

Prices vs. Quantities from a Citizen’s Perspective

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Abstract

The implementation of optimal environmental policies hinges on sufficient public support. We study the relative merit of regulation by “prices vs. quantities” by assessing the instrument choice between carbon taxes and emissions trading systems from the perspective of public perceptions. In a stated-choice experiment across 15,000 respondents from seven European countries, we elicit how citizens perceive the (non-)economic properties of carbon taxation and emissions trading, and study how they are linked to public support. Our analysis is guided by value-based, reason-based and motivated reasoning approaches to public choice. While there is considerable cross-country variation in the appraisal of both instruments, treatments effects of instrument framing are sizeable: carbon taxes are consistently more often perceived as increasing the state budget, harming the economy, and increasing costs of living and production, and emissions trading is more often perceived as easy to evade. Our results suggests that public opinion on carbon pricing is driven by perceptions around taxes being a ‘tougher’ measure, and that emissions trading may be less prone to solely appeal to pro-climate segments of European societies.

JEL codes — Q54, Q58, D78, H23, P48

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1 Introduction

Since Weitzman’s (1974) seminal article ‘Prices vs. Quantities’, economics has developed a mature understanding of the economic considerations that govern the choice between carbon taxes and emissions trading. Beyond questions of efficiency under uncertainty (Pizer, 1999) and equity, a considerable amount of literature has elucidated the comparative political economy of carbon taxes and emissions trading systems (Hepburn, 2006; Pizer and Prest, 2020). Aside from how both instruments compare on efficiency, how well they perform under political-economic barriers and whether they are compatible with existing political and legal institutions, there is little comparative work on the appraisal of citizens¹. However, while carbon taxes and emissions trading systems can, at least theoretically, be designed to be economically equivalent, both instruments may be perceived as markedly different in the eye of the public. This has potential consequences for the public appeal and political feasibility of carbon pricing. We study the perceptions of specific properties of carbon taxes and emissions trading, including their potential to raise revenues and how their respective cost-burden is shared between consumers and companies. Identifying variation in the appraisal of two instruments that are economically almost equivalent allows us to develop novel theory on the mental models and economic reasoning that citizens employ when evaluating climate policies. This paper contributes to a growing literature using surveys for uncovering the perceptions and reasoning behind citizens’ stated preferences in favor of or against certain economic policies (Dechezleprêtre et al., 2022; Stantcheva, 2023), and builds on substantive body of research on public support of carbon taxation.

We conducted a discrete-choice experiment with more than 15,000 citizens across seven European countries (France, Germany, Greece, Italy, Poland, Spain and the United Kingdom) to gain a better understanding of how the public reasons about carbon taxes and emissions trading. Overall, there is, substantial cross-country variation in the perception of carbon taxes and ETS and the level of support for both policies, with emissions trading more popular in Italy, Spain and France, and carbon taxes more popular with the German public. Using randomized framing treatments on carbon taxation and emissions trading, we find systematic variations in the perception of economic and non-economic policy properties across the whole sample. In particular, we find that citizens associate carbon taxes more strongly with an increase in living costs, production costs, negative effects on the economy and an increased state budget, while emissions trading systems are overall perceived as easier to evade. Aside from heterogenous *perception* of policy properties, we find evidence in favour of heterogenous *valuation*: the perception that a tax increases living costs has twice the negative effect on support than in the case of the ETS treatment.

In identifying properties of carbon taxes and ETS that are potentially relevant to citizens’ perceptions and opinion of carbon pricing policies, we build on a growing body of empirical research. Previous research has repeatedly shown that citizens care about three broader criteria when appraising a climate policy: (1) costs to self, (2) fairness concerns, and (3) environmental effectiveness (Drews and van den Bergh, 2016; Maestre-Andrés et al., 2019; Sommer et al., 2022) . In our survey, we will mainly focus on properties that are perceived to determine the effectiveness of carbon pricing in curbing emissions. This focus is justified given the findings by Baranzini and Carattini (2017) that “the lack of perception of primary and ancillary benefits is one of the main barriers to the acceptability of carbon taxes.” Nevertheless, our analysis could also cast light on previously under-examined dimen-

¹Two notable exceptions are the lab experiment by Cherry et al. (2017) on support of price-based and quantity-based environmental regulation, with elicitation of people’s worldviews, and the study by Lachapelle (2017) on questions of comparative political communication.

sions of fairness concerns, by investigating how the cost burden of carbon taxes and ETS is perceived to be distributed between consumers and companies (Andor et al., 2022). We specifically build on three strands of research findings. First, research has shown that citizens care strongly about the emissions reductions effect of carbon pricing but tend to have biased perceptions of the mitigation potential (Kallbekken et al., 2011). Second, pessimistic beliefs about the costs and effectiveness of pricing carbon have resisted information treatment, suggesting that aversion towards carbon taxes may reach deeper than lack of information (Douenne and Fabre, 2022). Indeed, consumers show more support for carbon taxes when they are framed under a different name, e.g., “climate contribution” (Baranzini and Carattini, 2017), and designed to be levied further upstream, rather than directly at the consumer level (Hardisty et al., 2019). For us, this evidence points to the possibility that there could be significant differences between how carbon taxes and emissions trading systems are perceived in terms of their cost implications, mitigation effect, and the distribution of burden between consumers and companies. We advance the existing research by comparing perceptions of effectiveness between carbon taxes and ETS, and testing whether the (mis)perception of specific instrument properties and their mitigation mechanism could help explain the phenomenon of “Pigouvian ignorance”. Third, a number of attitudinal variables and political preferences has been linked with support of carbon taxes and other environmental regulation, including trust in government (Fairbrother, 2016; Rafaty, 2018), pro-environmental attitudes and concern about climate change, and worldviews (Cherry et al., 2017). We assess and compare, to what extent these variables are also linked to support of emissions trading.

Taking account of people’s perceptions of the detailed properties of carbon pricing is important for the following reasons: Eliciting support as such yields no indication whether somebody rejects a policy proposal because they disagree with a policy’s objectives, including the desired level of mitigation ambition and preferred form of burden-sharing, or because they doubt that the policy will deliver as planned, or produce negative side effects. For an informed societal debate about policy options, it is important to disentangle where there is value-based disagreement about the objectives of policy instruments and where there is epistemic disagreement about the mechanism and expected real-world outcomes of climate policy. Our research is designed to investigate where there is disagreement about the anticipated outcomes of carbon taxes or ETS, and which factors can be understood to drive such disagreement. Understanding recurrent patterns in misperceptions about carbon taxes and emissions trading will allow policy makers to target information better, as well as tweaking the design of policy instruments to make them more appealing to specific groups in society.

