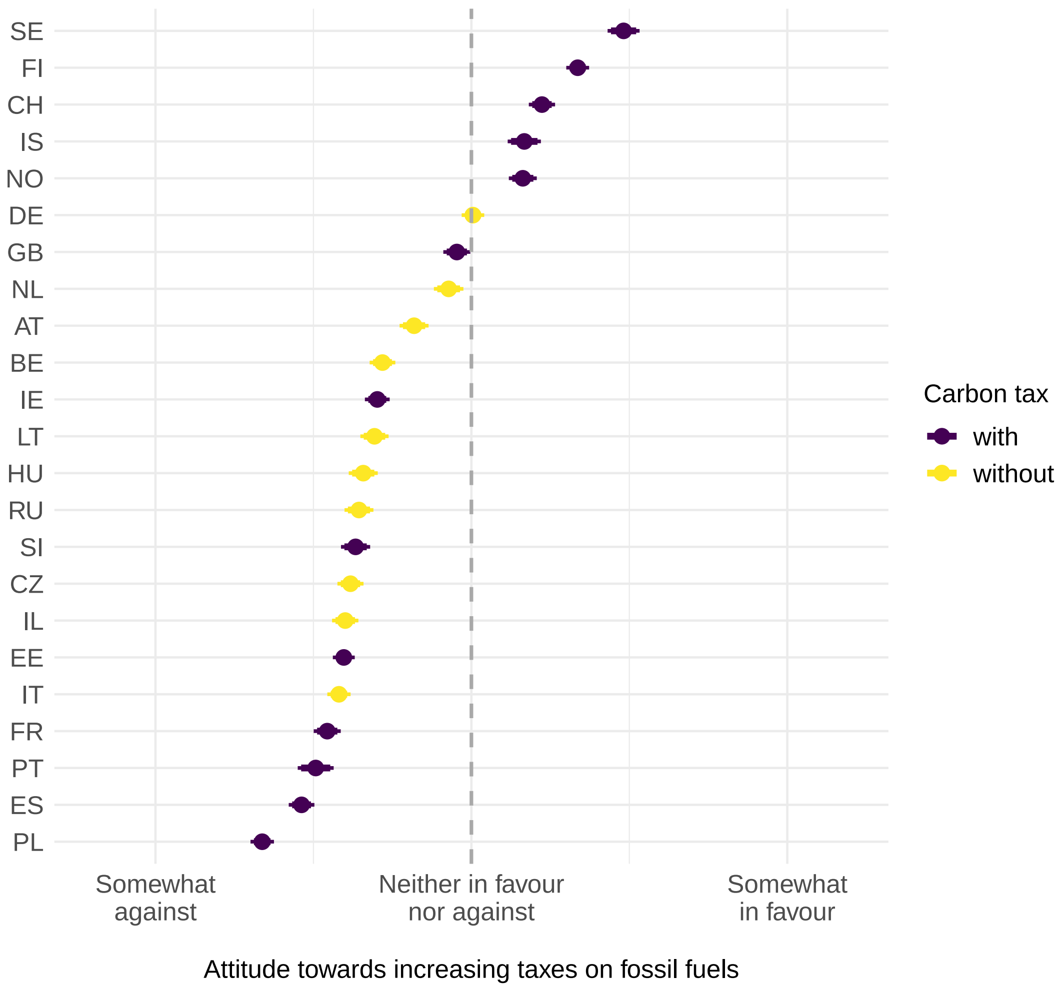

Figure 1: Mean levels of public support for increasing taxes on fossil fuels to reduce climate change. *Notes:* The values are based on the ESS Round 8 (ESS, 2016), weighted to account for sampling error, non-response bias, and differences in inclusion probabilities. Horizontal bars indicate standard errors. See Table S2 in Supporting Information for the underlying values in table format.

Before we move on to individual-level analysis, Figure 2 plots the average values of our dependent variable, support for increasing taxes on fossil fuels to reduce climate change, against the average values of our independent variables of interest, by each country in the dataset. Overall, the results suggest that the indicators for perceived uncertainty and self-interest are related to the mean levels of support for carbon taxes in several countries. Here we find strong correlations for *Political Trust* ($r = 0.9$), *Public Efficacy* ($r = 0.7$), and *Energy Dependence* ($r = -0.7$)—all in the expected directions. The only exception is *Rural Area* ($r = 0.2$), which has a much weaker correlation coefficient, in the

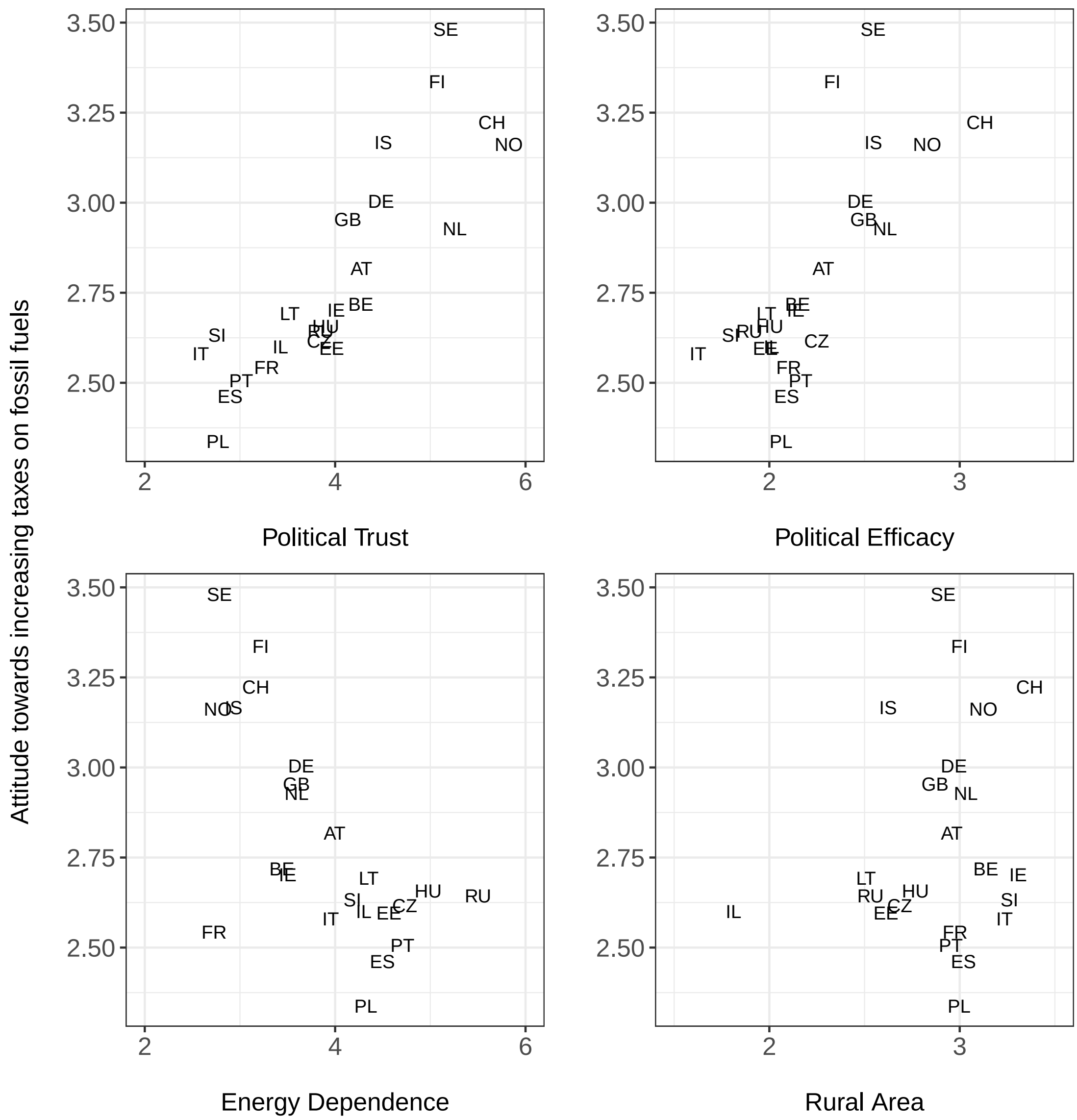

Figure 2: Mean levels of public support for increasing taxes on fossil fuels to reduce climate change, by independent variables. *Notes:* All values are country means, based on the ESS Round 8 (ESS, 2016), weighted to account for sampling error, non-response bias, and differences in inclusion probabilities.

unexpected direction. This suggests that countries with high rural populations are not necessarily the ones with low public support for carbon taxes. Note that, however, our hypotheses are for the level of individuals, which we analyse in the following sub-section.

