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What's in it for me?
Self-interest and preferences for distribution of costs and benefits of energy efficiency policies

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Abstract

Public acceptability appears an essential condition for the success of low-carbon transition policies. In this paper, we investigate the role of self-interest on citizens' preferences for the distribution of costs and of environmental benefits of energy efficiency policies. Using a discrete choice experiment on nationally representative household samples of Italy, Sweden, and the United Kingdom, we first investigate preferences for specific burden-sharing rules and for the distribution of policy environmental benefits accruing primarily in rural and/or urban areas. We examine the role of self-interest in a correlation manner by looking at the effects of income and of location of residency on preferences for these policy attributes. Moreover, we investigate the effect of self-interest on preferences for burden-sharing rules in a causal manner by exogenously priming subsets of participants to feel either rich or poor. Our results suggest that the polluter-pays rule is the most popular burden-sharing rule and an equal-amount rule the least popular and that policies with environmental benefits accruing primarily in rural areas are less preferred, with some heterogeneity in preferences across the three countries. We also find evidence for self-interest, both through correlational and through causal approaches.

Keywords: policy acceptability; self-interest; distributional fairness; discrete choice experiment; energy efficiency

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1 Introduction

Limiting global warming to 2°C or even 1.5°C requires ambitious low-carbon transition policies which imply economic challenges for households and companies (IEA 2021). As epitomized by the recent Yellow Vest protests in France that were triggered by an announced increase in the national carbon tax, governments introducing such policies may face opposition by those negatively affected by a policy and also by those considering it to be socially unfair. On the policy side, policy makers are increasingly focusing on the social and economic effects of low-carbon transition policies – as reflected, for example, in the Just Transition Mechanism of the European Green Deal (COM (2019) 640 final) which addresses regions, industries, and workers facing the most severe economic challenges. On the research side, a growing body of literature analyzes the drivers of public support for climate policies (typically carbon pricing), looking both at policy attributes and at individual (or household) characteristics (Carattini et al. 2018; Drews et al. 2016; Klenert et al. 2018).

Previous studies typically find perceived distributional fairness of climate policies to play a predominant role in achieving public support (see for reviews Drews et al. (2016) on climate policies in general and Maestre-Andrés et al. (2019) on carbon pricing policies in particular). So far, the literature has mostly focused on the distributional fairness of climate policy costs, especially on burden-sharing rules among citizens of a single country (e.g. Groh et al. 2018) or among countries in international agreements (e.g. Bechtel et al. 2013). Further, the literature on carbon pricing suggests that revenue recycling schemes may be designed to countervail detrimental distributional effects of a carbon price and thus help garner political support for carbon pricing (e.g. Bourgeois et al. 2021; Carattini et al. 2017; Douenne et al. 2020; Feindt et al. 2021). In contrast, there has been little research on distributional fairness of environmental benefits associated with domestic climate policies. The literature on climate justice does address preferences for distribution of climate benefits across regions of the world or across generations (e.g. Klinsky et al. 2011), however it does not consider how this affects the acceptability of climate policies through individual citizens in a given country.

Against this background, this study has two main objectives. First, we investigate preferences for the distribution of the costs (specifically burden-sharing rules) as well as of the environmental benefits of climate policies. Indeed, the way in which environmental benefits are distributed may also raise issues about distributional fairness if these benefits affect different socio-economic groups differently (Mansur et al. 2021).

Second, and most importantly, we study the role of self-interest on preferences for specific burden-sharing rules and distribution of environmental benefits associated with climate policies. Besides judging the collective consequences of climate policies, individuals also look at the consequences for themselves (Maestre-Andrés et al. 2019). Economic self-interest may induce individuals to engage in *self-serving bias,* that is, to believe that what is beneficial to themselves is also fair (Babcock et al. 1997). Accordingly, households' support for climate policies may depend on the costs and benefits that they derive from these policies. Although self-serving bias may play a major role in public opposition to climate policies, the extent to which it affects preferences for policy attributes is not yet well established and mostly based on correlational evidence (see Douenne et al. (2021) for an exception).[1] For example, studies finding evidence in support of a self-serving bias include Thalmann (2004) and Douenne et al. (2021) for carbon taxes in Switzerland and France, respectively, and Groh et al. (2018) and Sommer et al. (2020) for the energy transition in Germany in general. In contrast, Kallbekken et al. (2011) and Anderson et al. (2019) find that self-interest only marginally explains support for fuel taxation in Norway and carbon taxation in the United States, respectively. Finally, since the extant literature has largely overlooked preferences for the distribution of environmental benefits of climate policies, it is unclear whether individuals engage in self-serving bias when evaluating the benefits of these policies.

To achieve these objectives, we carry out a discrete choice experiment (DCE) to elicit preferences for energy efficiency policies. We conduct the same DCE on representative samples of the working-age population from Sweden (SE), Italy (IT) and the United Kingdom (UK) (3 079 participants in total). Since acceptability of climate policies depends on contextual factors such as economic and political aspects, social norms and weather (Drews et al. 2016), conducting the DCE in three separate European countries enables us to capture cross national differences and also increases the external validity of our findings. The key policy attributes of interest are the burden-sharing rules and the distribution of

1 While we focus on self-interest in preferences for distribution of costs and benefits of domestic climate policies, the literature on international climate agreements does not find conclusive results on the role of self-interest in preferences for burden-sharing rules across countries. Carlsson et al. (2013) and Lange et al. (2007, 2010) find evidence in favor of it while Carlsson et al. (2011) and Schleich et al. (2016) against it; Brick et al. (2015) find mixed evidence, with self-serving bias for citizens in China and the US but not for citizens in Europe.

environmental benefits (represented by a trade-off between policy benefits primarily in rural and/or urban areas). Based on correlational evidence, we examine the role of self-interest by looking at the effect of relevant socio-demographic characteristics (income and location of residency) on preference for these policy attributes. In addition, we investigate the effects of self-interest on preferences for burden-sharing rules in a causal setting in which we exogenously induce a feeling of being rich or of poor in two experimental groups, using an established priming technique (Nelson et al. 2005).

Our DCE includes the following burden-sharing rules: the polluter-pays rule (i.e. contribution to the costs of the policy is proportional to individual emissions), progressive-share rule (i.e. contribution to the costs of the policy increases more than in proportion with individual income), equal-amount rule (i.e. equal individual contribution to the costs of the policy) and an equal-share rule (i.e. contribution to the costs of the policy as a fixed share of individual income). We select these rules on the basis of previous literature (e.g., Gevrek et al. 2015; Groh et al. 2018).[2] In a recent DCE, Ščasný et al. (2017) examine the interaction between preferences for burden-sharing rules among EU member states and among citizens of the given state in three European countries; we use the burden-sharing rules that they used for citizens sharing rules. Besides our different focus on energy efficiency policies, our study departs from that of Ščasný et al. (2017) because we also look at preferences for the distribution of environmental benefits and the role of self-interest in shaping preference for policy attributes.

Note that while we refer to burden-sharing rules of the costs of energy efficiency policies, we do not refer to any specific policy instrument. We are interested in individual preferences for the distribution of costs and benefits of policies in general rather than in preferences for specific policy instruments, which may be driven by other factors such as tax aversion (e.g. Kallbekken et al. 2011; Rhodes et al. 2017).

Our results show that in the three countries, the polluter-pays rule is the most popular burden-sharing rule, and the equal-amount rule the least popular. We also observe country heterogeneity, suggesting that perceptions of what is considered a fair distribution of the costs depend on the context. In particular, participants from Italy and the UK show stronger preference for energy efficiency

2 Other burden-sharing rules that have been investigated elsewhere are the “need fulfillment principle”, that is, the more one needs to emit, the less one should reduce emissions (Hammar et al. 2007), or the beneficiary-pays principle, that is, the more one benefits from environmental improvement, the more they should pay for it (Dietz et al. 2010).

policies that implement an equal-amount rule than those from Sweden, and participants from Italy prefer the progressive-share rule compared to participants from the other two countries. With respect to preferences for the distribution of environmental benefits, participants prefer to see environmental benefits of the policies distributed equally in urban and rural areas or in urban areas only, compared to rural areas only.

Second, we find some evidence for self-interest in preferences for burden-sharing rules and distribution of environmental benefits. For the burden-sharing rules, high-income participants in all three countries tend to provide less support to the progressive-share rule, which would require them to pay more for the energy efficiency policies. The results based on the experimental manipulations through the exogenous primes provide further causal support in this direction, although with weak statistical significance. Finally, we provide novel (correlational) evidence for self-interest in preferences for distribution of environmental benefits. Participants from Italy and UK living in urban agglomerations are more likely to support policies whose environmental benefits occur mainly in urban areas.

The remainder of the paper is organized as follows. In Section 2 we present the methodology including the DCE, the exogenous primes, the data collection and the econometric framework. In Section 3 we present and discuss the findings. Section 4 concludes the paper.