The remainder of the article is structured as follows: In Section 2, we will compare different choice-theoretic approaches that explain the public’s appraisal of carbon pricing instruments, and relate them to the empirically observed discrepancies in perceived properties. Section 3 introduces the survey design and describes the data. The main results on the difference in perceived characteristics of carbon taxes and ETS, and differences in support for both instruments, are presented in Section 4. Section 5 discusses policy implications and concludes.

2 Theoretical Frame

In welfare-economic appraisal, carbon pricing designs are compared in terms of efficiency and distributional incidence (i.e., equity). Carbon taxes and emissions trading systems can be designed equivalently on both accounts. The public appraisal of both instruments takes a different perspective. Citizens do not strictly appraise policies on economy-wide terms, but take, at least in part, a ‘decen-

tralized’ view: they care about the effects on themselves. Moreover, insofar as citizens care about society-wide outcomes, what they care about, and the extent to which they care, may differ substantially from the social planner perspective underlying welfare analysis of climate policies. These two divergences alone do not suggest any difference in how carbon taxes and emissions trading would be appraised, as long as both instruments entail the same personalised costs and economy-wide outcomes.

Instead, the public evaluation of emissions trading and carbon taxes can be approached based on the following questions: First, what is it, exactly, that citizens value, and according to which set of choice rules/principles? Second, can we assume that citizens accurately perceive that, which they value?

2.1 Theory on public instrument choice

Several strands of choice theory within the social sciences can elucidate how ordinary citizens decide whether they approve of a policy and where the equivalence between carbon taxes and emissions trading might break down: (i) theories of value-based choice based on value maximization and stable preferences, (ii) theories of reason-based choice, and (iii) a collection of theories on ‘unreasoned’ ad-hoc appraisal (see Table 1 for overview).

Value-based theories, such as those in the tradition of public choice theory, have citizens chose to support or reject a policy purely based on the expected costs and benefits, as well as their environmental preferences (Besley and Persson, 2023)². On a rational-choice interpretation, this should imply that citizens chose to support a carbon pricing policy above a certain threshold of cost-effectiveness, which fulfills their individual willingness to pay for abatement. Once this threshold is met, citizens generally prefer efficiency principles (i.e., minimizing cost per abated unit). Other value-based choice theories, such as prospect theory (Kahneman and Tversky, 2013), can account for systematic biases in the evaluation of costs and benefits, such as the over-weighing of personal costs implied by carbon pricing due to loss aversion (Greene, 2011). Generally, value-based theories of how carbon pricing policies are appraised rely on the premise that preferences are stable, and that the choice criteria are consistent across policy options. This theory would posit that equivalently designed carbon taxes and ETS, with the same environmental stringency and cost implications, should yield equivalent support.

Reason-based theories, on the other hand, posit that people focus on *motivationally salient* properties of climate policies when deciding whether or not to endorse them (Dietrich and List, 2013, 2016; Shafir et al., 1993). For example, in the case of carbon pricing, such properties could include anticipated personal costs, whether it will raise government revenues or whether it would be easy to evade, but it may also include more superficial properties such as the name ‘tax’ or ‘trading system’. Reason-based evaluation of carbon pricing has two implications: first, citizens’ approval of carbon taxes and emissions trading may also be motivated by ‘immaterial’ non-economic properties (i.e., other than costs and benefits). Second, in contrast to value-based theories, what motivates people’s choices is not necessarily consistent across options, but may vary with the context and the framing of a policy option. Appraisal is therefore instrument-specific, or context-dependent (Dietrich and List,

²Diverging from pure self-interest, accounting for environmental preferences can go beyond the instrumental value of an intact environment on the consumption bundle of the affected individual but may also include altruistic concern to maintain the instrumental value of nature (i.e., ecosystem services) for far-away people and future generations, as well as non-anthropocentric concerns for the well-being and flourishing of animals and nature as a whole (Fleurbay and Leppanen, 2021).

Table 1: Choice theories on carbon pricing appraisal

	Value-based	Reason-based	Ad-hoc
Focus of appraisal	Costs and benefits	Motivationally salient properties	<i>unclear</i>
Ascription of support	Maximization of observable or expected value	Subjectively reasoned, based on properties	Ad-hoc appraisal
Consistency of reasoning	Consistent across instruments	Instrument-specific	<i>unclear</i>
Reasoning about support	Ex-ante	Ex-ante	Post-hoc justification
Leveraging support	Substantive policy design	Substantive policy design, policy framing	<i>unclear</i>

2016). Even when both instruments are designed with equivalent stringency, the frame of a 'carbon tax' might highlight different properties and reasons to support or oppose the instrument, compared to the 'emissions trading' frame.

Finally, **theories of ad-hoc appraisal and motivated reasoning** (Kunda, 1990; Chater, 2018) would deny the ex-ante 'intermediary' role of reasons for decision formation on policies. Instead, the reasoning process is reversed: people form spontaneous short-hand evaluations of a presented instruments and use reasoning merely as post-hoc justifications for their appraisal. These theories posit that citizens convince themselves of certain economic 'facts' about carbon taxes and emissions trading systems due to deeper values or ideological commitments for or against the policy. Findings on the French public's resistance to change beliefs about carbon taxes in light of new information (Douenne and Fabre, 2022), offer some support for this theory.

Both value-based and reason-based accounts of policy choice rely, *prima facie*, on the premise that the true costs and benefits (in value-based theories), and policy properties (in reason-based theories) are readily discernible. In reality, however, citizens rely on their perceptions to anticipate costs, and benefits, or to ascribe properties such as an instrument being 'easy to evade'. Such perceptions are often heuristically derived from past experiences, associations and worldviews³, meaning they are not necessarily stable and reliable. Indeed, empirical studies have shown that citizens often misperceive the costs, distributional effects and environmental outcomes of carbon pricing (Douenne and Fabre, 2022).

The different theories of appraisal may lead to diverging policy implications for increasing support for carbon pricing. Value-based theories in the rational-choice tradition suggest that support can be engineered by substantive policy design alone, i.e. by varying the level of stringency and the distribution of the cost burden in such ways that a critical share of citizens incurs net benefits (accounting for their individual willingness to pay for climate protection), for example via revenue recycling (?). Reason-based choice theories as well as theories of spontaneous appraisal would posit that the con-

³When they are only vaguely familiar with an issue, citizens may draw from an even broader set of higher-order values, vague impression, and beliefs, and new ad-hoc reasoning (Tourangeau et al., 2000).

text and presentation of policies, including labeling (Baranzini and Carattini, 2017), is important for opinion formation. Those theories would differ on whether altering the perception of critical policy properties – either through substantive design or through framing and more targeted information – could change support.