5.2 Individual-level analysis

Table 1 presents a summary of four multilevel linear regression models, where the dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. We report the complete models in Table S3, in Supplementary Information. To facilitate interpretation of the substantive results, Figure 3 visualises the predicted levels of support, at the minimum and maximum values of our key independent variables. These predictions are based on the forth model in Table 1, which includes the individual- and country-level control variables.

For the factors related to uncertainty, Table 1 shows that there are statistically significant, positive relationships between both *Political Trust* and *Political Efficacy* as independent variables and the support for increasing taxes as the dependent variable. Moreover, as visible in Figure 3, *Political Trust* is associated with a larger change in predictions than it is the case for any other variable of interest in our models. In its absence (*Political Trust* = 0), we predict the average support for increasing taxes to be 2.51—similar to the situation in Portugal, the country with third lowest score in the dataset. At the other end of the spectrum (*Political Trust* = 10), the cross-country result (mean = 3.20) looks very much like in Iceland, the country with the forth highest score. With regard to *Political Efficacy*, while the average support is predicted to be 2.69 among those who believe that people like them have no say in what their government does (*Political Efficacy* = 1), we predict this average to be 3.01 ('neither in favour nor against' increasing the taxes) for those who believe the complete opposite—that they have a great deal of say (*Political Efficacy* = 5). These results confirm our Hypotheses 1 and 2.

Table 1: Multilevel linear regression models—summary results.

	Basic Model	Individual Controls	Country Controls	All Controls
Political Trust	0.068*** (0.003)	0.064*** (0.004)	0.074*** (0.003)	0.069*** (0.004)
Political Efficacy	0.110*** (0.007)	0.079*** (0.008)	0.116*** (0.008)	0.080*** (0.009)
Energy Dependence	–0.047*** (0.002)	–0.028*** (0.003)	–0.050*** (0.003)	–0.029*** (0.003)
Rural Area	–0.074*** (0.005)	–0.053*** (0.006)	–0.074*** (0.005)	–0.052*** (0.006)
Individual-level Controls	✗	✓	✗	✓
Country-level Controls	✗	✗	✓	✓
Constant	2.669*** (0.050)	2.350*** (0.068)	2.304*** (0.156)	2.031*** (0.163)
N—Observations	40972	29890	33079	24379
N—Groups	23	23	18	18
Log likelihood	–64732.776	–46232.587	–52229.111	–37686.125
Wald χ^2	2121.56	3492.43	1971.66	2939.02
R^2 (Levels 1 / 2)	0.05 / 0.51	0.10 / 0.64	0.06 / 0.69	0.11 / 0.71

Notes: These results are from multilevel linear regressions, where individuals are nested in countries, with standard errors in parentheses. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. Individual–level controls include age, gender, left–right orientation, climate change worries, energy cost worries, and energy saving behaviours (efficiency and curtailment). Country–level controls include whether there is already a carbon tax in place, average party position on green energy, and GDP. R^2 values are calculated according to Bryk and Raudenbush (1992). See Table S3 for complete results. *** $p < 0.001$.

For the factors related to self-interest, we find statistically significant and negative relationships, confirming our respective Hypotheses 3 and 4. As we expect, first, the support for taxes decreases with respondents' dependency on energy. All else being equal, as Figure 3 shows, a switch from maximum (*Energy Dependence* = 10) to minimum (*Energy*

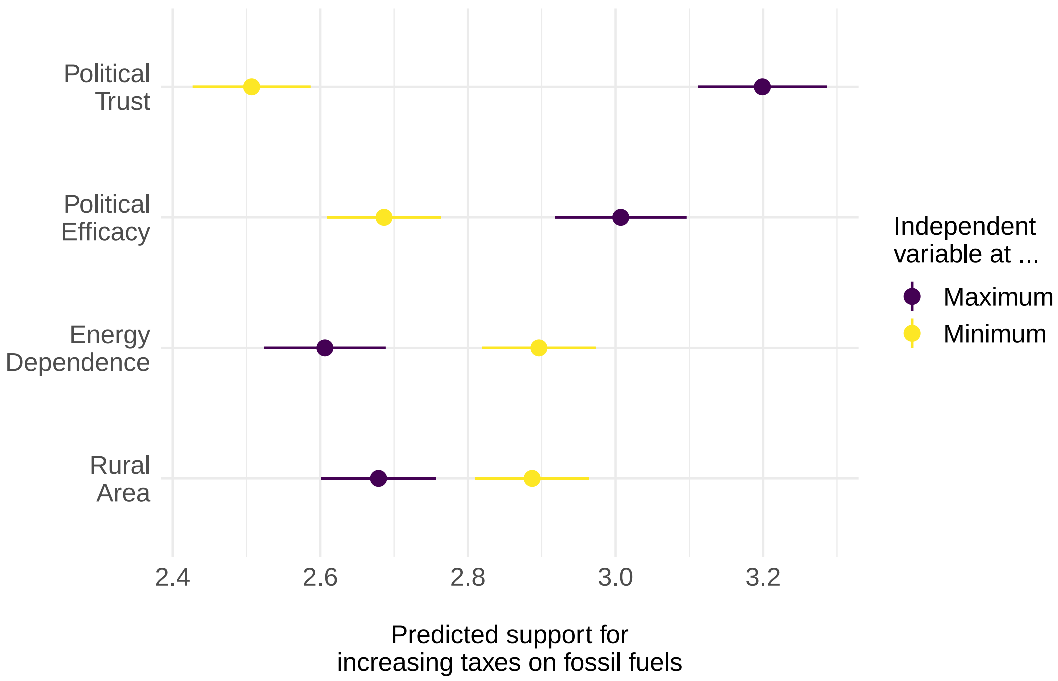

Figure 3: Predicted support for increasing taxes on fossil fuels to reduce climate change. *Notes*: Predictions are based the forth model in Table 1. The dependent variable is the respondents' support for increasing taxes for fossil fuels to reduce climate change. Horizontal bars represent 95% confidence intervals. Other variables are set to observed values.

Dependence = 0) confidence that the respondents could use less energy is associated with a 0.29 decrease on a five-point support scale for taxes. Second, there is a likewise decrease in support on the urban-rural divide. Here the effect size is smaller in comparison—about a quarter of a point on a five-point scale—where the support for increasing taxes on fossil fuels decreases significantly as the area that the respondents live in switches from 'a big city' (*Rural Area* = 1) to 'a farm or home in the countryside' (*Rural Area* = 5).