2 Methodology

2.1 Discrete choice experiment

The DCE method is a stated preference methods based on random utility theory (McFadden 1986). In DCEs, individuals face hypothetical choice situations in which they have to choose between different options (e.g. products, services, or policies) that are characterized by attributes relating to both benefits and costs. By selecting their most preferred option, individuals make trade-offs between attributes.

Attributes

In our study, we apply a DCE to estimate trade-offs among energy efficiency policies that are characterized by five attributes including additional annual cost for the household and different rules for sharing the costs and the environmental benefits associated with the policy. The remaining two attributes relate to benefits of energy efficiency policies, namely the reduction in energy consumption by 2030 and the decrease of dependency from energy imports.[3] Attributes and levels are summarized in Table 1.

Our focus on energy efficiency policies is motivated by the fact that they are typically seen as cost-effective short- to medium-term measures to achieve net zero greenhouse gas emissions targets (e.g., IEA 2021). Thus, understanding the factors that could lead to a greater acceptability of energy efficiency policies provides valuable insights for energy and climate policy making. The literature has mostly focused on other climate policies such as support for renewable energies. Empirical studies find individual preferences to differ between energy efficiency policies and renewable support policies (e.g. Alberini, Bigano et al. 2018; Ziegler 2019), which makes studying these policies separately particularly important.

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3 For reduction in energy consumption and decrease of dependency from energy imports, we used the same attributes and attribute levels than those used in a related DCE collected within the same H2020 project (Whitmarsh et al. 2019). Although the two DCEs were collected simultaneously, participants were at most exposed to one of these DCEs.

Table 1: Attributes and attribute levels in the discrete choice experiment

Attributes	Attribute levels
Reduction in energy consumption by 2030	Reduction by 20, 25, 30 or 40 percent, compared to having no energy efficiency policy in place
Distribution of costs	• Households that consume more energy pay more *(polluter-pays rule)* • Everyone pays the same amount (*equal-amount rule*) • Everyone pays the same percentage of their income (*equal-share rule*) • Higher earners pay a larger percentage of their income than lower earners (*progressive-share rule*)
Dependence on energy imports	Reduction by 5, 10, 30 or 50 percent, compared to having no energy efficiency policy in place
Improved quality of the environment	• Mainly in rural areas • Mainly in urban areas • Equally in both rural and urban areas
Additional annual costs	0€, 25€, 50€, 100€, 150€, 200€, or 300€

Attributes and levels for the energy-efficiency policies in the DCE were chosen to represent realistic policy options, cover common burden-sharing rules and include environmental benefits that are unequally distributed among survey respondents.

Costs were described as additional annual costs to the household and ranged from 0€ to 300€. Comparable cost levels have been used in previous DCEs (Alberini, Bigano et al. 2018; Ščasný et al. 2017).

The burden-sharing rules in our DCE were chosen in accordance with different taxation systems, where levels correspond to progressive income taxes (progressive-share rule), regressive income taxes (equal-amount rule), proportional income taxes (equal-share rule) and a consumption tax (polluter-pays rule). The progressive and equal-share rules are both consistent with an Ability-to-Pay Principle, under which those who have a greater ability to pay – based on their income and wealth – should pay more. The polluter-pays rule is based on the Polluter-Pays Principle; a proportional or progressive tax on energy or carbon would be consistent with the polluter-pays rule described in our DCE. The same attribute levels are used in Ščasný et al. (2017).

Improved environmental quality is often neglected, yet an important co-benefit of climate and energy efficiency policies (Karlsson et al. 2020). Benefits from improved environmental quality (e.g. improved air, soil or water quality, biodiversity) are likely unevenly distributed among citizens. For instance, households in urban areas might benefit more from improved air quality compared to households in rural areas. Uneven distribution of benefits, in turn, can impact policy acceptability, in particular when economic self-interest leads to self-serving bias. In our DCE, improvements to the environment are either evenly distributed between urban and rural areas, more important in urban areas, or more important in rural areas.

The remaining two attributes, reduction in energy consumption by 2030 and import dependence reduction, are based on EU energy policy objectives. At the time our survey was fielded, the official EU energy efficiency target was a 20% reduction in energy consumption by 2020 compared to projections made in 2007 (Directive 2012/27/EU). Shortly after, in December 2018, the amending Directive on Energy Efficiency (Directive (EU) 2018/2002) increased the EU target to at least 32.5% by 2030. Moreover, individual member states may set more ambitious targets. Our attribute levels ranging from 20% reduction in energy consumption by 2030 to 40% are thus in line with policy objectives. While EU energy policy is also aiming to reduce the dependence on energy imports, unlike for energy consumption, no concrete targets are set on EU level. We therefore chose levels to reflect a broad spectrum of import dependence reduction, ranging from 5% to 50%.

Choice tasks

Each respondent saw six choice tasks and, in each task, had to choose between three policy options. One option was labelled “current policy” and had the same attribute levels across all choice tasks: a 20% reduction in energy consumption by 2030, costs distributed according to an equal-share rule, a 5% decrease in dependency from energy, an equal distribution of environmental benefits across urban and rural areas, and zero additional cost for the household. The attribute levels were chosen to resemble energy efficiency policies in place at the time our survey was fielded. The current policy option can be considered as a status quo or opt-out option.

The other two options were presented as alternatives to the current policy option with additional costs for the household of at least 25€ per year and a reduction in energy consumption of at least 25% by 2030. Hence, all alternative policy options had additional costs and benefits compared to the current policy option. Figure 1 shows an example of a choice task as seen by respondents in the UK.

Figure 1: Example of a choice task

	Policy A	Policy B	Current policy
Energy consumption by 2030	25% less	40% less	20% less
Distribution of costs	Higher earners pay a larger percentage of their income than lower earners	Everyone pays the same amount	Everyone pays the same percentage of their income
Dependence on energy imports	10% less	50% less	5% less
Improved quality of environment	Mainly in urban areas	Equally in both rural and urban areas	Equally in both rural and urban areas
Additional annual costs	£50	£150	£0

	Policy A	Policy B	Current policy
I prefer:	○	○	○

We used NGENE (ChoiceMetrics 2014) to build a Bayesian efficient design with 12 choice tasks that were grouped into two blocks. Bayesian efficient designs use random prior preference parameters (priors). They therefore depend less on accurate priors than non-Bayesian efficient designs. In our design, priors for all attributes were assumed to follow a normal distribution; the mean values were obtained from a pretest with 50 respondents from the UK using the online platform Prolific Academic.

Respondents in all three countries saw the same choice cards, translated into their respective national language. The following rates were applied to monetary amounts used in the DCEs in order to keep the relative value similar between countries in terms of purchasing power: Sweden: 1€ = 10SEK; UK: 1€ = 1£.

2.2 Exogenous primes

Before participating in the DCE, respondents were randomly assigned to one of two experimental conditions or to a control group. In the experimental conditions, respondents were asked to indicate approximately how much money they had in their savings and current accounts at the end of the previous month. Following Nelson et al. (2005), in one experimental condition *(rich priming* condition), respondents were given an 11-point scale divided in increments of 500€ from 1 (0€ or less) to 11 (more than 4 500€). In the other experimental condition *(poor priming* condition), respondents were given a similar 11-point scale but with much larger increments from 1 (0€ to 5 000€) to 11 (more than 450 000€). In both conditions, respondents were asked to check an answer on the respective scale or indicate that they did not know or preferred not to answer. The two scales were chosen so that respondents in the *rich priming* condition would typically choose answers on the top of the scale whereas respondents in the *poor priming* condition would typically respond towards the bottom of the scale. As Nelson et al. (2005), we expect respondents who answer at the top (bottom) of the scale to make inferences about their financial circumstances and feel comparatively rich (poor). Respondents in the control condition were not asked about their personal savings.

In a separate online pretest with 50 respondents from the UK, respondents exposed to the *poor priming* reported lower levels of satisfaction with their personal finances compared to respondents exposed to the *rich priming*.[4] These findings are consistent with findings by Nelson et al. (2005), showing that respondents react to the priming conditions and make inferences about their personal circumstances.

If respondents' choices in the DCE are driven by self-interest, richer respondents should show a stronger dislike for the equal-percentage and the progressive-share rules. By priming respondents to feel comparatively rich (poor), we aim at providing causal evidence on the effect of self-interest in preferences for burden-sharing rules.

2.3 Data Collection

Data were collected through an online survey in July and August 2018. Respondents were recruited by the market research institute Norstat using their existing household panels in Sweden, Italy and the UK. In each country, quotas for gender, age (between 18 and 65 years), regional population dispersion and income were implemented in order to obtain demographically representative samples.