2.2 Model specification

In this study, we take the comparison of two economically close-to-equivalent policy options, carbon taxes and emissions trading, as a favourable testing ground for studying the public appraisal of climate policies. Assessing where the equivalence of both instruments "breaks down" allows us to discern more about the suitability of different choice theories in explaining public support or opposition. First, independently from the valuation rule, many theories presume that properties, such as costs and benefits and further non-economic policy properties, are objectively given and readily discernible. The simple setting of a stated-choice experiment allows us to test whether perceptions of costs and benefits and other policy properties differ between carbon taxes and emissions trading. Second, we can test correlationally, whether valuation or reasoning on carbon taxes and emissions trading draws on the same properties. This not being the case would yield some evidence in favour of heterogenous (i.e., instrument-specific) evaluation.

General model

For illustration, let us fix ideas in a simple framework, which is compatible with both value-based and reason-based theories of public appraisal: support S of citizen i for a set of carbon pricing instruments $C = \{p, q\}$ (tax and ETS) is a function of different policy properties x , weighted by weights δ . These properties can be limited to a simple cost-benefit calculus, as consistent with rationalized value-based theories, or encompass further material or immaterial properties. Generally, properties are assumed to be perceived, hence, they can vary between individual citizens i .

$$S_i(x_{i,C}, \delta_{i,C}, C) \tag{1}$$

Differences in support between instruments p and q are then either explained by differently perceived properties ($x_{i,p} \neq x_{i,q}$) (*heterogenous perception*), or different weights ($\delta_{i,p} \neq \delta_{i,q}$) (*heterogenous valuation*).

Econometric specification

In our experimental setting, we can obtain evidence on whether we have heterogenous perception and/or valuation by means of simple econometric specifications. First we will estimate equation (2), where we regress policy properties x_i , as perceived by individual respondent i on the treatment variable C (indicating whether respondents have been presented either with carbon taxes or emissions trading) and a vector of socio-demographic and attitudinal controls z_i . A significant coefficient β_2 indicates heterogenous property perceptions across carbon taxes and emissions trading.

$$x_i = \beta_1 + \beta_2 C + \beta_3 z_i + \beta_4 \epsilon_i \tag{2}$$

To assess how properties are linked to support, we estimate equation (3), where support S_i is regressed on treatment variable C , several policy properties x_i and a vector of socio-demographic and attitudinal controls z_i . A significant coefficient δ_4 for the interaction between instrument type and policy property hints at heterogenous valuation or reasoning between carbon taxes and ETS.

$$S_i = \delta_1 + \delta_2 C + \delta_3 x_i + \delta_4 C x_i + \delta_4 z_i + \delta_5 \epsilon_i \quad (3)$$

The results section of this article will be structured to assess whether there are potential differences in the perception of policy properties (Section 4.2), and whether we see consistent or heterogenous links between policy properties and support (Section 4.3).

3 Survey Design and Data

We conducted an inter-European representative survey with a sample size of 15,000 across seven European countries. Within this sample, 9,000 observations fall across six countries (1,500 per country), specifically France, Greece, Italy, Poland, Spain, and the United Kingdom. In Germany, the survey is implemented by the survey institute *Forsa* and draws a sub-sample from the existing Ariadne panel (Frondel et al., 2023), which allows us to sample around 6,000 individuals. In all other regions, we collaborate with the market research institute *Bilendi* as an implementing agency. We gather a large set of socio-economic and demographic background information as well as a large suite on psychological and political attitudes and environmental preferences. The data has been sampled to be representative along important socio-demographic dimensions, including age, gender, education, and income level.

Our analysis aims at identifying systematic variation in perceptions of economic and non-economic properties of carbon taxes and ETS. We also study the links between perceptions of policy properties and support for each instrument. We further aim to test the hypothesis that support for carbon taxes or ETS increases when respondents believe the instrument targets the (in their perception) relevant actor for effective decarbonization (i.e., government, consumers, or companies). More specifically, we expect that carbon taxes are more popular with citizens, who believe that governmental efforts and consumer-driven change play a primary role for decarbonising society, and who believe that the relevant mechanism of carbon taxes consists in raising revenue for green investment or incentivising demand-side change. On the other hand, we expect emissions trading to be more popular among people adhering to the idea that decarbonisation relies primarily on the action of companies and seeing emissions trading as an instrument to primarily incentivise firms to decarbonise their production.

3.1 Survey Structure

The survey is structured as follows (see Figure 1): We first elicit people’s psychological and environmental attitudes, as well as their political attitudes, world views and more general beliefs about government, companies, and citizens, and which actor they think is most important in the transition to a climate-friendly economy. In a next step, we test people’s knowledge of existing carbon pricing schemes in their countries, including whether people know if their countries currently have a national carbon tax or an ETS and at which level national carbon prices currently stand. We then separate the sample in two randomized groups and provide them with short descriptive information and definitions of either carbon taxes or emissions trading. In a third step, we elicit their support for the group’s assigned instrument and proceed with questions aimed at their intuitive beliefs about the intended mechanism of carbon taxes and ETS, their perceptions of the policy’s incidence between consumers and companies, as well as their perception of environmental, economic, and distributional effects and further policy characteristics. In a last step, we test people’s factual knowledge and understanding about their group’s assigned carbon pricing policy. To avoid priming at an earlier stage, at this stage

we also inquire about respondents’ familiarity with the European Union Emissions Trading System. As the field time of this survey coincided with political concerns around energy security and surging energy prices in the European Union as a result of the Russian war of aggression against Ukraine, we further elicit people’s concern about rising energy costs and the perceived burden cost surges have had on their household already.