These results are robust to inclusion or exclusion of control variables, be it at the level of individuals or countries. Adding these groups of variables to our analysis in separate models, we observe no change in terms of sign or significance of the coefficients of interest, and only small (ranging between 0.01 and 0.04, on a five-point scale) changes in terms of size. We provide further robustness checks in Supplementary Information.

First, we run 13 separate regressions, by adding one control variable to our basic model at a time. Our main results remain the same in all these models. Second, we conduct a test of multicollinearity, and find that there is no highly linear correlations among our independent variables. Similarly, we show that our results replicate if we treat our dependent variable as ordinal, and therefore run multilevel ordinal logistic regressions instead. Finally, repeating this regression analysis in each of the 23 countries in the dataset, we show that our results are not driven by respondents in a minority of countries. To the contrary, there is empirical support for our hypotheses in a large majority of the cases.

6 Conclusion and Policy Implications

In search for policy instruments to reduce climate change, many governments face a hard choice between effectiveness and popularity. One would think carbon taxes are the *go-to* instrument since they are known for their effectiveness in changing behaviour in favour of the environment. What is more, these taxes also generate additional revenues for governments to improve the lives of their citizens—environmentally or otherwise. Yet they are unpopular with the public. Indeed, we find that there is no overall support for carbon taxes in most of the 23 countries in our dataset.

Multivariate analyses provide insights into the reasons behind the unpopularity of carbon taxes. On the one hand, the results show that the attitudes towards taxes improve significantly with higher political trust and efficacy. We argue that this is because the level of support for taxes are particularly prone to uncertainty, which decreases with trust and efficacy. On the other hand, the level of support for carbon taxes is significantly lower among people who depend highly on energy or live in rural areas, for whom the economic cost of energy-based taxes is likely to be higher. We see this as evidence that the self-interest is one of the determining factors behind the attitudes to carbon taxes.

These results can be considered as good as well as bad news for the future of carbon taxes. These are bad news because, as things stand, people are on average against carbon taxes in many countries. If there are any governments looking into introducing taxes into their climate change policy any time soon, they are likely to meet public resistance like in France. However, our results can also be considered as good news at least in countries where the average support for taxes is only slightly negative. If the governments in these countries take steps to decrease the uncertainty around taxes, they can shift the attitudes towards positive. Increasing political trust and efficacy of the citizens could be a step in this direction.

This article extends the empirical evidence on public attitudes to carbon taxes, contributing to a growing literature of mainly single-case studies with cross-national evidence from 23 countries in Europe. First, it puts the existing reports on the unpopularity of carbon taxes from separate countries into a wider context. For example, we find that the overall public attitude towards carbon taxes is negative in about two out of three countries. Second, it shows that factors that decrease the uncertainty around carbon taxes or make the personal cost of taxes clearer for consumers are among the important determinants of public support for this policy instrument across the borders in Europe. Changes in these factors alone can be decisive, at least in countries where the levels of support for and opposition to carbon taxes are rather close to each other.

Our claims rest on survey data from 44,387 respondents in 23 countries (ESS, 2016), serving our main motivation to conduct a study that goes beyond the national borders. However, further research on this publicly available dataset can focus on one or more countries as well, addressing a limitation of our cross-national study. Although we show that our main results hold in a large majority of countries in the dataset, case-specific findings can further our understanding of public attitudes to carbon taxes as well.

References

Aldy, J. E., & Stavins, R. N. (2012). The promise and problems of pricing carbon: Theory and experience. *Journal of Environment & Development*, *21*(2), 152–180.

Ballard, C. L., & Medema, S. G. (1993). The marginal efficiency effects of taxes and subsidies in the presence of externalities: A computational general equilibrium approach. *Journal of Public Economics*, *52*(2), 199–216.

Baranzini, A., & Carattini, S. (2017). Effectiveness, earmarking and labeling: Testing the acceptability of carbon taxes with survey data. *Environmental Economics and Policy Studies*, *19*(1), 197–227.

Baumol, W. J., & Oates, W. E. (1971). The use of standards and prices for protection of the environment. *Swedish Journal of Economics*, *73*(1), 42–54.

Beiser-McGrath, L. F., & Bernauer, T. (2019). Could revenue recycling make effective carbon taxation politically feasible? *Science Advances*, *5*(9). https://doi.org/10.1126/sciadv.aax3323

Berry, A. (2019). The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the French context. *Energy Policy*, *124*, 81–94.

Beuermann, C., & Santarius, T. (2006). Ecological tax reform in Germany: Handling two hot potatoes at the same time. *Energy Policy*, *34*(8), 917–929.

Brännlund, R., & Persson, L. (2012). To tax, or not to tax: Preferences for climate policy attributes. *Climate Policy*, *12*(6), 704–721.

Broz, J. L., & Maliniak, D. (2010). *Malapportionment, gasoline taxes, and climate change.* Retrieved July 22, 2018, from https://ssrn.com/abstract=1642499

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods.* Thousand Oaks, Sage.

Carattini, S., Baranzini, A., & Lalive, R. (2018). Is taxing waste a waste of time? Evidence from a supreme court decision. *Ecological Economics*, *148*, 131–151.

Carattini, S., Baranzini, A., Thalmann, P., Varone, F., & Vöhringer, F. (2017). Green taxes in a post-Paris world: Are millions of nays inevitable? *Environmental and Resource Economics*, *68*(1), 97–128.

Carattini, S., Carvalho, M., & Fankhauser, S. (2018). Overcoming public resistance to carbon taxes. *Wiley Interdisciplinary Reviews: Climate Change*, *9*(5), 1–26.

Carattini, S., Kallbekken, S., & Orlov, A. (2019). How to win public support for a global carbon tax. *Nature*, *565*, 289–291.

Cherry, T. L., Kallbekken, S., & Kroll, S. (2012). The acceptability of efficiency-enhancing environmental taxes, subsidies and regulation: An experimental investigation. *Environmental Science & Policy*, *16*, 90–96.

Cherry, T. L., Kallbekken, S., & Kroll, S. (2014). The impact of trial runs on the acceptability of environmental taxes: Experimental evidence. *Resource and Energy Economics*, *38*, 84–95.

Clinch, J. P., & Dunne, L. (2006). Environmental tax reform: An assessment of social responses in Ireland. *Energy Policy*, *34*(8), 950–959.

Craig, S. C., Niemi, R. G., & Silver, G. E. (1990). Political efficacy and trust: A report on the NES pilot study items. *Political Behavior*, *12*(3), 289–314.

De Groot, J. I., & Schuitema, G. (2012). How to make the unpopular popular? Policy characteristics, social norms and the acceptability of environmental policies. *Environmental Science & Policy*, *19*, 100–107.

Deroubaix, J.-F., & François, L. (2006). The rise and fall of French ecological tax reform: Social acceptability versus political feasibility in the energy tax implementation process. *Energy Policy*, *34*(8), 940–949.

Dietz, T., Dan, A., & Shwom, R. (2007). Support for climate change policy: Social psychological and social structural influences. *Rural Sociology*, *72*(2), 185–214.

Douenne, T., & Fabre, A. (2019). Can we reconcile French people with the carbon tax? Disentangling beliefs from preferences [FAERE Working Paper, 2019.10]. Retrieved September 11, 2019, from https://faere.fr/pub/WorkingPapers/Douenne_Fabre_FAERE_WP2019.10.pdf

Dresner, S., Jackson, T., & Gilbert, N. (2006). History and social responses to environmental tax reform in the United Kingdom. *Energy Policy*, *34*(8), 930–939.