The surveys in the each country were part of a larger project in which participants responded to DCEs on different technologies and policies. Each participant took part in two separate DCEs, typically one DCE on policy acceptability and one on a given technology. Additional questions addressed energy efficient technologies adoption and participants' attitudes and socio-demographic characteristics. The

4 The difference in means between both groups is significant at the 10%-level, using a two-tailed t-test.

socio-demographic characteristics of main interest for this study are income distribution and participants' location of residency. Participants reported their income on two different scales at the beginning of the survey for screening purposes, and again at the end of the survey. The screening question was mandatory and therefore is the one used in our main analysis because it entails no missing responses.[5] For the location of residency, participants could select an option among the following ones: (1) Centre of a major town/city, (2) Suburban (fringes of a major town/city), (3) Small town or village, (4) Isolated dwelling (not in a town or village). Details of these variables, as well as their distribution per country, are reported in Appendix A, Table A 1 to Table A 3. All participants received a participation fee from Norstat for completing the survey. The overall median time for survey completion is 18 minutes.

A total of 1 031, 1 025 and 1 023 participants for Sweden, Italy and the UK completed the choice experiments investigated in this study. Table 2 presents sample descriptive statistics compared to national averages. The median age is slightly higher than the national statistics in Sweden and the UK while consistent for Italy. The share of males is in line with national statistics for Sweden and the UK, and slightly lower for Italy. The median income is slightly higher in our sample than in the national statistics for all countries. Finally, we note that for education, which was not a screening criteria, our sample is more educated than the population, especially for Italy. As mentioned in Section 2.2, in each country one third of the sample was randomly assigned to the *rich priming*, one third to the *poor priming*, and the remaining to the control group. The distribution of socio-demographic characteristics per experimental condition and country is provided in Appendix A, Table A 4 to Table A 6. In general, the randomization was quite successful. For Italy, however, the share of participants with a graduate degree is lower in the *poor priming* than in the *rich priming*. For the UK, participants in the highest income category are less frequent in the *poor priming* than in the control group.

5 The other question yields more fine-grained information about participants' income, but was not mandatory. We discuss the sensitivity of our findings to relying on this question in Section 0.

Table 2: Sample descriptive statistics

	Median age		Male		Graduate degree		Median income	
	Sample	**Population**	**Sample**	**Population**	**Sample**	**Population**	**Sample**	**Population**
SE	42	40	0.51	0.51	0.49	0.43	381 000	324 011
IT	43	43	0.47	0.5	0.39	0.19	29 300	20 128
UK	44	40	0.51	0.5	0.49	0.43	29 300	21 096

Note: The national median age is the median age of the population between 18 and 65 year old. Source: Eurostat (2018).The share of males refers to the population between 18 and 65 year old. Source: Eurostat (2018). For both the sample and the population, graduate degree is based on the age between 25 and 64 year old. Source: Eurostat (2018). Median income: National currency, based on population between 18 and 65 year old. Source: OECD (2018).

2.4 Econometric Framework

Within the random utility framework underlying DCEs, the utility that respondent n obtains from choosing alternative j in choice set t can be written as

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt}, \qquad n = 1, \ldots, N, \quad j = 1, \ldots, J \quad t = 1, \ldots, T \qquad (1)$$

where *N* indicates to the number of respondents, J the number of alternatives, and T the number of choice tasks. X_{njt} denotes a vector of explanatory variables, including attributes of alternative j in choice set t and respondents' characteristics. β_n denotes a vector of associated preference parameters. ε_{njt} is an error term which is assumed to follow an extreme-value Gumbel distribution.

We estimate preference parameters using mixed logit models. Unlike conditional logit models, mixed logit models do not rely on the Independence of Irrelevant Alternatives (IIA) assumption because preference parameters in mixed logit models can be specified as random parameters that may vary across respondents (Hensher et al. 2003). Following the literature (Revelt et al. 1998; Train 2003), we assume that preference parameters follow a normal distribution.

We first assess preferences for specific policy attributes focusing on the control group only, that is, without the exogenous priming groups. We run the following mixed logit specification in which participants from the control groups of the three countries are pooled:

$$U_{njt} = \beta_{n1} * costs_{njt} + \beta_{n2} * savings_{njt} + \beta_{n3} * imports_{njt} + \beta_{n4} * equal_{amount_{njt}} + \beta_{n5} * equal_{share_{njt}} + \beta_{n6} * progressive_{share_{njt}} + \beta_{n7} * quality\_urban_{njt} + \beta_{n8} * quality\_both_{njt} + \beta_{n9} * statusquo_{njt} + \varepsilon_{njt} \quad (2)$$

We refer to this specification as Model 1. The variable $costs$ denotes additional annual expenses for households compared to the current policy (in euros). The variable $savings$ represents the reduction in energy consumption compared to having no energy efficiency policy in place (in %). The variable $imports$ takes on the value of the reduction of country's energy imports (in %). The terms $equal\_amount$, $equal\_share$ and $progressive\_share$ are dummies for the corresponding burden-sharing rules. The polluter-pays rule serves as the reference category to avoid collinearity. The variables $quality\_urban$ and $quality\_both$ are dummies for improved quality of the environment mainly in urban areas and equally in both rural and urban areas, respectively. Improved quality mainly in rural areas is taken as the reference for comparison. Finally, $statusquo$ is a dummy variable which is equal to 1 for the current policy and 0 otherwise.

Next, we estimate Model 2 by adding to Model 1 the interactions between the policy attributes and country dummies to assess whether preferences systematically vary across participants from the three countries. The dummy variable *IT* is equal to 1 for participants from the sample in Italy, and the dummy *UK* is equal to 1 for participants from sample in the UK; Sweden is taken as the baseline country. Pooling the samples in this way (rather than using single country models) produces correct standard errors to test for differences across countries and hypothesis testing and increases the degrees of freedom of the estimation. However, it implicitly assumes the latent preference structure and the random component to be identical across countries. We also include interactions between $statusquo$ and country dummies to assess differences in preferences for the current policy.

We then investigate the role of self-interest. To this aim, we add to Model 1 the interactions between the policy attributes of interests (i.e. burden-sharing rules and areas with improved environmental quality) with income or location of residency. Income is specified as follows: low_income is a dummy equal to 1 if the participant states to be in the lowest income category of the income screening question, 0 otherwise; $high\_income$ is a dummy equal to 1 if the participant states to be in the highest income category of the income screening question, 0 otherwise; the reference category is middle income. Since the income screening question for Sweden had four categories, we combine the two intermediary categories in the middle income category. This explains the higher share of participants in this category for Sweden than for the other two countries in Table A 1.[6] With respect to the location of residency, the dummy agg_urban is equal to 1 if the participant lives in the center or the suburbs of a major town/city, 0 otherwise. We estimate this specification first by pooling participants from the control groups of the three countries (Model 3), and then by separating them by country. We do not add country interactions to Model 3 to ease interpretation and because a systematic evaluation of cross-country differences of self-interest is beyond the scope of this paper.

Finally, we evaluate the effect of the primes by including also the treatment groups and by substituting to Model 3 the interactions between the burden-sharing rules and participants' income with interactions between the burden-sharing rules and experimental conditions. The dummies $prime\_rich$ and $prime\_poor$ are equal to 1 if the participant is randomly assigned to the rich and the poor primes, respectively, and 0 otherwise. Again we estimate a pooled model with the three countries (Model 4) and one separate model for each country.

The parameters of policy attributes are specified as random parameters and assumed to follow a normal distribution. The parameters of all interaction terms are specified as fixed parameters.

6 As discussed in Section 0, results are virtually the same if we combine the two lowest categories in the low_income variable rather than the two intermediary categories in the baseline.

3 Results and Discussion

3.1 Preferences for energy efficiency policy attributes

Table 3 reports the estimates for the parameters in equation 2. P-values appear in parentheses. The upper part of the table depicts the mean values of these coefficients, the lower part the standard deviations of the means. Based on a likelihood ratio test we rejects the null hypothesis that all standard deviations are jointly zero at $p < 0.01$, justifying the use of a mixed logit model rather than a conditional logit model.

Table 3: Results for mixed logit model, main effects

	1 Model 1	2 Model 2
Mean		
costs	-0.0064***	-0.0062***
	(0.000)	(0.000)
savings	0.0325***	0.0459***
	(0.000)	(0.000)
imports	0.0100***	0.0124***
	(0.000)	(0.000)
equal_amount	-1.0956***	-1.4900***
	(0.000)	(0.000)
equal_share	-0.6845***	-0.7573***
	(0.000)	(0.000)
progressive_share	-0.4288***	-0.8138***
	(0.000)	(0.000)
quality_both	0.2338***	0.3309***
	(0.001)	(0.006)
quality_urban	0.1123*	0.0117
	(0.081)	(0.918)
statusquo	0.1029	-0.0961
	(0.421)	(0.665)
costs x IT		0.0002
		(0.836)

	1 Model 1	2 Model 2
Mean		
savings x IT		-0.0182
		(0.111)
imports x IT		-0.0076**
		(0.048)
equal_amount x IT		0.5402***
		(0.006)
equal_share x IT		0.1320
		(0.472)
progressive_sharex IT		0.7234***
		(0.000)
quality_both x IT		-0.1520
		(0.360)
quality_urban x IT		0.2219
		(0.158)
statusquo x IT		-0.0438
		(0.887)
costs x UK		-0.0013
		(0.225)
savings x UK		-0.0192
		(0.104)
imports x UK		0.0006
		(0.870)
equal_amount x UK		0.5771***
		(0.005)
equal_share x UK		0.0496
		(0.795)
progressive_share x UK		0.3797*
		(0.071)
quality_both x UK		-0.1240
		(0.471)

	1 Model 1	2 Model 2
Mean		
$quality\_urban\ x\ UK$		0.0626
		(0.700)
$statusquo\ x\ UK$		0.7303**
		(0.021)
Standard deviation		
costs	-0.0075***	0.0078***
	(0.000)	(0.000)
savings	0.0448***	0.0444***
	(0.000)	(0.000)
imports	-0.0125***	0.0141***
	(0.002)	(0.000)
$equal\_amount$	0.8356***	0.8506***
	(0.000)	(0.000)
$equal\_share$	0.5617***	0.6461***
	(0.001)	(0.000)
$progressive\_share$	1.1845***	1.2281***
	(0.000)	(0.000)
$quality\_both$	0.4792***	0.4759***
	(0.001)	(0.001)
$quality\_urban$	-0.0089	0.0279
	(0.962)	(0.889)
$statusquo$	2.6007***	2.5528***
	(0.000)	(0.000)
Log likelihood	-5286.14	-5256.76
Number of participants	1016	1016
Number of observations	18288	18288

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values in parentheses.

