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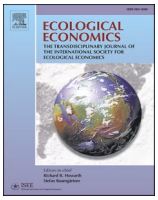

Impartial policymakers prefer to impose carbon pricing to capping, especially when combined with offsets

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ABSTRACT

Sustainable socio-economic development requires a global reduction of greenhouse gas emissions. We utilize an incentivized experiment to map the preferences of 'policymakers' over climate actions of 'decision-makers'. Our design guarantees that these preferences are unaffected by selfish motives such as a concern about being re-elected or an unwillingness to pay for the greater good. Few of our impartial policymakers choose interventions that leave the autonomy of decision-makers' completely untouched. The choice patterns of those who intervene suggest that policymakers care not only about minimizing emissions, but also about *how* emissions are reduced. Policymakers strongly prefer pricing policies over capping emissions, and among the pricing policies, they prefer those that include voluntary carbon offsets, even if this leaves considerable scope for decision-makers to selfishly emit CO_2. The reason is that policymakers expect decision-makers to voluntarily offset some of their emissions at their own cost, and believe that this would eventually improve the outcome in terms of both emissions and the decision-makers' profit relative to a standard carbon pricing policy (without offsetting). Our decision-making data confirm this expectation.

1. Introduction

While there is a broad consensus that greenhouse gas emissions need to be reduced to tackle climate change, there is a lack of consensus about which policy should be imposed to reach the goal. Economists argue that carbon pricing is an indispensable strategy for reducing carbon emissions (Economists' Statement on Carbon Dividends, 2019; Economists' Statement on Carbon Pricing, 2019; MacKay et al., 2015; Stiglitz et al., 2017), yet public support for carbon pricing is weak and policymakers often prefer alternative mechanisms such as subsidies and standards (Carattini et al., 2019; Douenne and Fabre, 2022; Mildenberger, 2020; Mildenberger et al., 2022; Rosenbloom et al., 2020). Understanding the motives of the various stakeholders is crucial for identifying a portfolio of policy measures that is considered environmentally just and ethical and that effectively mitigates climate change.

Some of the empirical literature studying people's preferences between different climate policies is based on non-incentivized surveys and vignette studies (Baranzini and Carattini, 2017; Klenert et al., 2018; Rhodes et al., 2017). However, research based on hypothetical climate action and policy has received criticism from various fields, including behavioral economics and environmental psychology, arguing that the answers may be biased due to social desirability and other confounding factors (Berger and Wyss, 2021; Lange and Dewitte, 2019). One common finding in this literature is that there is an enormous gap between self-reported environmental decision-making and actual observed environmental behavior (Carrington et al., 2014; Kollmuss and Agyeman, 2002; Lange and Dewitte, 2019; see Kormos and Gifford, 2014, for a meta-analysis). But even studies that properly incentivize decisions, or that are based on actual poll data, do so from the perspective of affected consumers and households, and thus – maybe not surprisingly – often find that people are reluctant to, say, pay carbon taxes themselves (Anderson et al., 2019; Thalmann, 2004). However, this does not necessarily imply that people find carbon pricing policies *fundamentally* unreasonable or unacceptable; they may rationally oppose such policies in the role of affected decision-makers, yet welcome them as appropriate measures to address climate change from the perspective of an impartial policymaker. As a further illustration, another study finds that most people are unwilling to offset their own carbon emissions from flying

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(Berger et al., 2022), but this study cannot separate whether carbon offsetting measures are not chosen because they are not in line with the respondents' climate policy attitudes or because respondents want to avoid paying the costs associated with them. People may individually reject offsetting their carbon emissions, yet support a policy that generally mandates offsetting. We study the choices of participants who are not directly affected by the policy. This captures situations where policies have at best a marginal impact on one's own financial situation.

A second important feature of our study is that we let participants express their preferences over a large set of policies, from carbon prices with and without earmarked revenues to production caps and voluntary offsetting. We explain every policy in detail, exactly as it is applied to the affected individuals, thereby making sure that participants have a good understanding of what they are evaluating.