ESS. (2016). European Social Survey Round 8 Data [Data file edition 2.1]. [Norwegian Centre for Research Data, Norway—Data Archive and distributor of ESS data for ESS ERIC]. Retrieved February 1, 2019, from https://www.europeansocialsurvey.org/download.html?file=ESS8e02_1&y=2016

Ewing, R., & Rong, F. (2008). The impact of urban form on US residential energy use. *Housing Policy Debate*, *19*(1), 1–30.

Fairbrother, M. (2017a). Environmental attitudes and the politics of distrust. *Sociology Compass*, *11*(5), 1–10.

Fairbrother, M. (2017b). When will people pay to pollute? environmental taxes, political trust and experimental evidence from britain. *British Journal of Political Science*, 1–22.

Farrell, J. (2016). Corporate funding and ideological polarization about climate change. *Proceedings of the National Academy of Sciences*, *113*(1), 92–97.

Gaunt, M., Rye, T., & Allen, S. (2007). Public acceptability of road user charging: The case of Edinburgh and the 2005 referendum. *Transport Reviews*, *27*(1), 85–102.

Gevrek, Z. E., & Uyduranoglu, A. (2015). Public preferences for carbon tax attributes. *Ecological Economics*, *118*, 186–197.

Goulder, L. H., & Parry, I. W. H. (2008). Instrument choice in environmental policy. *Review of Environmental Economics and Policy*, *2*(2), 152–174.

Hammar, H., & Jagers, S. C. (2006). Can trust in politicians explain individuals' support for climate policy? The case of CO2 tax. *Climate Policy*, *5*(6), 613–625.

Heres, D. R., Kallbekken, S., & Galarraga, I. (2017). The role of budgetary information in the preference for externality-correcting subsidies over taxes: A lab experiment on public support. *Environmental and Resource Economics*, *66*(1), 1–15.

Hsu, S.-L., Walters, J., & Purgas, A. (2008). Pollution tax heuristics: An empirical study of willingness to pay higher gasoline taxes. *Energy Policy*, *36*(9), 3612–3619.

Jagers, S. C., & Hammar, H. (2009). Environmental taxation for good and for bad: The efficiency and legitimacy of Sweden's carbon tax. *Environmental Politics*, *18*(2), 218–237.

Kallbekken, S., & Aasen, M. (2010). The demand for earmarking: Results from a focus group study. *Ecological Economics*, *69*(11), 2183–2190.

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

Klok, J., Larsen, A., Dahl, A., & Hansen, K. (2006). Ecological tax reform in Denmark: History and social acceptability. *Energy Policy*, *34*(8), 905–916.

Maestre-Andrés, S., Drews, S., & van den Bergh, J. (2019). Perceived fairness and public acceptability of carbon pricing: A review of the literature. *Climate Policy*, *19*(9), 1186–1204.

Mankiw, N. G. (2009). Smart taxes: An open invitation to join the Pigou club. *Eastern Economic Journal*, *35*(1), 14–23.

Metcalf, G. E. (2009). Designing a carbon tax to reduce US greenhouse gas emissions. *Review of Environmental Economics and Policy*, *3*(1), 63–83.

Paxton, P., & Knack, S. (2012). Individual and country-level factors affecting support for foreign aid. *International Political Science Review*, *33*(2), 171–192.

Schuitema, G., Steg, L., & Forward, S. (2010). Explaining differences in acceptability before and acceptance after the implementation of a congestion charge in Stockholm. *Transportation Research Part A: Policy and Practice*, *44*(2), 99–109.

Shapiro, R. Y. (2011). Public opinion and American democracy. *Public Opinion Quarterly*, *75*(5), 982–1017.

Steg, L., Dreijerink, L., & Abrahamse, W. (2006). Why are energy policies acceptable and effective? *Environment and Behavior*, *38*(1), 92–111.

Stern, N., & Stiglitz, J. E. (2017). *Report of the high-level commission on carbon prices.* Washington D.C., World Bank.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*, *25*(5), 322–348.

Thalmann, P. (2004). The public acceptance of green taxes: 2 million voters express their opinion. *Public Choice*, *119*(1–2), 179–217.

Tiezzi, S., & Xiao, E. (2016). Time delay, complexity and support for taxation. *Journal of Environmental Economics and Management*, *77*, 117–141.

Weitzman, M. L. (2017). Voting on prices vs. voting on quantities in a World Climate Assembly. *Research in Economics*, *71*(2), 199–211.

World Bank. (2019). *Carbon pricing dashboard [dashboard]*. Retrieved July 26, 2019, from https://carbonpricingdashboard.worldbank.org/map_data

SUPPORTING INFORMATION

‘Attitudes to environmental taxes across Europe: The role of perceived uncertainty and self-interest’

Resul Umit

University of Lucerne

resul.umit@unilu.ch

Lena Schaffer

University of Lucerne

lena.schaffer@unilu.ch

S1 Codebook of Variables

As explained in the main text, our main data source is the European Social Survey (ESS), and except for the country-level controls, all our variables originate from Round 8 of this survey (ESS, 2016). The ESS is an academically driven project based on face-to-face interviews with cross-sectional samples. It has been conducted every two years since 2002, with rotating sections complementing the core survey in different rounds. In Round 8, one of these rotating sections was for the first time a module on public perceptions of climate change and energy security.

Table S1: Descriptive statistics.

	N	Mean	Median	SD	Min	Max
Dependent variable						
Support for Taxes	42401	2.77	3.00	1.23	1.00	5.00
Key independent variables						
Political Trust	44051	3.96	4.00	2.27	0.00	10.00
Political Efficacy	43429	2.20	2.00	0.94	1.00	5.00
Energy Dependence	43435	3.96	4.00	2.63	0.00	10.00
Rural Area	44337	2.87	3.00	1.24	1.00	5.00
Individual-level controls						
Age	44232	49.14	49.00	18.61	15.00	100.00
Education	44170	4.01	4.00	1.85	1.00	7.00
Female	44378	0.53	1.00	0.50	0.00	1.00
Household Income	36445	3.76	3.05	2.67	0.32	17.43
Left-Right Orientation	38583	5.16	5.00	2.24	0.00	10.00
Climate Worries	42654	3.01	3.00	0.93	1.00	5.00
Cost Worries	43955	3.10	3.00	1.04	1.00	5.00
Efficiency	43276	7.77	8.00	2.29	0.00	10.00
Curtailment	43836	4.15	4.00	1.22	1.00	6.00
Country-level controls						
Carbon Tax	44387	0.51	1.00	0.50	0.00	1.00
Party Position	35450	0.21	0.31	0.28	–0.35	0.60
GDP	44387	4.21	4.14	1.25	2.49	7.25

Table S1 provides the descriptive statistics for all variables used in the analysis before we proceed to define each of them in detail below.

Dependent variable

The dependent variable comes from a battery of questions measuring how much the respondents are in favour or against different instruments to reduce climate change:

Support for Taxes. Increasing taxes on fossil fuels, such as oil, gas and coal.

The answers are (reverse) coded as 5 = 'strongly in favour', 4 = 'somewhat in favour', 3 = 'neither in favour nor against', 2 = 'somewhat against', and 1 = 'strongly against' to code the first two dependent variables above. In addition, we created a third, index dependent variable out of two items.

Independent variables

Political Trust. We created this variable out of a battery of questions measuring respondents' trust towards a list of actors and institutions. The wording of the overall instruction was as follows: 'please tell me on a score of 0-10 how much you personally trust each of the institutions I read out. 0 means you do not trust an institution at all, and 10 means you have complete trust'. We then calculated this individual-level variable as the mean value of trust towards the country's parliament, political parties, and politicians.[i]

Political Efficacy. Respondents' answer to the survey question, 'How much would you say the political system in [country] allows people like you to have a say in what the government does?', with response options as 1 = 'not at all', 2 = 'very little', 3 = 'some', 4 = 'a lot', 5 = 'a great deal'.