Turning towards the interpretation of parameter estimates in the upper half of Table 3 for Model 1, we first observe that the coefficient for $costs$ is negative and statistically significant, indicating that private costs have a negative effect on the probability to choose a given energy efficiency policy. This is a standard result in the literature on the acceptability of climate policies (e.g. Brannlund et al. 2012; Carattini et al. 2017; Gevrek et al. 2015; Sælen et al. 2011) and is consistent with standard economic theory. Second, the positive and statistically significant effect of $savings$ shows that higher energy savings are linked with higher acceptability. Hence, individuals prefer policies with more ambitious targets. This result echoes previous DCEs finding that policy acceptability is higher if the policy generates more environmental benefits, such as reductions in greenhouse gas emissions (Alberini, Bigano, et al. 2018; Alberini, Ščasný et al. 2018) or reductions in air pollution (Dietz et al. 2010). Moreover, the positive and statistically significant effect of the variable $imports$ indicates a preference for policies that reduce energy imports. Finally, the variable $statusquo$ is not statistically significant. Thus, we find no evidence that respondents prefer the current policy over the policy packages proposed in the DCE.

Regarding preferences for burden-sharing rules, the polluter-pays rule is the most popular rule in Model 1. The dummies for all other burden-sharing rules are negative and statistically significant. We also observe some differences in preferences over the three other burden-sharing rules. Wald tests indicate that progressive-share is the second most popular ($progressive\_share$ vs. $equal\_share$, $p < 0.01$; $progressive\_share$ vs. $equal\_amount$, $p < 0.01$), and that the equal-amount rule is the least popular (Wald test $equal\_share$ vs. $equal\_amount$, $p < 0.01$).

The coefficients for $quality\_urban$ and $quality\_both$ are positive and statistically significant, suggesting that participants prefer that the environment improves in urban areas only or in both rural and urban areas relative to rural areas only.[7] Wald tests also reveal a preference for improved environmental quality in both the urban and rural areas compared to urban areas only ($p < 0.1$). The preference for improved environmental quality in urban areas over rural areas may be explained by the majority of our sample living in urban agglomerations (see Table A 1 to Table A 3). If participants are driven by self-interest, then they are also more likely to choose the policy which provides the highest environmental benefits to them. In line with this reasoning, Table 5 and Table 6 show that when adding interactions between location of residency and benefits in urban areas, the coefficient of $quality\_urban$ is no longer statistically different from zero,

7 Note that when we run the same model on the full sample to increase statistical power, the difference between preference for environmental benefits in urban vs. rural area becomes statistically significant at $p < 0.01$.

suggesting that participants living in urban agglomerations drive the result of Table 3.

Model 2 reveals some differences in preferences for burden-sharing rules across the three countries. Compared to participants from Sweden, participants from Italy and the UK prefer the equal-amount rule, as suggested by the positive and statistically significant coefficients of $equal\_amount\ x\ IT$ and $equal\_amount\ x\ UK$. In comparison, based on Wald tests we find no difference in preferences for this burden-sharing rule for participants in Italy and the UK. Moreover, the positive and statistically significant coefficients of $progressive\_share\ x\ IT$ and $progressive\_share\ x\ UK$ indicate that citizens from Italy and the UK also prefer the progressive-share rule relative to participants from Sweden. For this rule also the difference between the coefficients for Italy and the UK is statistically significant (Wald test, significance at $p < 0.1$), indicating that Italian participants are those who most prefer the progressive-share rule. Further, participants from Italy are indifferent between the polluter-pays and the progressive-share rules (Wald test shows that $progressive\_share + progressive\_share\ x\ IT$ is not statistically significant different from 0).

Overall, our findings for the preferences for burden-sharing rules are in line with previous literature. Most closely related to our study, Ščasný et al. (2017) find that individuals in the Czech Republic, Poland and the UK prefer the polluter-pays rule to distribute the costs of domestic climate policy costs. They also find that the equal-amount rule is the least preferred rule in all three countries. Moreover, employing DCEs on carbon taxes Brannlund et al. (2012) and Gevrek et al. (2015) find that individuals in Turkey and Sweden prefer more progressive allocation rules (i.e. progressive-share compared to equal-amount). Finally, the results from a survey of the population in Germany (Groh et al. 2018) suggest that participants prefer the polluter-pays rule to the progressive-share rule and to the equal-amount rule.

With respect to the other policy attributes, participants from Italy value the reduction in the country's energy dependency less than participants from Sweden and the UK, as implied by the negative and statistically significant coefficient of $imports\ x\ IT$, and by a Wald test between $imports\ x\ IT$ and $imports\ x\ UK$ ($p < 0.05$). The positive and significant coefficient of $statusquo\ x\ UK$ highlights that participants from this country prefer the current policy more than participants from Sweden and Italy (Wald test, $statusquo\ x\ IT$ vs. $statusquo\ x\ UK$, $p < 0.01$).

Finally, Table 4 reports the share of respondents who prefer the current policy over the alternative policies in all six scenarios as well as the share of scenarios in which the current policy is chosen. In the UK, the current policy is chosen almost half of the time and 26% of participants always choose the current policy. This partly explains the positive and statistically significant coefficient of $statusquo\ x\ UK$ in Table 3. For Sweden and Italy, fewer respondents always prefer the current policy over the alternative policies – but the share of scenarios in which the current policy is chosen remains high.

Table 4: Preference for current policy over alternative policies

	SE	IT	UK
Share of respondents always choosing the current policy	17%	16%	26%
Share of scenarios in which the current policy is chosen	41%	38%	48%

3.2 Preferences for policy attributes and self-interest

Table 5 reports the results for the mixed logit model with interactions of participants' socio-demographic characteristics and preferences for the distribution of costs and benefits. Column 1 reports the results for Model 3, and Columns 2, 3 and 4 for the single country samples.

Table 5: Results for mixed logit model with socio-demographic interactions

	1 Model 3	2 SE	3 IT	4 UK
Mean				
costs	-0.0066***	-0.0057***	-0.0063***	-0.0081***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0324***	0.0445***	0.0261***	0.0320***
	(0.000)	(0.000)	(0.004)	(0.000)
imports	0.0100***	0.0127***	0.0049*	0.0130***
	(0.000)	(0.000)	(0.078)	(0.000)
$equal\_amount$	-1.1396***	-1.3593***	-1.2040***	-0.6736**
	(0.000)	(0.000)	(0.000)	(0.016)
$equal\_amount\ x\ low\_income$	0.0091	-0.1041	0.1200	-0.3725
	(0.960)	(0.759)	(0.712)	(0.296)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
equal_amount x high_income	0.0263	-0.5802	0.5940	-0.3923
	(0.905)	(0.178)	(0.162)	(0.309)
equal_share	-0.6298***	-0.7248***	-0.4864**	-0.7738***
	(0.000)	(0.000)	(0.020)	(0.007)
equal_share x low_income	-0.0431	0.3725	-0.2223	-0.1181
	(0.801)	(0.207)	(0.428)	(0.744)
equal_share x high_income	-0.2565	-0.7625**	-0.4316	0.2076
	(0.207)	(0.042)	(0.244)	(0.583)
progressive_share	-0.4139***	-0.7148***	-0.3993	0.1669
	(0.001)	(0.000)	(0.107)	(0.502)
progressive_share x low_income	0.1496	-0.1205	0.6489**	-0.6721**
	(0.411)	(0.750)	(0.042)	(0.037)
progressive_share x high_income	-0.4116*	-0.8844*	-0.1216	-0.7641**
	(0.066)	(0.061)	(0.776)	(0.026)
quality_both	0.1955*	0.2463	0.1591	0.1459
	(0.081)	(0.153)	(0.429)	(0.488)
quality_both x agg_urban	0.0814	0.1622	0.0377	0.0737
	(0.542)	(0.461)	(0.872)	(0.763)
quality_urban	-0.0901	-0.1794	0.0821	-0.2217
	(0.411)	(0.317)	(0.681)	(0.286)
quality_urban x agg_urban	0.3212**	0.2704	0.2437	0.4159*
	(0.016)	(0.244)	(0.305)	(0.088)
statusquo	0.0243	-0.0968	-0.2699	0.9326**
	(0.891)	(0.704)	(0.411)	(0.026)
statusquo x low_income	0.5443**	-0.0589	0.4557	0.3668
	(0.025)	(0.889)	(0.263)	(0.472)
statusquo x high_income	-0.4972	0.1392	-0.4057	-1.6023***
	(0.104)	(0.805)	(0.482)	(0.006)