We investigate the incentivized choices of participants in the role of impartial policymakers who can impose one climate policy out of a set of pricing and non-pricing measures that have a real impact on others who make CO_2 emission-relevant decisions. The interventions of the policymakers affect the choice menu and the payoff of participants in the role of producers, yet they do not affect the policymakers' payoff. While the interventions may affect real CO_2 emissions, the policymaker's utility from a potential change in the resulting climate change is negligibly small. In this sense, the result of our laboratory experiment is a map of 'pure' preferences over climate policies, unaffected by one's own immediate selfish motives, such as a concern about being reelected or an unwillingness to pay for the greater good.

We find that few of our impartial policymakers in the laboratory prefer to not touch the decision-makers' autonomy when making choices. By far, most policymakers are willing to intervene to reduce CO_2 emissions, and if they do, they strongly prefer pricing policies over capping emissions. Among the available pricing policies, policymakers prefer those that involve carbon offsetting over those without offsetting. The most preferred policy is *Earmarked Carbon Price* where all revenues are used for carbon offsets, followed by *Voluntary Offsetting* where revenues are also directed to carbon offsets but based on voluntary contributions. The third-most preferred option is *Carbon Price* where the revenues are pocketed by the experimenter followed by a *Cap* on the production level. The policy *No Intervention* is ranked lowest.

This is in line with previous work that finds environmental taxes to be more acceptable, among other factors, when the tax returns are earmarked. Case studies and surveys are employed by Baranzini and Carattini, 2017, Carattini et al., 2017, and Carattini et al., 2018, whereas Kallbekken et al., 2011 have studied incentivized choices in lab experiments. Kallbekken et al. (2011) focus their experiment on the acceptability of taxes and whether it matters how tax revenues are used. They study voting on policy regimes by consumers in a market who can purchase goods with externalities on others. In contrast, we investigate the decisions of participants who have no direct stake in the decisions but who can influence the payoffs of other participants. Moreover, our participants not only choose between earmarked and non-earmarked taxes and no intervention, but can also opt for caps and voluntary carbon offsets.

Our results also resonate with work on the acceptance of carbon offsets and voluntary contributions to the mitigation of climate change. Löschel et al. (2013) also withdraw certificates from the European Emissions Trading Scheme to estimate the willingness to pay. Blasch and Farsi (2014) observe that consumers' willingness to compensate depends on the consumption good as well as the exact project that offsets the emissions. Blasch and Ohndorf (2015) observe that internalized norms and income are the most important determinants of offsetting behavior in Switzerland while Diederich and Goeschl (2014) identify education, the information structure among the population, and exogenous environmental conditions as relevant factors in Germany. Lange and Ziegler (2017) compare offsetting behavior in the US and Germany and its determinants, based on a theoretical model. A model of voluntary donations (applied to offsetting choices) is also developed in Lange et al. (2017). Kuhn and Uler (2019) extend the study of voluntary offsetting to experimental markets.

Finally, our results also speak to the experimental literature on the endogenous formation of institutions in cooperation games (see Dannenberg and Gallier, 2020, for a review). Similar to our results, these studies find that beliefs about others' willingness to cooperate are important determinants of institutional choice. The literature has also shown that strong institutions are often more popular than weak ones, while individuals refrain from implementing restrictive policies, even if they guarantee full cooperation (Bó et al., 2010). This is similar to our finding that many policymakers refrain from enforcing zero emissions by setting a cap of zero, suggesting that in both experimental setups individuals not only care about the final outcomes but also about how they came about.

2. Experiment

2.1. Design

In our experiment, participants acted as either producers or policymakers.[1] Producers had to decide how many units (between zero and nine) of a fictitious good to produce. Each unit produced increased the producers' payoff up until the eighth unit but also led to an emission of 17.5 kg of CO_2 per unit. To ensure that the production decision had real consequences in terms of the externality, for every ton of CO_2 not emitted in our experiment we bought one EU emissions trading system emission certificate, which was then deleted and removed from the system.[2] Therefore, abstention from production in the experiment can be interpreted as a contribution to a social good at a personal financial cost. Table 1 summarizes the decision situation of the producers in our baseline scenario (see below).