Energy Dependence. Respondents' answer to the survey question, 'Overall, how confident are you that you could use less energy than you do now?', with response options (reverse coded) from 0 = 'completely confident' to 10 = 'not at all confident'.

[i] The other actors and institutions in the battery, which we did not include in the calculation of this variable, were the country's legal system and police as well as the European Parliament and the United Nations.

Rural Area. A variable based on respondents' deception of the area where they live, coded as 1 = 'a big city', 2 = 'the suburbs or outskirts of a big city', 3 = 'a town or a small city', 4 = 'a country village', 5 = 'a farm or home in the countryside'.

Individual-level controls

Age. A continuous variable based on the age of respondents. The acceptance of environmental taxes likely decreases with age (Thalmann, 2004).

Education. An ordinal variable indicating the highest level of education that the respondents successfully completed: 'less than lower secondary' = 1, 'lower secondary' = 2, 'lower tier upper secondary' = 3, 'upper tier upper secondary' = 4, 'advanced vocational, sub-degree' = 5, 'lower tertiary education, BA level' = 6, or 'higher tertiary education, MA level or above' = 7. The acceptance of environmental taxes likely increases with education (Alberini et al., 2018; Hsu et al., 2008; Thalmann, 2004).

Female. A binary variable based on gender, coded as 1 for females and 0 for males.

Household Income. As the ESS measures income with pre-defined deciles of the national household income distribution, the cross-country comparability of the resulting variable is limited. To address this issue, we re-estimated the original variable in the dataset, in line with a solution offered by Donnelly and Pop-Eleches (2018).

For example, for a survey respondent in Austria, for whom the original income variable is coded as 3, our re-estimation was as follows. First, as the third decile ranges from €19,800 to €24,200 in this country, we take (19800 + 24800) / 2 = 22000 as the midpoint. We then divide this value by the purchasing power parity for Austria in 2016—that is, 22000 / 0.841 = 26159.33—in the second step. Notice that, to provide meaningful regression coefficients, we code this variable in $10,000, and therefore this respondent is assigned 2.62 as *Household Income.* We control for this variable because the acceptance of environmental taxes likely increases with income (Berry, 2019; Gevrek & Uyduranoglu, 2015; Hsu et al., 2008; Kotchen et al., 2017).

Left-Right Orientation. An ordinal variable measuring where the respondents would place themselves on a left-right scale, where 0 indicates the left and 10 indicates the right. The acceptance of environmental taxes is likely higher among the people on the left of the political spectrum (Hammar & Jagers, 2006; Thalmann, 2004).

Climate Worries. An ordinal variable measuring whether the respondents are are 'not at all worried' = 1, 'not very worried' = 2, 'somewhat worried' = 3, 'very worried' = 4, or 'extremely worried' = 5 about climate change. The acceptance of environmental taxes likely increases with the redistributional concerns for the environment (Alberini et al., 2018; Carattini et al., 2017; Gevrek & Uyduranoglu, 2015; Kotchen et al., 2017).

Cost Worries. An ordinal variable measuring whether the respondents are 'not at all worried' = 1, 'not very worried' = 2, 'somewhat worried' = 3, 'very worried' = 4, or 'extremely worried' = 5 that energy may be too expensive for many people in their country. The acceptance of environmental taxes likely decreases with the redistributional concerns for others (Brännlund & Persson, 2012; Carattini et al., 2017; Kallbekken & Sælen, 2011; Thalmann, 2004).

Efficiency. An ordinal variable measuring 'If [the respondents] are to buy a large electrical appliance for your home, how likely is it that [they] would buy one of the most energy efficient ones'? Response options were on an 11-point scale, where 0 means 'Not at all likely' and 10 means 'Extremely likely'.

Curtailment. An ordinal variable measuring 'In [the respondents'] daily life, how often do [they] do things to reduce [their] energy use'? The response options were on six-point Likert scale, coded as 'Never' = 1, 'Hardly ever' = 2, 'Sometimes' = 3, 'Often' = 4, 'Very often' = 5, and 'Always' = 6.

Country-level controls

Carbon Tax. A binary variable, coded as 1 for countries with carbon pricing initiatives, or otherwise as 0 (World Bank, 2019). The acceptance of environmental taxes is likely related to the current tax situation in a country (Jagers & Hammar, 2009).

Party Position. The average position of political parties—in the European Union countries in 2014—with regard to the following statement: 'Renewable sources of energy (e.g. solar or wind energy) should be supported even if this means higher energy costs', with response categories as –1 = 'completely disagree', –0.5 = 'tend to disagree', 0 = 'neutral', 0.5 = 'tend to agree', and 1 = 'completely agree'. The data for this variable comes from an expert survey in the *euandi* project (Garzia et al., 2017).

GDP. Gross domestic product, calculated as 10,000 US Dollars per capita in 2016 (OECD, 2018).

S2 Mean Levels of Support: Source Data

Figure 1 in the main text plots the mean levels of public support for increasing taxes to reduce climate change in each country. In this section, we provide the source data in Table S2.

S3 Complete Table

For reasons of brevity and space, the regression table in the main text report only a summary of the results. This section provides the complete version of Table S3.

Table S2: Mean values of public support for increasing taxes on fossil fuels.

Country	Sample	Mean	SE
Austria (AT)	2010	2.82	0.04
Belgium (BE)	1766	2.72	0.03
Czech Republic (CZ)	2269	2.62	0.03
Estonia (EE)	2019	2.60	0.02
Finland (FI)	1925	3.34	0.03
France (FR)	2070	2.54	0.03
Germany (DE)	2852	3.00	0.02
Hungary (HU)	1614	2.66	0.04
Iceland (IS)	880	3.17	0.04
Ireland (IE)	2757	2.70	0.03
Israel (IL)	2557	2.60	0.03
Italy (IT)	2626	2.58	0.03
Lithuania (LT)	2122	2.69	0.03
Netherlands (NL)	1681	2.93	0.04
Norway (NO)	1545	3.16	0.03
Poland (PL)	1694	2.34	0.03
Portugal (PT)	1270	2.51	0.05
Russian Federation (RU)	2430	2.64	0.03
Slovenia (SI)	1307	2.63	0.04
Spain (ES)	1958	2.46	0.03
Sweden (SE)	1551	3.48	0.04
Switzerland (CH)	1525	3.22	0.03
United Kingdom (GB)	1959	2.95	0.03
Total	44387	2.72	0.01

Notes: This table reports the means and standard errors (SE) of public support for increasing taxes on fossil fuels to reduce climate change, as plotted in Figure 1. All values are based on ESS Round 8 ESS (2016), weighted to account for sampling error, non-response bias, and differences in inclusion probabilities. The total values are calculated with additional weights to account for the different population sizes of the countries in the dataset.

Table S3: Multilevel linear regression models—complete results.