	1 Model 3	2 SE	3 IT	4 UK
Standard deviation				
costs	-0.0078***	0.0058***	-0.0082***	0.0089***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0512***	0.0533***	0.0684***	0.0233
	(0.000)	(0.002)	(0.000)	(0.457)
imports	-0.0149***	0.0082	-0.0143**	0.0189***
	(0.000)	(0.253)	(0.014)	(0.001)
$equal\_amount$	0.8580***	0.6951***	1.0333***	0.9265***
	(0.000)	(0.008)	(0.000)	(0.000)
$equal\_share$	-0.6851***	0.5507*	0.5218*	0.7783***
	(0.000)	(0.051)	(0.063)	(0.007)
$progressive\_share$	-1.2214***	-1.5514***	1.2974***	0.6176**
	(0.000)	(0.000)	(0.000)	(0.023)
$quality\_both$	-0.5270***	-0.5606**	0.4593	0.4303
	(0.000)	(0.014)	(0.119)	(0.110)
$quality\_urban$	0.0618	-0.5513**	-0.1077	-0.1109
	(0.752)	(0.036)	(0.631)	(0.659)
$statusquo$	2.5513***	-2.3332***	2.4412***	2.8859***
	(0.000)	(0.000)	(0.000)	(0.000)
Log likelihood	-5266.54	-1712.75	-1831.10	-1667.32
Number of participants	1016	322	347	347
Number of observations	18288	5796	6246	6246

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values in parentheses.

Results reveal some evidence of self-interest in preferences for burden-sharing rules. In Model 3, the coefficient of $progressive\_share\ x\ high\_income$ is negative and statistically significant at $p < 0.10$, suggesting that high-income participants tend to like the progressive-share rule less than middle-income participants. When comparing preferences of high-income and low-income participants this difference becomes more pronounced. A Wald test of the coefficients of $progressive\_share\ x\ high\_income$ and $progressive\_share\ x\ low\_income$ is significant at $p < 0.05$. High-income households therefore appear to dislike the rule according to which richer households pay a higher share of their income for the policy than others.

Similarly, the findings from the single country samples confirm such a self-interest in participants' preferences for the distribution of policy costs. In particular, high-income participants from Sweden and the UK are significantly less likely to support the progressive-share rule than middle-income participants. In addition, high-income participants from Sweden are also less likely to support the equal-share rule than middle-income participants. For Italy, low-income participants are more likely to prefer the progressive-share rule than middle-income and high-income participants (Wald test, $progressive\_share\ x\ high\_income$ vs. $progressive\_share\ x\ low\_income$, $p < 0.1$). Surprisingly though, low-income participants from the UK are less likely to prefer the progressive-share rule than middle-income participants. Possibly, participants from the UK may find it unfair to have high-income earners spend a larger portion of their income for the policy than others, regardless of their own income level.

In Model 3 and in the specification for the UK, we also find support for a self-interest in preferences for the distribution of environmental benefits. Participants living in urban agglomerations prefer policies with environmental benefits mainly in urban areas, as indicated by the positive and statistically significant coefficient of $quality\_urban\ x\ agg\_urban$. For the samples in Sweden and Italy this coefficient is also positive, but – possibly because of lack of power – not statistically significant at conventional levels. Indeed, in the model that also includes participants from the treatment groups (Table 6), this coefficient is statistically significant for Italy and almost for Sweden ($p = 0.134$).[8]

Finally, we also find heterogeneous preferences for the current policy depending on income. The pooled model shows that low-income participants are more likely to choose the current policy than middle-income and high-income participants (Wald test, $statusquo\ x\ high\_income$ vs. $statusquo\ x\ low\_income$, $p < 0.01$). This also holds for the samples in Italy ($p < 0.1$) and the UK ($p < 0.01$). In Model 3, the coefficient of $statusquo\ x\ high\_income$ is just shy of being statistically significant ($p = 0.104$), suggesting that high-income participants are less likely to choose the current policy than middle-income participants. The single country specifications

8 Note that this result may be also driven by an alternative explanation. That is, if income and location of residency are correlated and income is the driver of this preference, then income may act as an omitted variable and we may capture its effect through the dummy variable agg_urban. We find a significant and negative correlation between low income and living in the urban agglomeration only for the sample in Italy. Thus, we re-estimate the specification of Table 5, for the sample of Italy, by substituting the dummy agg_urban with those for low_income and $high\_income$. None of the interactions is statistically significant, indicating that we can rule out issues of omitted variable bias as an explanation for this effect.

suggest that this finding is mainly driven by participants from the UK, where the coefficient is statistically significant at $p < 0.01$.

Our finding that low-income participants prefer the current policy compared to others may be driven by two explanations. First, low-income participants may oppose policies entailing additional costs, and the current policy was described as not entailing any. This is in line with previous research suggesting that the negative relationship between policy costs and policy acceptance is likely to be stronger for low-income respondents (e.g., Kallbekken et al. 2011). Second, preference for the current policy may be driven by a status quo bias (Samuelson et al. 1988) and by risk aversion, which appear to be prominent among individuals with lower socio-economic status (von Gaudecker et al. 2011). Our data, however, does not allow us to disentangle the two explanations.

Results of the analyses with the experimental primes are displayed in Table 6. For Model 4 and for Sweden, we find a negative and statistically significant coefficient associated with $progressive\_share\ x\ prime\_rich$. The result for Italy is similar, but the level of statistical significance ($p = 0.12$) is just shy of conventional levels. Moreover, in Model 4 and for Sweden, participants exposed to the rich priming are also less likely to support the progressive-share rule than participants exposed to the poor priming (Wald tests, $p < 0.05$ for both models). Arguably, low power may explain why we find a limited effect of the exogenous primes. Taken together, these results provide weak causal support for the role of self-interest in individual preferences for burden-sharing rules.

Finally, as mentioned before, Table 6 implies that increasing the statistical power by using the full sample to estimate our specifications, evidence of self-interest in preferences for the distribution of environmental benefits becomes stronger. The coefficient associated with $quality\_urban\ x\ agg\_urban$ is positive and statistically significant at $p < 0.01$ in all specifications except for Sweden. For Sweden, this effect is less pronounced, and just above conventional levels of significance.

Table 6: Results for mixed logit model with priming effects

	1 Model 4	2 SE	3 IT	4 UK
Mean				
costs	-0.0057***	-0.0054***	-0.0054***	-0.0069***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0272***	0.0368***	0.0200***	0.0260***

	1 Model 4	2 SE	3 IT	4 UK
	(0.000)	(0.000)	(0.000)	(0.000)
imports	0.0089***	0.0124***	0.0066***	0.0082***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_amount	-1.0899***	-1.6234***	-0.9006***	-0.8783***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_amount x prime_rich	-0.0809	-0.0879	-0.2133	0.0884
	(0.475)	(0.692)	(0.250)	(0.656)
equal_amount x prime_poor	-0.0215	-0.0246	-0.0081	-0.0202
	(0.849)	(0.910)	(0.965)	(0.919)
equal_share	-0.6745***	-0.7715***	-0.5847***	-0.7079***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_share x prime_poor	0.0150	0.0551	-0.0160	-0.0286
	(0.880)	(0.758)	(0.923)	(0.881)
equal_share x prime_rich	-0.0944	-0.2725	-0.0812	0.0221
	(0.353)	(0.144)	(0.621)	(0.910)
progressive_share	-0.4328***	-0.9481***	-0.0710	-0.3560***
	(0.000)	(0.000)	(0.590)	(0.010)
progressive_share x prime_poor	0.0286	0.0572	-0.0494	0.0725
	(0.799)	(0.798)	(0.791)	(0.704)
progressive_sharex prime_rich	-0.1984*	-0.3876*	-0.2858	0.0738
	(0.083)	(0.093)	(0.123)	(0.701)
quality_both	0.2288***	0.4773***	0.0724	0.1387
	(0.000)	(0.000)	(0.472)	(0.240)
quality_both x agg_urban	0.0989	0.0636	0.1601	0.1633
	(0.169)	(0.625)	(0.183)	(0.234)
Mean				
quality_urban	-0.0526	0.0663	-0.0416	-0.2560**
	(0.378)	(0.510)	(0.683)	(0.031)
quality_urban x agg_urban	0.2956***	0.1948	0.3737***	0.3914***
	(0.000)	(0.134)	(0.003)	(0.005)
statusquo	0.0537	-0.1991	-0.2038	0.5440**
	(0.657)	(0.325)	(0.300)	(0.013)