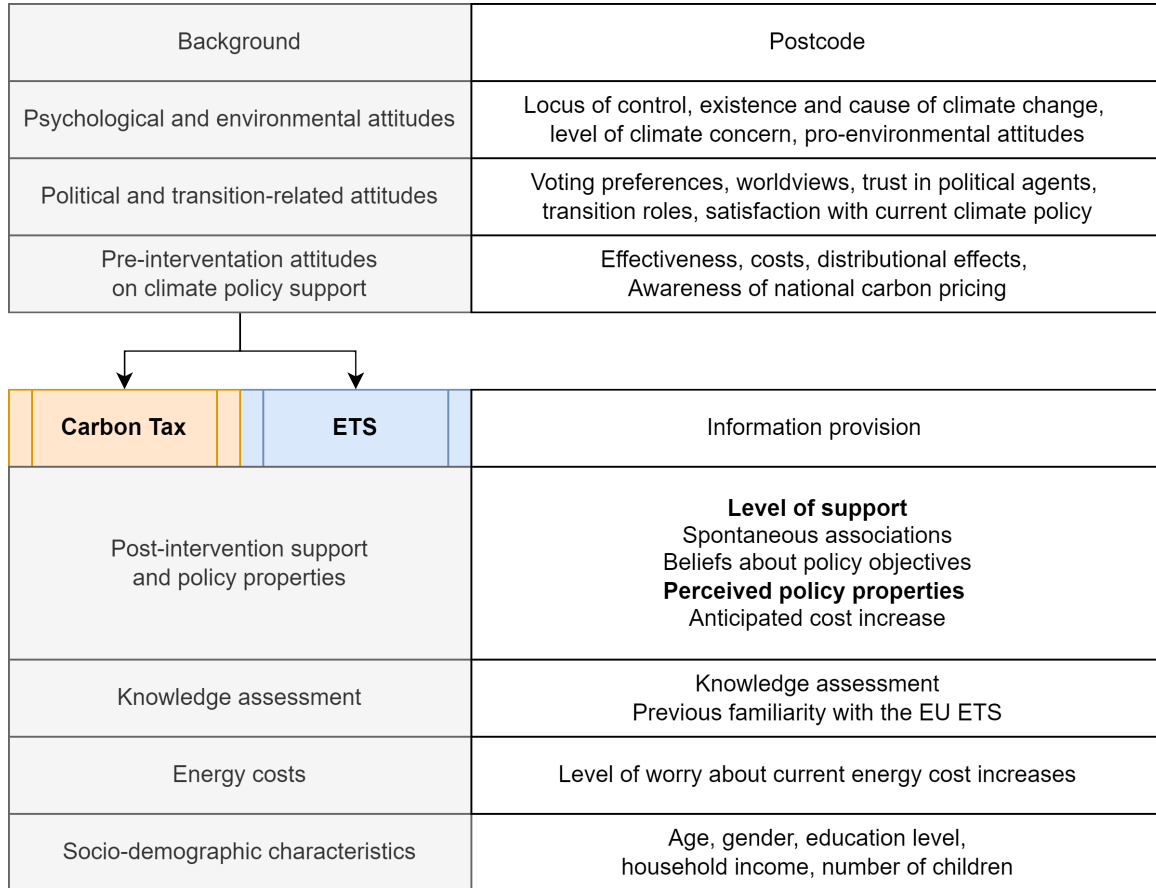


Figure 1: Survey structure

3.2 Data

The survey data was collected between 28 November and 22 December 2022 by survey implementation agencies *Forsa* and *Bilendi*, after successful pre-testing and national soft launches. The median answering time in the Bilendi sample was around 17 minutes in both treatment groups. The country datasets collected by Bilendi were sampled to be representative of the underlying populations across the dimensions age, education and gender. Since the German dataset stems from a specific-purpose panel that was not representative of relevant socio-economic characteristics, we used post-stratification weights to correct for the over-sampling of male respondents, older age strata and high-educated respondents. Due to different country sample sizes, notably the large sample size of German respondents, regression results were obtained using frequency weights to achieve results that are balanced across countries.

Table 2 depicts weighted summary statistics across the two treatment groups for socio-demographic characteristics, political attitudes, environmental attitudes, and respondents' statements on which factors matter for their support of climate policies. Using Wilcoxon tests, we find no significant differences in the means of socio-demographic and attitudinal co-variates, implying successful randomization across treatment groups. Concerning socio-demographic characteristics, 19% of our sample lives in rural areas, 21% have a college degree, and 25% belong to the lower income tertile.

Attitudinal variables were elicited with five-point Likert scales and were dichotomized for simple interpretation (e.g., 'trust in government' has been coded as '4' and '5' on a five-point Likert scale ranging from "strongly distrust" to "strongly trust"). Concerning political attitudes, on average 21% (20%) of respondents in our sample trusts in government (businesses), and 32% of the sample feel that they can trust their fellow citizens. Our sample includes 17% of respondents leaning towards far-right parties, and 24% of the sample either declared to be a non-voter, or did not want to state their voting preferences. Concerning environmental attitudes, 57% of our sample are moderately or strongly concerned about climate change, and a similar share of people (55%) agrees that current climate policies are not ambitious enough. A large majority of the sample (78%) is worried about energy costs (amid the energy crisis in 2022). Differences in how important respondents believe the government, businesses and citizens to be for achieving decarbonization goals are rather moderate, with the shares of respondents holding an actor to be important ranging between 66% and 72%. We further asked about how important the instrument's effectiveness, personal cost implications, fair burden-sharing and co-benefits are for their decision to support or reject a climate policy. While each of these factors is deemed important by between 40-49% of the respondents, it is remarkable that the share of respondents agreeing that the policy has to share the financial burden fairly across society (49%) is larger than the share of respondents agreeing that their personal costs ought to be kept low (40%), stressing the role of fairness and not strictly self-centered factors for support (Sommer et al., 2022).

4 Results

In this section, we first present descriptive results, including the support levels for carbon taxes and emissions trading across different countries in our sample. Subsequently, we present the treatment effects of framing carbon pricing as 'carbon tax' or 'emissions trading' on support levels and the perception of economic and non-economic policy characteristics. Lastly, we assess differences in how support is linked to different socio-economic characteristics, attitudes and policy perceptions by looking at the corresponding treatment interaction effects.

We find significant differences between the carbon-tax and ETS-group across all stages of our analysis. Descriptively, the share of respondents opposing carbon taxes is consistently higher, and more respondents were undecided about their opinion of emissions trading. There are also cross-country differences in the support levels and comparative preferences for either instrument. We further find robust variations in the perception of cost implications between carbon taxes and emissions trading: carbon taxes are more often perceived as costly, both to the own purse, as well as to the producing sectors and the economy as a whole. Emissions trading, on the other hand, is more often perceived as 'easy to evade'. Finally, the treatment interactions point towards heterogenous valuation, or design-dependent reasoning, about carbon prices: the way in which attitudes or policy perceptions are linked to support differ between both instruments. More specifically, the link between support and green

Table 2: Summary Statistics (full sample)

Variables	Mean (Tax)	Mean (ETS)	p-value (MWW)
Socio-demographic variables			
60+	0.204	0.207	0.666
Female	0.497	0.492	0.551
Rural areas	0.195	0.192	0.739
College degree	0.204	0.211	0.400
Lower income tertile	0.256	0.251	0.538
Political attitudes			
Trust in government	0.205	0.214	0.248
Trust in businesses	0.199	0.198	0.895
Trust in citizens	0.310	0.325	0.097
Green voting preference	0.061	0.063	0.671
Left voting preference	0.195	0.189	0.383
Liberal voting preference	0.046	0.047	0.732
Conservative voting preference	0.141	0.137	0.558
Extreme-right voting preference	0.174	0.171	0.760
Environmental attitudes			
Concerned about climate change	0.564	0.568	0.697
Worried about energy costs	0.786	0.782	0.588
Climate policies not ambitious enough	0.546	0.544	0.822
Government is important for net-zero transition	0.657	0.664	0.449
Businesses are important for net-zero transition	0.711	0.724	0.109
Citizens are important for net-zero transition	0.692	0.693	0.916
Support factors			
Has to reduce emissions effectively	0.409	0.408	0.897
Has to keep personal costs low	0.397	0.401	0.662
Has to share the financial burden fairly	0.492	0.489	0.690
Has positive co-benefits	0.423	0.414	0.337

voting preferences and support and high educational attainment is only present for carbon taxes. Furthermore, the negative link between support and perceived costs for oneself and the economy is stronger in the carbon tax than the ETS-group, while the perception of the policy being 'easy to evade' is only negatively associated with support for carbon taxation. In sum, these results suggest that public appraisal of both instruments centers around carbon taxes being perceived as a 'tougher' measure, while emissions trading may be less prone to solely appeal to traditionally pro-climate segments of European societies.