	Basic Model	Individual Controls	Country Controls	All Controls
Political Trust	0.068***	0.064***	0.074***	0.069***
	(0.003)	(0.004)	(0.003)	(0.004)
Political Efficacy	0.110***	0.079***	0.116***	0.080***
	(0.007)	(0.008)	(0.008)	(0.009)
Energy Dependence	–0.047***	–0.028***	–0.050***	–0.029***
	(0.002)	(0.003)	(0.003)	(0.003)
Rural Area	–0.074***	–0.053***	–0.074***	–0.052***
	(0.005)	(0.006)	(0.005)	(0.006)
Age		–0.000		–0.001
		(0.000)		(0.000)
Education		0.046***		0.045***
		(0.004)		(0.005)
Female		0.052***		0.045**
		(0.013)		(0.015)
Household Income		0.014***		0.022***
		(0.003)		(0.004)
Left-Right Orientation		–0.049***		–0.038***
		(0.003)		(0.003)
Climate Worries		0.229***		0.229***
		(0.008)		(0.009)
Cost Worries		–0.140***		–0.143***
		(0.007)		(0.008)
Efficiency		0.009**		0.001
		(0.003)		(0.004)
Curtailment		–0.010		0.003
		(0.006)		(0.007)
Carbon Tax			–0.003	0.031
			(0.077)	(0.075)
Party Position			0.448**	0.359**
			(0.141)	(0.136)
GDP			0.053	0.032
			(0.034)	(0.033)
Constant	2.669***	2.350***	2.304***	2.031***
	(0.050)	(0.068)	(0.156)	(0.163)
N—Observations	40972	29890	33079	24379
N—Groups	23	23	18	18
Log likelihood	–64732.776	–46232.587	–52229.111	–37686.125
Wald χ^2	2121.56	3492.43	1971.66	2939.02
R^2 (Levels 1 / 2)	0.05 / 0.51	0.10 / 0.64	0.06 / 0.69	0.11 / 0.71

Notes: These results are from multilevel linear regressions, where individuals are nested in countries, with standard errors in parentheses. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. R^2 values are calculated according to Bryk and Raudenbush (1992). ** $p < 0.01$, *** $p < 0.001$.

S4 Robustness Checks

Adding one control variable at a time

To explore the effect of individual control variables on our main results, Table S4 provides 13 separate models—starting from our basic model (no controls included), it adds one control variable at a time, until we reach our final model (all controls included). With this exercise, we find further evidence that our results are robust to inclusion or exclusion of control variables: the signs and statistical significance of the estimates for our key explanatory variables remain exactly the same. Moreover, there are no remarkable changes in the coefficients from one model to the next.

Variation inflation factors

One concern is that two or more of our independent variables might be highly linearly related, which would lead to collinearity or multicollinearity. Looking for such relationships among all independent variables used in the final models (e.g., Model 4 in Table 1), we calculated variation inflation factors (VIFs), reported in Table S5. The results show no signs of high linear relationships as the factors range between 1.02 and 1.35 only, with a mean of 1.14. Note that a VIF of 1.0 refers to no multicollinearity while values higher than 10.0 are considered problematic (Hair et al., 2014). Assuringly, the factors in our case are very close to the former.

Table S4: Multilevel linear regression models—adding one control at a time.

	Basic Model	Step 1	Step 2	Step 3
Political Trust	0.068***	0.069***	0.066***	0.066***
	(0.003)	(0.003)	(0.003)	(0.003)
Political Efficacy	0.110***	0.105***	0.089***	0.090***
	(0.007)	(0.007)	(0.007)	(0.007)
Energy Dependence	–0.047***	–0.044***	–0.040***	–0.040***
	(0.002)	(0.002)	(0.002)	(0.002)
Rural Area	–0.074***	–0.071***	–0.057***	–0.057***
	(0.005)	(0.005)	(0.005)	(0.005)
Age		–0.003***	–0.003***	–0.003***
		(0.000)	(0.000)	(0.000)
Education			0.064***	0.063***
			(0.003)	(0.003)
Female				0.067***
				(0.012)
Household Income				
Left-Right Orientation				
Climate Worries				
Cost Worries				
Efficiency				
Curtailment				
Carbon Tax				
Party Position				
GDP				
Constant	2.669***	2.830***	2.531***	2.502***
	(0.050)	(0.053)	(0.055)	(0.055)
N—Observations	40972	40852	40697	40692
N—Groups	23	23	23	23
Log likelihood	–64732.776	–64491.044	–64060.083	–64032.828
Wald χ^2	2121.56	2245.34	2605.54	2638.14
R^2 (Levels 1 / 2)	0.05 / 0.51	0.05 / 0.50	0.06 / 0.51	0.06 / 0.50

Notes: These results are from multilevel linear regressions, where individuals are nested in countries, with standard errors in parentheses. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. R^2 values are calculated according to Bryk and Raudenbush (1992). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table S4 (Continued): Multilevel linear regression models—adding one control at a time.

	Step 4	Step 5	Step 6	Step 7
Political Trust	0.066***	0.071***	0.072***	0.064***
	(0.003)	(0.004)	(0.004)	(0.004)
Political Efficacy	0.094***	0.099***	0.085***	0.079***
	(0.008)	(0.008)	(0.008)	(0.008)
Energy Dependence	–0.038***	–0.038***	–0.030***	–0.029***
	(0.003)	(0.003)	(0.003)	(0.003)
Rural Area	–0.064***	–0.058***	–0.055***	–0.053***
	(0.005)	(0.006)	(0.006)	(0.006)
Age	–0.002***	–0.001***	–0.001**	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.059***	0.056***	0.050***	0.046***
	(0.004)	(0.004)	(0.004)	(0.004)
Female	0.071***	0.067***	0.041**	0.052***
	(0.013)	(0.013)	(0.013)	(0.013)
Household Income	0.016***	0.019***	0.019***	0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
Left-Right Orientation		–0.056***	–0.048***	–0.049***
		(0.003)	(0.003)	(0.003)
Climate Worries			0.200***	0.230***
			(0.008)	(0.008)
Cost Worries				–0.140***
				(0.007)
Efficiency				
Curtailment				
Carbon Tax				
Party Position				
GDP				
Constant	2.415***	2.638***	1.995***	2.377***
	(0.056)	(0.059)	(0.065)	(0.064)
N—Observations	34147	31135	30316	30216
N—Groups	23	23	23	23
Log likelihood	–53668.693	–48769.374	–47083.809	–46734.868
Wald χ^2	2325.13	2484.51	3159.47	3567.89
R^2 (Levels 1 / 2)	0.06 / 0.57	0.07 / 0.57	0.09 / 0.53	0.10 / 0.64

Notes: These results are from multilevel linear regressions, where individuals are nested in countries, with standard errors in parentheses. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. R^2 values are calculated according to Bryk and Raudenbush (1992). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table S4 (Continued): Multilevel linear regression models—adding one control at a time.

	Step 8	Step 9	Step 10	Step 11	All Controls
Political Trust	0.064***	0.064***	0.064***	0.069***	0.069***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Political Efficacy	0.079***	0.079***	0.079***	0.080***	0.080***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Energy Dependence	–0.028***	–0.028***	–0.028***	–0.029***	–0.029***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Rural Area	–0.053***	–0.053***	–0.053***	–0.052***	–0.052***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Age	–0.001	–0.000	–0.000	–0.001	–0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.045***	0.046***	0.046***	0.045***	0.045***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Female	0.053***	0.052***	0.052***	0.045**	0.045**
	(0.013)	(0.013)	(0.013)	(0.015)	(0.015)
Household Income	0.014***	0.014***	0.014***	0.022***	0.022***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Left-Right Orientation	–0.048***	-0.049***	–0.049***	–0.038***	–0.038***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Climate Worries	0.228***	0.229***	0.229***	0.229***	0.229***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Cost Worries	–0.141***	–0.140***	–0.140***	–0.143***	–0.143***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
Efficiency	0.007*	0.009**	0.009**	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Curtailment		–0.010	–0.010	0.003	0.003
		(0.006)	(0.006)	(0.007)	(0.007)
Carbon Tax			0.073	0.030	0.031
			(0.076)	(0.076)	(0.075)
Party Position				0.355*	0.359**
				(0.139)	(0.136)
GDP					0.032
					(0.033)
Constant	2.328***	2.350***	2.310***	2.160***	2.031***
	(0.067)	(0.068)	(0.080)	(0.089)	(0.163)
N—Observations	30008	29890	29890	24379	24379
N—Groups	23	23	23	18	18
Log likelihood	–46403.595	–46232.587	–46232.138	–37686.565	–37686.125
Wald χ^2	3530.24	3492.43	3494.88	2936.26	2939.02
R^2 (Levels 1 / 2)	0.10 / 0.64	0.10 / 0.64	0.10 / 0.65	0.11 / 0.69	0.11 / 0.71

Notes: These results are from multilevel linear regressions, where individuals are nested in countries, with standard errors in parentheses. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. R^2 values are calculated according to Bryk and Raudenbush (1992). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table S5: Variation inflation factors.