	1 Model 4	2 SE	3 IT	4 UK
statusquo x prime_poor	0.0626	0.3107	0.0317	-0.0509
	(0.695)	(0.240)	(0.906)	(0.863)
statusquo x prime_rich	0.2078	0.4772*	0.0373	0.1793
	(0.202)	(0.079)	(0.888)	(0.553)
Standard deviation				
costs	0.0066***	-0.0059***	-0.0066***	0.0080***
	(0.000)	(0.000)	(0.000)	(0.000)
reduction	0.0425***	0.0516***	0.0439***	0.0422***
	(0.000)	(0.000)	(0.000)	(0.000)
imports	-0.0131***	0.0116**	-0.0109***	0.0186***
	(0.000)	(0.010)	(0.003)	(0.000)
equal_amount	-0.9036***	1.1889***	-0.8392***	0.7884***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_share	0.4651***	0.7255***	-0.3196	0.5684***
	(0.000)	(0.000)	(0.126)	(0.000)
progressive_share	1.2482***	1.7214***	1.1690***	0.8689***
	(0.000)	(0.000)	(0.000)	(0.000)
quality_both	-0.2049	0.5615***	0.0336	0.3148
	(0.196)	(0.000)	(0.842)	(0.108)
quality_urban	-0.0340	0.2253	-0.0496	0.1203
	(0.799)	(0.355)	(0.747)	(0.547)
statusquo	-2.7683***	2.6022***	2.6786***	3.0151***
	(0.000)	(0.000)	(0.000)	(0.000)
Log likelihood	-15821.22	-5318.15	-5409.07	-4986.04
Number of participants	3079	1031	1025	1023
Number of observations	55422	18558	18450	18414

* p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parentheses.

3.3 Robustness checks

To assess the robustness of our findings we estimated a series of alternative model specifications. First, we run the specifications with correlated random parameters, which allows for various sources of correlation, including scale heterogeneity (Hess et al. 2017). Table B 1 and Table B 2 in Appendix B show that the results from this specification are largely consistent with those reported in Table 3 and Table 5, respectively. With respect to self-interest, the only difference is that $progressive\_share\ x\ high\_income$ for Sweden is just shy of being statistically significant (p = 0.107).

Second, we test the sensitivity of our findings to the specification of income used in the survey. For the main specification, we used the mandatory income screening questions that were used by the market research company to classify respondents by quota groups. Our survey includes another income question that yields more fine-grained information about participants' income (but has missing values representing about 13% of respondents in each country). We use this variable to produce a second income classification in each country: participants in the top 25 percent of the distribution are classified as high-income, those in the bottom 25 percent as low-income, and the remaining 50 percent represent the baseline category (middle income). Besides concerns for statistical power from a reduced sample size due to the missing values, the use of this variable may introduce sampling bias if non-reporting is systematically correlated with income; for these reasons we chose to use the screening question for the main specification. The results from this robustness check, reported in Table B 3, largely support those in Table 5. We find a few differences: in Model 1, the coefficients associated with $progressive\_share\ x\ high\_income$ and $statusquo\ x\ low\_income$ have the expected sign, but they are slightly above standard levels of statistical significance (p = 0.12 and p = 0.21, respectively). Similarly, the coefficients associated with $progressive\_share\ x\ low\_income$ for Italy and $progressive\_share\ x\ high\_income$ for the UK are consistent with those reported in Table 5, but are far from being statistically significant.

Third, we test in a separate robustness check whether the results are sensitive to the definition of the low_income variable for Sweden. As detailed in the Section 2.4, for Sweden the income screening question had four categories, whereas for Italy and the UK it had three categories. Thus, the share of participants classified as high, low or middle income is slightly different for Sweden than in Italy and the UK. Table B 4 indicates that changing the coding of the low_income dummy by combining the two lowest income categories (instead of solely including the lowest category as in our main specification) yields results that are virtually the same as those reported in Table 5 for M3 and for Sweden.

Finally, we examine whether our findings on preferences for the distribution of benefits of policies are sensitive to the specification of location of residency. To this end, we split the dummy variable for agg_urban in two dummy variables, one for living in the center of a major town/city and one for living in its suburbs. The goal is to assess whether preferences of participants living in these two areas differ systematically and whether one of the two groups drives the results reported in Table 5 and Table 6. We re-estimate Model 3 as well as single country specification including also the priming conditions (as in Table 6) to increase statistical power. Across all specifications, both the coefficients of $quality\_urban\ x\ centre\_city$ and $quality\_urban\ x\ suburb\_city$ are positive and statistically significant and have similar magnitude. The only exception is in Sweden, for which only $quality\_urban\ x\ suburb\_city$ is statistically significant. Overall, these results indicate that preferences for policies improving environmental quality in urban areas (compared to rural areas) are equally driven by those living in city centers and suburban areas. Thus, our findings on self-interest in preferences for the distribution of benefits are robust to the alternative specifications of urban and non-urban areas considered.

4 Conclusion

Low-carbon transition policies are urgently needed to limit global warming. Recent evidence, however, reveals that lack of public support endangers the political feasibility of such policies that are only acceptable if they are considered fair. Therefore, knowing citizens' preferences about which principles should govern the distribution of costs and benefits of policies and better understanding the factors shaping these preferences will help design low-carbon transition policies that are publicly acceptable.

Our results from demographically representative DCEs in three European countries (Sweden, Italy and the UK) suggest that the acceptability of energy efficiency policies is highest when the polluter-pays rule is used as burden-sharing rule, followed by a progressive distribution of the costs. By contrast, splitting costs equally among all citizens of a country appears to be the least preferred burden-sharing rule in all three countries. In addition, our results indicate that low-income participants generally prefer the status quo policy over new energy efficiency policies. Policy-makers therefore need to consider how to overcome preferences for policies that are currently in place, thereby taking into account not only distributional fairness but possibly also other issues such as status quo bias or risk aversion (Weber 2017).

Most importantly, our findings highlight the role of self-interest in citizens' preferences for climate policy distributional rules. Our findings not only contribute to understanding the role of self-interest in preferences for burden-sharing rules; they also suggest that self-interest shapes individual preferences for the distribution of the environmental benefits associated with climate policies.

Similar to the extant literature, our findings on the effects of self-interest are mostly based on correlational evidence. Interestingly, our exogenous prime approach provides (albeit weak) causal evidence for the effect of self-interest on citizens' valuation of burden-sharing rules. Future research examining the acceptability of low-carbon transition policies should strive to provide further causal evidence on the factors shaping individual preferences for these policies.

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Declarations of interest

The authors declare no competing interests.

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Appendix

Appendix A: Descriptive statistics

Table A 1: Details of income and location of residency for Sweden

Survey items	Variable	Distribution
Panel A: Income		
Less than 199 999kr	low_income	0.24
Between 200 000 and 399 999kr Between 400 000 and 599 999kr	*baseline*	0.61
More than 599 999kr	$high\_income$	0.14
Panel B: location of residency		
Centre of a major town/city Suburban (fringes of a major town/city)	agg_urban	0.57
Small town or village Isolated dwelling (not in a town or village)	*baseline*	0.43

Table A 2: Details of income and location of residency for Italy

Survey items	Variable	Distribution
Panel A: Income		
Less than 1 999€	low_income	0.50
Between 2 000 and 3 999€	*baseline*	0.36
More than 4 000€	$high\_income$	0.14
Panel B: location of residency		
Centre of a major town/city Suburban (fringes of a major town/city)	agg_urban	0.66
Small town or village Isolated dwelling (not in a town or village)	*baseline*	0.34

Table A 3: Details of income and location of residency for the UK

Survey items	Variable	Distribution
Panel A: Income		
Less than 1 579£	low_income	0.48
Between 1 580 and 3 159£	*baseline*	0.30
More than 3 160£	$high\_income$	0.23
Panel B: location of residency		
Centre of a major town/city Suburban (fringes of a major town/city)	agg_urban	0.68
Small town or village Isolated dwelling (not in a town or village)	*baseline*	0.32

Table A 4: Sample characteristic by treatment for Sweden

	Control	Poor priming	Rich priming
Sample size	322	377	332
Male	0.50	0.49	0.54
Mean age (in years)	42.42	41.21	43.13
Graduate degree (share)	0.52	0.45	0.44
Living in urban agglomeration (share)	0.56	0.60	0.54
Income			
Below 199 999kr	0.23	0.27	0.22
Between 200 000kr and 399 999kr	0.38	0.38	0.38
Between 400 000kr and 599 999kr	0.25	0.23	0.23
More than 600 000kr	0.14	0.12	0.17

Note: Numbers in bold indicate differences between groups statistically significant at the 0.05 level based on Bonferroni's correction for multiple hypothesis testing

Table A 5: Sample characteristic by treatment for Italy

	Control	**Poor priming**	**Rich priming**
Sample size	347	329	349
Male	0.49	0.45	0.48
Mean age (in years)	43.16	42.12	42.87
Graduate degree (share)	0.40	0.33	0.43
Living in urban agglomeration (share)	0.69	0.67	0.62
Income			
Below 1 999€	0.49	0.47	0.53
Between 2 000 and 3 999€	0.36	0.39	0.33
More than 4 000€	0.16	0.14	0.14

Note: Numbers in bold indicate differences between groups statistically significant at the 0.05 level based on Bonferroni's correction for multiple hypothesis testing

Table A 6: Sample characteristic by treatment for the UK

	Control	**Poor priming**	**Rich priming**
Sample size	347	341	335
Male	0.52	0.54	0.48
Mean age (in years)	42.31	42.95	42.26
Graduate degree (share)	0.51	0.53	0.50
Living in urban agglomeration (share)	0.70	0.66	0.68
Income			
Below 1 579£	0.46	0.50	0.47
Between 1 580 and 3 159£	0.28	0.32	0.30
More than 3 160£	0.26	0.18	0.23

Note: Numbers in bold indicate differences between groups statistically significant at the 0.05 level based on Bonferroni's correction for multiple hypothesis testing.