4.1 Support levels for Carbon Taxes and ETS

For elicitation of support attitudes in surveys, there are different interpretations of how 'support' should be conceived, and which forms of endorsement are relevant to the feasibility of climate policies. For the remainder of the survey we follow a narrow interpretation and code support as binary and explicitly stated (i.e., selecting '4' or '5' on a five-point Likert scale). We further repeat our analysis with a measure of 'tolerance', interpreted as those not opposing the measure explicitly (i.e., selecting '1' or '2') (see Appendix).

Figure 2 depicts the support levels at the more granular structure of Likert-scale answers, including "Don't Know" answers. While across the whole sample average support for carbon taxes and emissions trading is roughly even-handed at around 35 percent of the sample (excluding 'Don't know' answers), there are substantial cross-country differences. In Italy and Spain, emissions trading is supported more strongly than carbon taxes (by a margin of 7 and 6 percentage points respectively). In Germany and the UK, on the other hand, carbon taxes are supported more strongly than ETS by a margin of approximately 0.11 and 0.06 respectively. Furthermore, in France, Spain and Italy, the share of respondents strongly in opposition of the policy is considerably smaller in the ETS group, compared to the carbon tax group. Particularly noteworthy is the consistently higher share of "Don't Know" answers for support of ETS, with approximately a quarter of respondents in France, Italy and the UK not providing a clear answer for support of emissions trading.

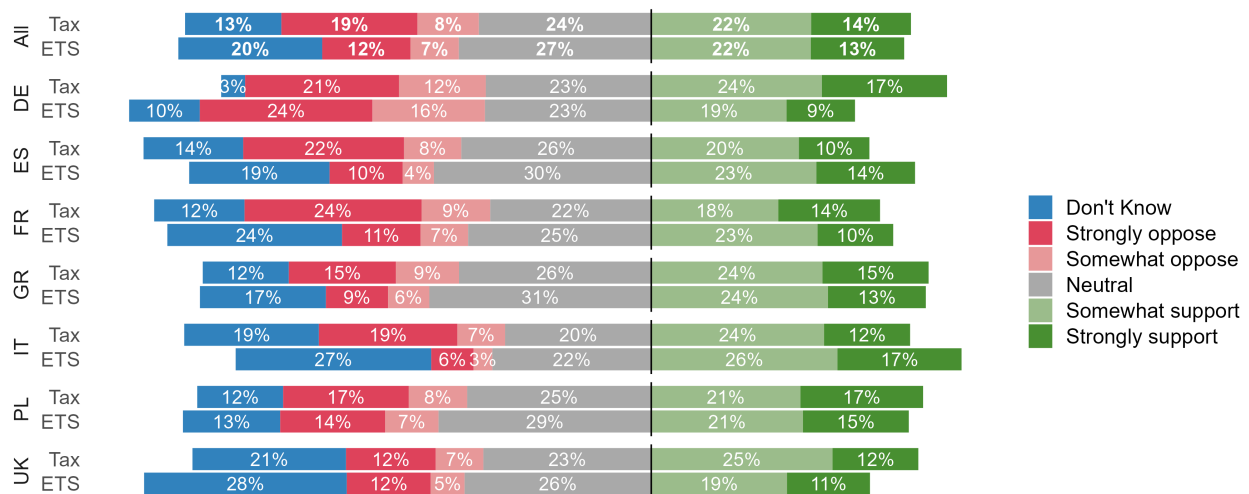


Figure 2: Support for carbon taxes and emissions trading by country (full Likert scale)

4.2 Public Perception of Instrument Properties

At the core of our experimental design lies the quest to assess potential differences in citizens' perceptions of the economic and non-economic properties associated with both carbon taxation and emissions trading. By providing only sparse information about the respective carbon pricing policy to both treatment groups, we aim at assessing respondents' intuitive associations and evaluations. Since support was elicited at an earlier stage of the survey, we cannot rule out that some of the below perceptions are the result of motivated reasoning.

Table 3 highlights robust treatment effects in the perception of policy properties. Treatment effect denotes the difference between being assigned in the '*Carbon Tax*' (treatment = 0) versus '*ETS*' group (treatment = 1). Confirming the descriptive results above, there is a significant difference in the share of respondents opposed to the policy, with opposition among the ETS-group reduced by 8 percentage points in comparison to the baseline level of 23 percent in the tax group. Concerning cost implications, around half of the sample agree that carbon taxes will markedly increase their living expenses, raise production costs and grow the government budget, and a third agrees that it will have negative impacts on the economy. In comparison, the 'emissions trading' treatment reduces these perceptions by between 6 and 11 percentage points on average. On the other hand, emissions trading is more often perceived as easy to evade, with 38 percent agreement, compared to 30 percent agreement in the carbon tax group. Perceptions on the distributional properties and the positive effects of carbon pricing on emissions reductions and innovation do either not differ significantly across carbon taxes and emissions trading, or, where effects are significant, they are negligibly weak. On average, respondents in both groups are in agreement that the burden of carbon pricing falls more strongly on businesses than consumers.

Moreover, we have tested for people's beliefs concerning the objectives of the policy and the 'Pigouvian' mechanism of carbon pricing. One hypothesis to explain opposition of carbon pricing, and the comparative popularity of combining it with green spending, is that people see carbon prices predominantly as a mechanism to raise government revenues, which are then to be spent on decarbonization measures. In our survey, respondents do not identify revenue generation as a dominant objective, at least in comparison to the other suggested objectives of '*incentivising changes in consumption behaviour*', and '*incentivising a greening of producing processes*'. On average, there are also no significant differences between how respondents ascribe policy objectives to carbon taxes and emissions trading. We further elicit beliefs in 'Pigouvian' principles by asking respondents whether they believe the emissions reductions effect is maintained even when revenues are distributed back to consumers (i.e., they are not to be spend on additional mitigation measures). The share of respondents believing in the isolated effect of relative price changes is fairly low at 31 percent. Notably, we find that 'Pigouvian' beliefs are independent from the question of whether a carbon price is presented as a tax or an emissions trading system.