Variable	VIF
Political Trust	1.35
Political Efficacy	1.30
Energy Dependence	1.12
Rural Areas	1.06
Age	1.10
Education	1.26
Female	1.02
Household Income	1.32
Left-Right Orientation	1.03
Climate Worries	1.14
Cost Worries	1.18
Efficiency	1.10
Curtailment	1.03
Carbon Tax	1.07
Party Position	1.07
GDP	1.15

Mean VIF: 1.14

Ordered logistic regression models

In the main text, we treated various variables—most importantly, the dependent variables—as continuous although they are ordinal. In this section, we show that our conclusions remain the same if we treat them as ordinal instead. Table S6 presents the results re-estimated in multilevel ordered logistic regression models.

Based on the forth model (All Controls) in this table, Figure S1 plots the predicted probabilities of support for increasing taxes on fossil fuels to reduce climate change. In other words, it shows the average probability of respondents answering that they are ‘strongly in favour’ (5) or ‘somewhat in favour’ (4) of such an increase, along the range of our key variables of interest. For example, it shows that this probability is 37% among the respondents who live in ‘a big city’ (1), which decreases to 30% among those living in ‘a farm or home in the countryside’ (5).

Results from individual countries

Although we are interested in explaining the public attitudes to carbon taxes *across borders* in Europe, it would be a concern if our overall results are driven by respondents from a minority of countries. Therefore, as a robustness check, we have conducted regression analyses by country, reported in Table S7. Re-running the basic model in Table S6 for each country, we find that the results reported in the main body of the text hold in a large majority of the cases. For example, out of the (23 x 4) 92 coefficients that we estimate for this robustness check, only 5% have the ‘wrong’ sign—exactly what we would expect to happen by random chance. Indeed, in four out of five cases, the estimates by country do not only have the correct sign but they are also statistically significant.

Table S6: Multilevel ordinal logistic regression models.

	Basic Model		Individual Controls		Country Controls		All Controls	
	Coef.	Std.Error	Coef.	Std.Error	Coef.	Std.Error	Coef.	Std.Error
Political Trust	0.109***	(0.005)	0.104***	(0.006)	0.117***	(0.005)	0.112***	(0.006)
Political Efficacy	0.176***	(0.011)	0.130***	(0.013)	0.187***	(0.013)	0.131***	(0.015)
Energy Dependence	–0.074***	(0.004)	–0.045***	(0.005)	–0.078***	(0.004)	–0.047***	(0.005)
Rural Area	–0.112***	(0.008)	–0.082***	(0.009)	–0.111***	(0.008)	–0.080***	(0.010)
Age			–0.001	(0.001)			–0.001	(0.001)
Education			0.074***	(0.006)			0.073***	(0.007)
Female			0.076***	(0.021)			0.070**	(0.023)
Household Income			0.022***	(0.005)			0.035***	(0.006)
Left-Right Orientation			–0.082***	(0.005)			–0.063***	(0.006)
Climate Worries			0.388***	(0.013)			0.389***	(0.015)
Cost Worries			–0.242***	(0.012)			–0.247***	(0.014)
Efficiency			0.014**	(0.005)			0.001	(0.006)
Curtailment			–0.015	(0.010)			0.002	(0.011)
Carbon Tax					0.002	(0.118)	0.070	(0.120)
Party Position					0.678**	(0.216)	0.553*	(0.219)
GDP					0.071	(0.053)	0.047	(0.053)
Cut-point 1	–1.362***	(0.077)	–0.964***	(0.109)	–0.831***	(0.240)	–0.460	(0.262)
Cut-point 2	–0.055	(0.077)	0.457***	(0.109)	0.472*	(0.240)	0.957***	(0.262)
Cut-point 3	0.957***	(0.077)	1.474***	(0.109)	1.475***	(0.240)	1.972***	(0.262)
Cut-point 4	2.809***	(0.078)	3.427***	(0.111)	3.349***	(0.241)	3.942***	(0.263)
N—Observations	40972		29890		33079		24379	
N—Groups	23		23		18		18	
Log likelihood	–61262.237		–43672.851		–49298.939		–35554.667	
Wald χ^2	2103.80		3313.56		1937.49		2758.56	

Notes: These results are from multilevel ordered logistic regressions, where individual respondents are nested in countries, with standard errors in adjoining columns. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