Appendix B: Robustness checks

Table B 1: Results for mixed logit model with correlated random parameters, main effects

	1 Model 1	2 Model 2
Mean		
costs	-0.0070***	-0.0064***
	(0.000)	(0.000)
savings	0.0326***	0.0398***
	(0.000)	(0.000)
imports	0.0094***	0.0128***
	(0.000)	(0.000)
equal_amount	-1.1130***	-1.4914***
	(0.000)	(0.000)
equal_share	-0.5379***	-0.6643***
	(0.000)	(0.000)
progressive_share	-0.3777***	-0.7532***
	(0.001)	(0.000)
quality_both	0.2049**	0.3044**
	(0.021)	(0.021)
quality_urban	0.0643	-0.0334
	(0.457)	(0.793)
statusquo	-0.0650	-0.3580*
	(0.635)	(0.092)
costs x IT		0.0000
		(0.978)
savings x IT		-0.0162
		(0.169)
imports x IT		-0.0081**
		(0.040)
equal_amount x IT		0.5414***
		(0.009)

	1 Model 1	2 Model 2
Mean		
equal_share x IT		0.1643
		(0.405)
progressive_share x IT		0.7313***
		(0.001)
quality_both x IT		-0.1689
		(0.326)
quality_urban x IT		0.2239
		(0.175)
statusquo x IT		0.0346
		(0.904)
costs x UK		-0.0016
		(0.137)
savings x UK		-0.0211*
		(0.084)
imports x UK		-0.0008
		(0.854)
equal_amount x UK		0.6054***
		(0.005)
equal_share x UK		0.1633
		(0.433)
progressive_share x UK		0.3738
		(0.101)
quality_both x UK		-0.1058
		(0.558)
quality_urban x UK		0.0595
		(0.732)
statusquo x UK		0.7141**
		(0.015)

	1 Model 1	2 Model 2
Log likelihood	-5243.42	-5214.18
Number of participants	1016	1016
Number of observations	18 288	18 288

* p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parentheses.

Table B 2: Results for mixed logit model with correlated random parameters and socio-demographic interactions[9]

	1 Model 3	2 SE	3 IT	4 UK
Mean				
costs	-0.0072***	-0.0065***	-0.0072***	-0.0097***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0297***	0.0454***	0.0148	0.0267**
	(0.000)	(0.000)	(0.154)	(0.011)
imports	0.0097***	0.0134***	0.0046	0.0158***
	(0.000)	(0.000)	(0.229)	(0.000)
$equal\_amount$	-1.1152***	-1.4365***	-1.4161***	-0.3653
	(0.000)	(0.000)	(0.000)	(0.334)
$equal\_amount\ x\ low\_income$	0.0516	-0.1929	0.2263	-0.4661
	(0.787)	(0.590)	(0.549)	(0.263)
$equal\_amountx\ high\_income$	0.0125	-0.5200	0.5721	-0.6323
	(0.957)	(0.251)	(0.259)	(0.171)
$equal\_share$	-0.4671***	-0.7687***	-0.2906	-0.5556
	(0.001)	(0.000)	(0.234)	(0.163)
$equal\_share\ x\ low\_income$	-0.0208	0.1973	-0.2449	-0.1383
	(0.909)	(0.585)	(0.425)	(0.763)
$equal\_share\ x\ high\_income$	-0.3079	-0.7505	-0.7475*	0.1258
	(0.157)	(0.106)	(0.074)	(0.797)
$progressive\_share$	-0.3314**	-0.7438***	-0.3966	0.4209
	(0.028)	(0.003)	(0.169)	(0.235)

9 Standard deviations and the correlation matrix are not reported to save space. They are available upon request.

	1 Model 3	2 SE	3 IT	4 UK
Mean				
progressive_share x low_income	0.1502	-0.2738	0.7199**	-0.8258**
	(0.442)	(0.542)	(0.039)	(0.032)
progressive_share x high_income	-0.4766**	-0.9049	-0.1859	-0.9292**
	(0.050)	(0.107)	(0.696)	(0.027)
quality_both	0.1412	0.2531	0.0897	-0.0345
	(0.262)	(0.233)	(0.723)	(0.899)
quality_both x agg_urban	0.1448	0.3233	0.0792	0.2523
	(0.297)	(0.211)	(0.772)	(0.387)
quality_urban	-0.1592	-0.2935	0.1115	-0.3815
	(0.205)	(0.191)	(0.631)	(0.165)
quality_urban x agg_urban	0.3603**	0.4020	0.2957	0.6271**
	(0.010)	(0.140)	(0.255)	(0.032)
statusquo	-0.1811	-0.2061	-0.5993*	1.0036**
	(0.313)	(0.451)	(0.069)	(0.024)
statusquo x low_income	0.5000**	-0.0926	0.6088	0.4046
	(0.027)	(0.836)	(0.110)	(0.425)
statusquo x high_income	-0.4908	-0.0566	-0.4018	-1.6063***
	(0.106)	(0.924)	(0.443)	(0.004)
Log likelihood	-5228.98	-1675.63	-1804.38	-1647.95
Number of participants	1 016	322	347	347
Number of observations	18 288	5 796	6 246	6 246

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values in parentheses.

Table B 3: Results for mixed logit model with socio-demographic interactions (alternative income specification)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
costs	-0.0067***	-0.0057***	-0.0060***	-0.0090***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0306***	0.0461***	0.0210**	0.0291***
	(0.000)	(0.000)	(0.037)	(0.004)
imports	0.0106***	0.0137***	0.0054*	0.0120***
	(0.000)	(0.000)	(0.071)	(0.001)
equal_amount	-1.2062***	-1.3518***	-1.2334***	-0.9297***
	(0.000)	(0.000)	(0.000)	(0.001)
equal_amount x bottom25_income	0.2322	0.0362	0.3003	0.1916
	(0.350)	(0.936)	(0.474)	(0.674)
equal_amount x top25_income	0.1449	-0.4382	0.5447	-0.0471
	(0.471)	(0.222)	(0.118)	(0.898)
equal_share	-0.5570***	-0.4230***	-0.6390***	-0.7660***
	(0.000)	(0.010)	(0.001)	(0.002)
equal_share x bottom25_income	-0.0621	-0.4403	0.2031	0.0671
	(0.783)	(0.261)	(0.577)	(0.882)
equal_share x top25_income	-0.1209	-0.5782**	0.0656	0.1527
	(0.494)	(0.047)	(0.829)	(0.666)
progressive_share	-0.2802**	-0.5879***	0.0658	-0.2362
	(0.024)	(0.005)	(0.767)	(0.301)
progressive_share x bottom25_income	-0.0847	0.0846	0.0997	-0.5801
	(0.728)	(0.862)	(0.808)	(0.177)
progressive_share x top25_income	-0.3060	-0.6168*	-0.2834	-0.2295
	(0.118)	(0.093)	(0.411)	(0.490)
quality_both	0.1476	0.1923	0.0839	0.1777
	(0.218)	(0.285)	(0.704)	(0.451)
quality_both x agg_urban	0.0615	0.1259	0.0995	0.0477
	(0.664)	(0.585)	(0.695)	(0.861)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
quality_urban	-0.1048	-0.1925	-0.0047	-0.0965
	(0.374)	(0.284)	(0.983)	(0.678)
quality_urban x agg_urban	0.2785*	0.1454	0.3142	0.3751
	(0.050)	(0.534)	(0.229)	(0.171)
statusquo	0.0769	-0.2212	-0.0424	0.7069**
	(0.657)	(0.395)	(0.888)	(0.041)
statusquo x bottom25_income	0.4033	0.5236	-0.2521	0.5920
	(0.211)	(0.383)	(0.633)	(0.287)
statusquo x top25_income	-0.3544	0.4444	-0.8165*	-1.2378**
	(0.176)	(0.293)	(0.065)	(0.020)
Standard deviation				
costs	-0.0077***	-0.0054***	0.0085***	0.0101***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0554***	0.0495***	-0.0774***	0.0341
	(0.000)	(0.003)	(0.000)	(0.374)
imports	-0.0132***	-0.0012	-0.0149***	-0.0226***
	(0.001)	(0.912)	(0.007)	(0.000)
equal_amount	0.9357***	0.6869**	1.0137***	1.0131***
	(0.000)	(0.033)	(0.000)	(0.000)
equal_share	-0.6390***	0.5183**	-0.4642	-0.9383***
	(0.000)	(0.046)	(0.142)	(0.000)
progressive_share	-1.2134***	1.4478***	1.2825***	0.8098***
	(0.000)	(0.000)	(0.000)	(0.003)
quality_both	-0.4868***	0.6531***	0.3913	0.4123
	(0.001)	(0.002)	(0.141)	(0.208)
quality_urban	-0.0204	0.3747	-0.0798	-0.0490
	(0.920)	(0.288)	(0.706)	(0.910)
statusquo	-2.4602***	2.2495***	2.4057***	-2.6249***
	(0.000)	(0.000)	(0.000)	(0.000)