Splitting the sample per country highlights strong cross-country heterogeneity in how carbon taxes and emissions trading systems are perceived (see Appendix). Most notably, respondents in Greece, and to a lesser degree in Poland, see on average fewer differences between regulation by taxation and emissions trading. Whether this lack of significant mean differences is, for example, due to lesser knowledge or politicization of the debate on carbon pricing remains a subject for further research.

Table 3: Differences in support and perceptions of Carbon Taxation and ETS (full data)

Perceived policy properties	Mean (Tax)	Treatment effect (ETS)
Support		
Support	0.35	-0.005 (0.009)
Opposition	0.23	-0.083*** (0.008)
Policy objectives		
Increase in government revenues	0.46	-0.015 (0.010)
Incentives for consumers towards sobriety	0.51	0.015 (0.010)
Incentives for businesses to lower carbon footprint	0.57	0.009 (0.009)
Policy properties: cost implication		
Increases costs of living	0.52	-0.092*** (0.010)
Increases businesses' production costs	0.50	-0.063*** (0.010)
Increases government budget	0.46	-0.107*** (0.010)
Policy properties: distributional burden		
Equitable burden-sharing	0.26	0.019* (0.008)
Businesses most burdened	0.64	-0.014* (0.007)
Consumers most burdened	0.20	0.007 (0.008)
Policy properties: effects		
Reduces emissions effectively	0.32	-0.003 (0.009)
Positive effect on innovation	0.36	0.023* (0.009)
Negative effect on the economy	0.34	-0.075*** (0.009)
Easy to evade	0.30	0.078*** (0.009)
Believes in Pigouvian effect	0.31	-0.001 (0.009)
Controls		Yes
Country-fixed effects		Yes
Observations		9652

Note: This table shows the treatment coefficient of nine separate linear regressions of policy property perceptions. Treatment effect denotes the difference between being assigned in the "Carbon Tax" versus "ETS" group. Controls include socio-economic variables, political attitudes and climate-change related attitudes. Standard errors are shown in parentheses. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.3 Differences in support between ETS and Carbon Tax

To assess the comparative political feasibility of carbon taxes and emissions trading, correlational analysis helps identify along which criteria support for each instrument diverges. Differences between carbon taxes and emissions trading in how variables are linked to support may further indicate that not only perceptions, but also the appraisal (i.e., which factors matter for support) are specific to carbon pricing design.

Figure 3 depicts the results of separate regression analyses for both treatment groups, where we regress support against a suite of socio-demographic controls, attitudinal variables and instrument perceptions. We further control for country-fixed effects, which are not depicted here. All coefficients that are not at least significant at the 10-percent level (p-values corrected for multiple testing), were greyed out. For both instruments, the strongest positive correlates of support are mitigation effectiveness (i.e., perception that emissions are effectively reduced) and positive perceived effect on innovation. This is in line with previous literature that identified perceived environmental effectiveness as a first-order factor for public support of carbon prices (Baranzini and Carattini, 2017). Other comparatively large associations with support are concern about climate change and positive perceptions of the burden-sharing between consumers and businesses implied by the policy.

Table 4 depicts the corresponding treatment interactions per variable group (i.e., the difference in correlation coefficients depending on the treatment with the 'carbon tax' or 'emissions trading' frame), with carbon taxes as the baseline. These correspond to the distance between instrument-specific correlation coefficients in Figure 3. Concerning cross-country differences, the coefficients for Italy suggest a robust level of tax aversion in Italy (i.e., that cannot be explained by the remaining co-variates), which however is tax-specific and reversed in the ETS group. Concerning political and environmental attitudes, positive associations of support for carbon taxes with college-level education, a preference to vote for a green party and the perception that climate policy is "not ambitious enough" only apply to the carbon tax group, but not to the ETS treatment. Trust in government is positively associated with support for both instruments, while there is a positive relationship with trust in businesses only in the ETS group. Perceptions of the policy being costly (to either consumers or the economy) have a stronger negative association with support for carbon taxes, while the perception that the policy is "easy to evade" has a small positive connotation for the support of taxes, but none for support of emissions trading.

Our results indicate that differences in appraisal between the two equivalently stringent carbon pricing instruments are due to both heterogeneous perceptions and valuations of properties. Not only do people consistently perceive taxes as costlier than ETS. The perception that a tax increases the cost of living has also twice the negative effect on support than in the case of an ETS. Hence, the effect of biased perceptions of a tax on support is magnified by the fact that people are less willing to accept a increase in living costs resulting from a tax.

There are several caveats to our research. Correlational analyses can help highlighting the link between support of carbon taxes and emissions trading on the one hand, and socio-demographic variables, attitudes, and policy perceptions on the other hand. While we can draw from previous economic research to contextualise the correlations with socio-demographic factors and attitudes, research on the here elicited policy properties is scarce. Importantly, our research design does not allow for drawing conclusions on causal links between policy properties and support. Rather than

representing a reasoned opinion formation on support based on policy properties, the link might just as well hint at motivated reasoning: policy properties may be ascribed based on an ad-hoc liking/dislike of carbon taxes or emissions trading