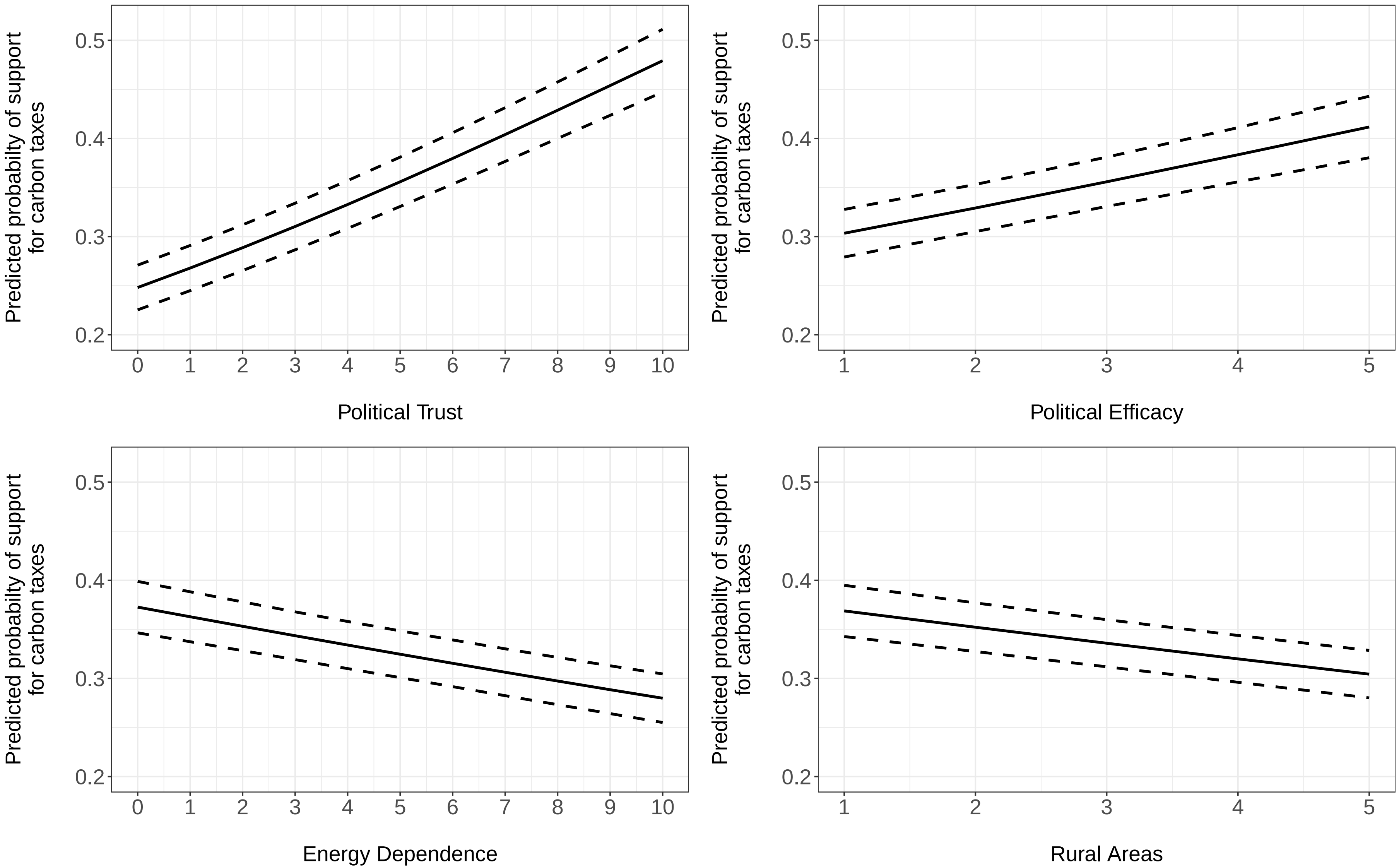

Figure S1: Predicted probabilities of support for increasing taxes on fossil fuels to reduce climate change. *Notes*: Predictions are based the forth model (All Controls) in Table S6. The dependent variable is the support for increasing taxes for fossil fuels to reduce climate change. Predictions are for the combination of positive response categories—5 ('strongly in favour') and 4 ('somewhat in favour'). Dotted lines represent 95% confidence intervals. Other variables are set to mean values.

Table S7: Multilevel ordinal logistic regression results by country.

	Political Trust		Political Efficacy		Energy Dependence		Rural Areas	
Country	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Austria	0.125***	0.021	0.397***	0.054	-0.11***	0.017	-0.145***	0.034
Belgium	0.177***	0.024	0.158**	0.054	-0.042*	0.02	-0.04	0.036
Czech Republic	0.079***	0.019	-0.041	0.043	-0.053**	0.016	0.017	0.032
Estonia	0.118***	0.022	0.135*	0.054	-0.099***	0.015	0.022	0.032
Finland	0.121***	0.023	0.062	0.056	-0.098***	0.021	-0.209***	0.03
France	0.168***	0.023	0.194***	0.049	-0.012	0.021	-0.165***	0.036
Germany	0.137***	0.02	0.278***	0.044	-0.099***	0.015	-0.148***	0.032
Hungary	0.016	0.023	0.254***	0.06	-0.086***	0.019	-0.082*	0.041
Iceland	0.034	0.035	0.326***	0.081	-0.068**	0.025	-0.162*	0.065
Ireland	0.164***	0.019	0.253***	0.045	-0.062***	0.015	-0.156***	0.028
Israel	0.021	0.018	0.022	0.04	-0.064***	0.015	0.175***	0.034
Italy	0.084***	0.02	0.214***	0.061	-0.083***	0.017	-0.039	0.037
Lithuania	0.038	0.022	0.23***	0.052	-0.157***	0.018	-0.196***	0.035
Netherlands	0.181***	0.031	0.365***	0.063	-0.058**	0.018	-0.128***	0.037
Norway	0.177***	0.031	0.323***	0.068	-0.043*	0.02	-0.236***	0.036
Poland	0.027	0.024	0.053	0.057	-0.041*	0.019	-0.129**	0.041
Portugal	0.128***	0.028	0.051	0.063	-0.069***	0.017	-0.122**	0.046
Russian Federation	0.053**	0.018	-0.029	0.046	-0.029	0.016	-0.181***	0.033
Slovenia	0.116***	0.03	0.209**	0.076	-0.084***	0.019	-0.094*	0.046
Spain	0.116***	0.022	0.049	0.052	-0.083***	0.018	-0.099**	0.037
Sweden	0.143***	0.029	0.216***	0.065	-0.067***	0.019	-0.199***	0.042
Switzerland	0.115***	0.029	0.235***	0.048	-0.098***	0.023	-0.268***	0.05
United Kingdom	0.115***	0.023	0.215***	0.054	-0.086***	0.016	-0.038	0.042

Notes: These results are from ordered logistic regressions, repeating the Basic Model in Table S6 for each country. The dependent variable is the support for increasing taxes on fossil fuels to reduce climate change. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

References

Alberini, A., Ščasný, M., & Bigano, A. (2018). Policy-v. individual heterogeneity in the benefits of climate change mitigation: Evidence from a stated-preference survey. *Energy Policy*, *121*, 565–575.

Berry, A. (2019). The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the French context. *Energy Policy*, *124*, 81–94.

Brännlund, R., & Persson, L. (2012). To tax, or not to tax: Preferences for climate policy attributes. *Climate Policy*, *12*(6), 704–721.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods.* Thousand Oaks, Sage.

Carattini, S., Baranzini, A., Thalmann, P., Varone, F., & Vöhringer, F. (2017). Green taxes in a post-Paris world: Are millions of nays inevitable? *Environmental and Resource Economics*, *68*(1), 97–128.

Donnelly, M. J., & Pop-Eleches, G. (2018). Income measures in cross-national surveys: Problems and solutions. *Political Science Research and Methods*, *6*(2), 355–363.

ESS. (2016). European Social Survey Round 8 Data [Data file edition 2.1]. [Norwegian Centre for Research Data, Norway—Data Archive and distributor of ESS data for ESS ERIC]. Retrieved February 1, 2019, from https://www.europeansocialsurvey.org/download.html?file=ESS8e02_1&y=2016

Garzia, D., Trechsel, A., & De Sio, L. (2017). Party placement in supranational elections: An introduction to the euandi 2014 dataset. *Party Politics*, *23*(4), 333–341.

Gevrek, Z. E., & Uyduranoglu, A. (2015). Public preferences for carbon tax attributes. *Ecological Economics*, *118*, 186–197.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Essex, Pearson.

Hammar, H., & Jagers, S. C. (2006). Can trust in politicians explain individuals' support for climate policy? The case of CO2 tax. *Climate Policy*, *5*(6), 613–625.

Hsu, S.-L., Walters, J., & Purgas, A. (2008). Pollution tax heuristics: An empirical study of willingness to pay higher gasoline taxes. *Energy Policy*, *36*(9), 3612–3619.

Jagers, S. C., & Hammar, H. (2009). Environmental taxation for good and for bad: The efficiency and legitimacy of Sweden's carbon tax. *Environmental Politics*, *18*(2), 218–237.

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

Kotchen, M. J., Turk, Z. M., & Leiserowitz, A. A. (2017). Public willingness to pay for a US carbon tax and preferences for spending the revenue. *Environmental Research Letters*, *12*(9), 1–5.

OECD. (2018). *Gross domestic product (GDP) [indicator]*. Retrieved February 5, 2018, from https://data.oecd.org/gdp/gross-domestic-product-gdp.htm

Thalmann, P. (2004). The public acceptance of green taxes: 2 million voters express their opinion. *Public Choice*, *119*(1–2), 179–217.

World Bank. (2019). *Carbon pricing dashboard [dashboard]*. Retrieved July 26, 2019, from https://carbonpricingdashboard.worldbank.org/map_data