	1 Model 3	2 SE	3 IT	4 UK
Log likelihood	-4629.38	-1541.36	-1582.35	-1451.61
Number of participants	883	288	297	298
Number of observations	15 894	5 184	5 346	5 364

* p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parentheses.

Table B 4: Results for mixed logit model with socio-demographic interactions (alternative aggregation of income categories for Sweden)[10]

	1 Model 3	2 SE
Mean		
costs	-0.0066***	-0.0057***
	(0.000)	(0.000)
savings	0.0323***	0.0451***
	(0.000)	(0.000)
imports	0.0100***	0.0130***
	(0.000)	(0.000)
$equal\_amount$	-1.0585***	-1.3831***
	(0.000)	(0.000)
$equal\_amount\ x\ low\_income$	-0.0561	-0.4654
	(0.812)	(0.311)
$equal\_amount\ x\ high\_income$	-0.1248	0.0458
	(0.509)	(0.883)
$equal\_share$	-0.5681***	-0.6384***
	(0.000)	(0.007)
$equal\_share\ x\ low\_income$	-0.3190	-0.7889*
	(0.141)	(0.052)
$equal\_share\ x\ high\_income$	-0.1305	0.0295
	(0.457)	(0.916)
$progressive\_share$	-0.3518**	-0.7704**
	(0.021)	(0.010)

10 Standard deviations and the correlation matrix are not reported to save space. They are available upon request.

	1 Model 3	2 SE
Mean		
progressive_share x low_income	0.0154	0.0874
	(0.935)	(0.803)
progressive_share x high_income	-0.4751**	-0.8294
	(0.046)	(0.104)
quality_both	0.1910*	0.2535
	(0.089)	(0.137)
quality_both x agg_urban	0.0880	0.1376
	(0.510)	(0.529)
quality_urban	-0.0900	-0.1762
	(0.412)	(0.308)
quality_urban x agg_urban	0.3219**	0.2856
	(0.016)	(0.203)
statusquo	-0.0102	-0.3855
	(0.961)	(0.297)
statusquo x low_income	0.4626*	0.4471
	(0.064)	(0.295)
statusquo x high_income	-0.4615	0.3507
	(0.154)	(0.572)
Standard deviation		
costs	-0.0078***	0.0056***
	(0.000)	(0.000)
savings	0.0518***	-0.0459**
	(0.000)	(0.014)
imports	-0.0151***	0.0009
	(0.000)	(0.977)
equal_amount	0.8579***	0.6533**
	(0.000)	(0.021)
equal_share	-0.6930***	0.5439**
	(0.000)	(0.019)
progressive_share	-1.2254***	-1.4760***
	(0.000)	(0.000)

	1 Model 3	2 SE
Standard deviation		
quality_both	-0.5273***	0.5918***
	(0.000)	(0.002)
quality_urban	0.0604	-0.4429
	(0.755)	(0.127)
statusquo	2.5469***	2.3937***
	(0.000)	(0.000)
Log likelihood	-5267.57	-1713.62
Number of participants	1 016	322
Number of observations	18 288	5 796

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parentheses.

Table B 5: Results for mixed logit model with socio-demographic and primes interactions (alternative coding of location of residency)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
costs	-0.0065***	-0.0054***	-0.0053***	-0.0067***
	(0.000)	(0.000)	(0.000)	(0.000)
savings	0.0326***	0.0376***	0.0200***	0.0260***
	(0.000)	(0.000)	(0.000)	(0.000)
imports	0.0101***	0.0122***	0.0068***	0.0080***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_amount	-1.1380***	-1.6065***	-0.8793***	-0.8352***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_amount x low_income	0.0210			
	(0.907)			
equal_amountx high_income	0.0476			
	(0.828)			
equal_amount x prime_poor		-0.0489	-0.0227	-0.0429
		(0.822)	(0.901)	(0.824)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
equal_amount x prime_rich		-0.0994	-0.2154	0.0895
		(0.649)	(0.239)	(0.642)
equal_share	-0.6290***	-0.7719***	-0.5679***	-0.7097***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_share x low_income	-0.0407			
	(0.808)			
equal_share x high_income	-0.2376			
	(0.232)			
equal_share x prime_poor		0.0604	-0.0319	-0.0088
		(0.732)	(0.846)	(0.962)
equal_share x prime_rich		-0.2626	-0.0841	0.0493
		(0.156)	(0.604)	(0.795)
progressive_share	-0.4093***	-0.9269***	-0.0779	-0.3657***
	(0.001)	(0.000)	(0.550)	(0.007)
progressive_share x low_income	0.1636			
	(0.363)			
progressive_share x high_income	-0.3967*			
	(0.073)			
progressive_share x prime_poor		0.0432	-0.0313	0.0773
		(0.846)	(0.865)	(0.680)
progressive_share x prime_rich		-0.4041*	-0.2832	0.0846
		(0.077)	(0.122)	(0.656)
quality_both	0.1868*	0.4785***	0.0764	0.1426
	(0.090)	(0.000)	(0.446)	(0.218)
quality_both x centre_city	0.1099	-0.0838	0.1607	0.1158
	(0.480)	(0.586)	(0.228)	(0.494)
quality_both x fringe_city	0.0649	0.1776	0.1385	0.1823
	(0.666)	(0.247)	(0.337)	(0.209)
quality_urban	-0.0904	0.0651	-0.0364	-0.2446**
	(0.405)	(0.511)	(0.720)	(0.035)

	1 Model 3	2 SE	3 IT	4 UK
Mean				
quality_urban x centre_city	0.3170**	0.0243	0.3700***	0.2896*
	(0.042)	(0.874)	(0.007)	(0.091)
quality_urban x fringe_city	0.3099**	0.3736**	0.3511**	0.4309***
	(0.040)	(0.015)	(0.018)	(0.004)
statusquo	0.0241	-0.2242	-0.1965	0.5041**
	(0.893)	(0.280)	(0.315)	(0.020)
statusquo x low_income	0.5631**			
	(0.020)			
statusquo x high_income	-0.5650*			
	(0.072)			
statusquo x prime_poor		0.3630	-0.0174	-0.0218
		(0.172)	(0.948)	(0.941)
statusquo x prime_rich		0.5181*	0.0152	0.2240
		(0.063)	(0.954)	(0.457)
Standard deviation				
costs	-0.0077***	-0.0059***	0.0065***	0.0076***
	(0.000)	(0.000)	(0.000)	(0.000)
reduction	0.0495***	0.0484***	0.0436***	0.0372***
	(0.000)	(0.000)	(0.000)	(0.001)
imports	0.0124***	0.0115**	-0.0087*	0.0177***
	(0.005)	(0.012)	(0.080)	(0.000)
equal_amount	0.8582***	1.1865***	0.8361***	0.6973***
	(0.000)	(0.000)	(0.000)	(0.000)
equal_share	-0.6217***	0.7003***	0.2928	-0.4749***
	(0.000)	(0.000)	(0.158)	(0.004)
progressive_share	-1.2012***	1.6960***	1.1393***	-0.8480***
	(0.000)	(0.000)	(0.000)	(0.000)
quality_both	-0.4994***	0.4990***	-0.0160	-0.2597
	(0.000)	(0.001)	(0.922)	(0.289)

	1 Model 3	2 SE	3 IT	4 UK
Standard deviation				
quality_urban	0.1196	-0.1664	0.0278	0.1101
	(0.505)	(0.668)	(0.850)	(0.546)
statusquo	2.5631***	2.5808***	2.6782***	3.0370***
	(0.000)	(0.000)	(0.000)	(0.000)
Log likelihood	-5269.39	-5319.12	-5411.23	-4988.73
Number of participants	1 016	1 031	1 025	1 023
Number of observations	18 288	18 558	18 450	18 414

* p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parentheses.

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