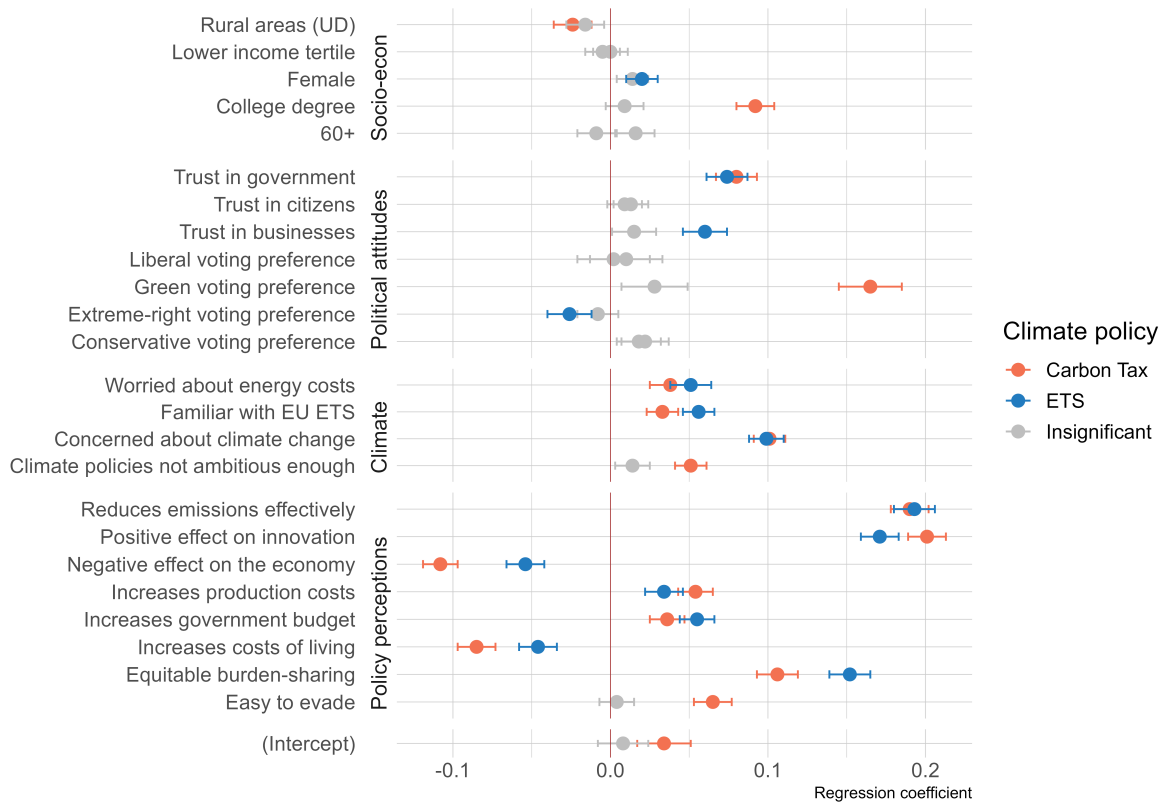


Figure 3: Difference in support correlations between carbon taxes and ETS

Note: This figure shows correlations of indicator variables (y-axis) and "support" (coded as "4" and "5" on the corresponding Likert scale), separately for the "Carbon Tax" and "ETS" framing (insignificant coefficients are greyed out). Controls include country-fixed effects, socio-economic variables, political attitudes and climate-change related attitudes.

Table 4: Support - fully interactive

Variables	(1)	(2)	(3)	(4)
	Est.	Est.	Est.	Est.
(Intercept)	0.063*** (0.019)	0.075*** (0.019)	0.066** (0.020)	0.079*** (0.019)
Treatment	-0.037+ (0.021)	-0.059** (0.021)	-0.039 (0.026)	-0.065** (0.021)
Country-fixed effects				
France	-0.031+ (0.018)	-0.037* (0.018)	-0.033+ (0.018)	-0.027 (0.018)
Greece	-0.024 (0.019)	-0.025 (0.019)	-0.028 (0.019)	-0.026 (0.019)
Italy	-0.064*** (0.019)	-0.067*** (0.019)	-0.068*** (0.019)	-0.061** (0.019)
Spain	-0.086*** (0.018)	-0.090*** (0.019)	-0.092*** (0.018)	-0.079*** (0.018)
UK	-0.024 (0.020)	-0.023 (0.020)	-0.018 (0.020)	-0.016 (0.020)
Germany	-0.019 (0.019)	-0.047* (0.019)	-0.022 (0.019)	-0.023 (0.019)
Socio-demographic variables				
60+	-0.010 (0.012)	0.004 (0.008)	0.004 (0.008)	0.005 (0.008)
Female	0.015 (0.010)	0.018* (0.007)	0.018** (0.007)	0.017* (0.007)
Rural areas (UD)	-0.033** (0.013)	-0.027** (0.009)	-0.026** (0.009)	-0.026** (0.009)
College degree	0.091*** (0.012)	0.049*** (0.009)	0.050*** (0.009)	0.050*** (0.009)
Lower income tertile	-0.002 (0.011)	-0.004 (0.008)	-0.005 (0.008)	-0.004 (0.008)
Political attitudes				
Trust in government	0.080*** (0.009)	0.084*** (0.013)	0.081*** (0.009)	0.081*** (0.009)
Trust in businesses	0.040*** (0.010)	0.013 (0.013)	0.040*** (0.010)	0.040*** (0.010)
Extreme-right voting preference	-0.023* (0.010)	-0.025+ (0.014)	-0.023* (0.010)	-0.024* (0.010)
Green voting preference	0.104*** (0.016)	0.187*** (0.022)	0.104*** (0.016)	0.105*** (0.016)
Conservative voting preference	0.016 (0.011)	0.006 (0.015)	0.016 (0.011)	0.017 (0.011)
Liberal voting preference	0.003 (0.017)	-0.006 (0.023)	0.003 (0.017)	0.005 (0.017)
Environmental attitudes				
Concerned about climate change	0.101*** (0.007)	0.100*** (0.007)	0.110*** (0.010)	0.099*** (0.007)
Worried about energy costs	0.043*** (0.009)	0.043*** (0.009)	0.025* (0.013)	0.045*** (0.009)
Familiar with EU ETS	0.044*** (0.007)	0.044*** (0.007)	0.034*** (0.010)	0.043*** (0.007)
Climate policies not ambitious enough	0.033*** (0.008)	0.033*** (0.007)	0.063*** (0.010)	0.034*** (0.008)
Policy perceptions				
Reduces emissions effectively	0.194*** (0.009)	0.193*** (0.009)	0.194*** (0.009)	0.194*** (0.012)
Increases costs of living	-0.064*** (0.008)	-0.064*** (0.008)	-0.064*** (0.008)	-0.087*** (0.012)
Increases production costs	0.043*** (0.008)	0.044*** (0.008)	0.043*** (0.008)	0.051*** (0.012)
Equitable burden-sharing	0.128*** (0.009)	0.127*** (0.009)	0.127*** (0.009)	0.104*** (0.013)
Easy to evade	0.033*** (0.008)	0.033*** (0.008)	0.032*** (0.008)	0.064*** (0.012)
Increases government budget	0.047*** (0.008)	0.047*** (0.008)	0.046*** (0.008)	0.035*** (0.011)
Negative effect on the economy	-0.079*** (0.008)	-0.080*** (0.008)	-0.079*** (0.008)	-0.106*** (0.011)
Positive effect on innovation	0.188*** (0.008)	0.188*** (0.008)	0.187*** (0.008)	0.206*** (0.012)
Treatment x Country-fixed effects				
Treatment:France	0.026 (0.025)	0.041 (0.026)	0.031 (0.025)	0.024 (0.025)
Treatment:Germany	-0.044+ (0.026)	0.013 (0.027)	-0.038 (0.025)	-0.032 (0.025)
Treatment:Greece	0.041 (0.026)	0.046+ (0.027)	0.050+ (0.026)	0.042 (0.026)
Treatment:Italy	0.099*** (0.026)	0.107*** (0.026)	0.105*** (0.026)	0.098*** (0.026)
Treatment:Spain	0.052* (0.026)	0.059* (0.026)	0.063* (0.026)	0.042 (0.025)
Treatment:UK	-0.011 (0.028)	-0.013 (0.028)	-0.027 (0.028)	-0.027 (0.027)
Treatment x Socio-demo				
Treatment:60+	0.029+ (0.017)			
Treatment:Female	0.006 (0.014)			
Treatment:Rural areas (UD)	0.015 (0.018)			
Treatment:College degree	-0.083*** (0.017)			
Treatment:Lower income tertile	-0.003 (0.016)			
Treatment x Political				
Treatment:Trust in government		-0.006 (0.018)		
Treatment:Trust in businesses		0.054** (0.019)		
Treatment:Extreme-right voting preference		0.004 (0.019)		
Treatment:Green voting preference		-0.164*** (0.031)		
Treatment:Conservative voting preference		0.022 (0.021)		
Treatment:Liberal voting preference		0.020 (0.033)		
Treatment x Environmental				
Treatment:Concerned about climate change			-0.021 (0.014)	
Treatment:Worried about energy costs			0.036* (0.018)	
Treatment:Familiar with EU ETS			0.020 (0.014)	
Treatment:Climate policies not ambitious enough			-0.061*** (0.014)	
Treatment x Policy perceptions				
Treatment:Reduces emissions effectively				-0.003 (0.017)
Treatment:Increases costs of living				0.047** (0.017)
Treatment:Increases production costs				-0.017 (0.016)
Treatment:Equitable burden-sharing				0.044* (0.019)
Treatment:Easy to evade				-0.064*** (0.016)
Treatment:Increases government budget				0.024 (0.015)
Treatment:Negative effect on the economy				0.058*** (0.016)
Treatment:Positive effect on innovation				-0.037* (0.016)
Num.Obs.	14392	14392	14392	14392
R2	0.295	0.299	0.297	0.298
AIC	139147.4	139316.4	139220.7	139195.1
BIC	139473.1	139649.7	139538.9	139543.5

* Regression coefficient (Standard Deviation). +: q | 0.1, *: q | 0.05, **: q | 0.01, ***: q | 0.001.

5 Conclusion

Since Weitzman (1974), much research in public and environmental economics has clarified when the regulatory symmetry between prices and (tradeable) quantities is broken, including by uncertainty, market power and overlapping jurisdictions. In this manuscript, we take a different perspective, and show that a set of different considerations pre-occupies the European public on supporting 'prices vs tradeable quantities' in the context of climate policy.

We conducted a simple discrete choice experiment with 'carbon tax' and 'emissions trading' framing treatments to document variation in the perception of policy properties and appraisal of carbon pricing among the European citizenry. While, across the whole sample, average support for carbon taxes and emissions trading is roughly even-handed at around 35%, opposition is consistently stronger for carbon taxes in all countries but Germany, and a higher share of respondents is inconclusive about their opinion on emissions trading. In cross-country comparison, emissions trading is preferred by a margin of 7% in Italy and Spain, and carbon taxation yields more support by 13 and 7 percentage points in Germany and the UK respectively.

Our results indicate that differences in support between carbon taxes and emissions trading happen in the context of both heterogeneous perceptions and heterogeneous valuation, or reasoning, about properties. We find sizeable treatment effects on the perception of several policy properties: by an effect size in the order of 10 percentage points, European citizens believe that emissions trading, at the same stringency of carbon taxation, is less likely to increase the cost of living and less likely to increase the government budgets, and between 6-8% less likely to negatively impact the economy and increase production costs. Emissions trading is also 8% more likely to be perceived as easy to evade. Further, observing treatment interactions, support for taxes, but not ETS is related to green voting preference and college-level education while trust in business is linked to support for ETS. An understanding that both instruments reduce emissions effectively and spur innovation, as well as trust in government, explain support for pricing in either form. Crucially, aside from taxes being generally perceived as the 'tougher' (i.e., costlier) instrument, the perception that living costs are being increased has also twice the negative effect on support for the carbon tax framing compared to the ETS framing.

We relate these findings to differing approaches in public choice: While rational public choice posits that individuals solely care about material payoffs, wider value-based political economy approaches recognize fairness or environmental values as important factors for public endorsement of carbon pricing: we document that these objectives are substantially at play in the public appraisal of emissions trading and carbon taxes. Yet, evidence of heterogeneous valuation across both instruments documents the plausibility of 'reason-based' public choice theory: as the links between specific policy properties and support vary across both instruments, the two different frames of 'tax' or 'trading systems' seem to highlight different perceived aspects of the respective policy. Whether these properties are causally linked to support via robust ex-ante reasoning processes, or, on the contrary, result from motivated reasoning based on ad-hoc policy affinity or aversion, remains a question for further research.

Our analysis has two implications, one for behavioural public economics theory and one for climate policy advice: First, with elements of rational public choice, reason-based and motivated reasoning all at play in explaining the public's views on taxes vs. emissions trading, we suggest that elements of each are important for designing convincing policy that makes carbon pricing feasible: As an example, debates about equitable redistribution of carbon pricing revenues, such as the 'fee and dividend' approach – which take center-stage with economists' policy advice on carbon pricing design in Europe – are only relevant under a value-based approach to public choice. Reason-based approaches suggest that framing policy under different names highlights different reasons for citizens to support or reject carbon pricing: specifically, the 'tax' frame seems to highlight the regulatory 'toughness' and cost implications of the measure. Hence, policymakers ought to take into account, whether the properties highlighted by instrument framing and communication are in line with the preferences of those voter coalitions relevant for sustained public support. Yet, if public appraisal is fundamentally driven by a pro- or anti-regulation stance (and a case of motivated reasoning), no amount of cushioning or language framing will make carbon pricing feasible – instead, change in the societal and governance circumstances that

shape attitudes of aversion and affinity would be needed.

For European climate policy, our approach sheds new light on how the predilection of the European Union to drive decarbonisation by emissions trading in the future will be perceived by the public: with a large group of convinced climate policy supporters being in favour of tough regulation anyway, we expect emissions trading rather than carbon taxes to be the easier overall political sell to those tending to be unconvinced by the steep emission reductions required by EU climate targets. However, with rising permit prices, and especially with the extension of the EU ETS II to the consumer-exposed transport and buildings sectors, it remains to be seen how perceptions of emissions trading, especially perceptions around cost implications, change.

To conclude, comparing pricing with command-and-control rather than tradeable quantities, Weitzman (1974) hypothesizes that the public intuitively prefers quantity-based regulation, due to lack of understanding of the Pigouvian logic:

“I think it is a fair generalization to say that the average economist in the Western marginalist tradition has at least a vague preference toward indirect control by prices, just as the typical non-economist leans toward the direct regulation of quantities. That a person not versed in economics should think primarily in terms of direct controls is probably due to the fact that he does not comprehend the full subtlety and strength of the invisible hand argument” (Weitzman, 1974)

Concerning perceptions of climate mitigation effectiveness, we document no such differences between carbon taxes and emissions trading. However, we show related effects concerning the perception of cost implications: it is the tax that is perceived as the tough instrument and to citizens the “full subtlety and strength” of emissions trading as a quantity instrument is less clear.

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