The main task of the policymakers was to decide whether and how to intervene in the producers' production decision. Interventions did not alter their own payoff. Policymakers could choose between the following five policies: (i) *No Intervention*, in which case producers simply decided how many units to produce as described above, (ii) *Voluntary Offsetting*, where producers were given the opportunity to offset some or all of their emissions by making a donation to the non-profit organization Atmosfair (https://www.atmosfair.de/en/) that uses the money to fund projects that mitigate CO_2 emissions, (iii) *Carbon Price*, where a price of 0.40€ per unit produced had to be paid by the producer to the experimenter, (iv) *Earmarked Carbon Price*, which is identical to *Carbon Price* except that the revenues go to Atmosfair instead of the experimenter and where the price of 0.40€ per unit was set such that it equals the amount needed to fully offset the emissions, (v) *Cap*, in which case policymakers set a maximum number of units that producers are allowed to produce.[3]

One could argue that, from an economic perspective, what matters for efficiency is an appropriate carbon price; the use of carbon pricing revenues – whether they go back to the experimenter as in our *Carbon Price* treatment, or are used to further reduce emissions, as in *Earmarked Carbon Price* – may only be of secondary importance. However, based on the previous evidence described above, it seems plausible that *Earmarked Carbon Price* makes carbon pricing more attractive. We also note that the carbon price is below the marginal returns from production. Therefore, only the cap could change the behavior of rational payoff-

[1] The instructions (documented in Appendix B) were framed neutrally and did not use the term "policymaker". Instead, participants were asked to rank "options" that would set the rules for the decisions of producers.

[2] This was implemented in collaboration with the TheCompensators* (https://www.compensators.org/en/compensators/).

[3] See the instructions in Appendix B for a full description of how the different policies were described to the participants. E.g., the "Earmarked Carbon Price" option was presented to participants as "Force producers to compensate CO2."

Table 1
| Decision situation of producers.

Units produced	0	1	2	3	4	5	6	7	8	9
Profit (in €)	0.00	2.00	3.50	4.50	5.40	6.20	6.90	7.50	8.00	7.90
CO_2 (in kg)	0	17.5	35	52.5	70	87.5	105	122.5	140	157.5

maximizing decision makers in our experiment. We thus consider a situation where all policies (apart from the cap) do not differ with respect to the optimal production decision. Assuming that producers would generally not want to increase production if doing so reduces their payoff *and* increases carbon emissions, policies cannot be ranked by policymakers with respect to their effectiveness in changing production choices (except for the cap), but the focus is on pure policy preferences and the potential behavioral effects of policies, i.e., how they affect non-selfishly motivated climate action.

Our main interest is to explore the policymakers' preferences regarding the different policies. We therefore asked them to rank the five policies from their most to their least preferred one. To ensure that policymakers had an incentive to reveal their true preferences, it was explained that higher-ranked policies had a higher likelihood of being implemented for one producer. The obtained ranking allows us to design a map of 'pure' preferences over climate policies, unaffected by one's own immediate selfish motives. For example, if policymakers are only concerned about the producers' payoffs or autonomy, then they should rank *No Intervention* and *Voluntary Offsetting* in the first two places. If, instead, policymakers care only about reducing emissions, then they should choose the *Cap* and set it to zero. Alternatively, they can rank *Earmarked Carbon Price* highly to ensure that all emissions are fully neutralized.

2.2. Procedures

We administered the data collection in a two-step procedure. In a first experiment, we collected the responses from the policymakers. The experiment consisted of several parts. At the beginning of the experiment, participants first received written instructions explaining the two-part nature of the experiment, the task of the producers, their own task, and how the CO_2 externality would be implemented. After that, participants had to answer a set of control questions testing their understanding of the setup. The experiment proceeded only after all questions had been answered correctly. Participants then first had to state an initial ranking over the alternatives *No Intervention*, *Voluntary Compensation*, *Carbon Price* and *Earmarked Carbon Price*. Next, they were asked to set a cap and integrate this alternative into the previously determined ranking. The reason for this procedure was to avoid the endogenously chosen cap from affecting the ranking of the other alternatives, which would make the ranking across individuals less comparable. To incentivize the ranking, at the end of the experiment three of the five alternatives were randomly selected and deleted. Among the remaining two alternatives, the one that had a lower rank number (i.e., was more preferred) was implemented for one producer. This procedure ensures that policymakers have an incentive to state a complete preferred ranking over all five alternatives, instead of only stating their most preferred alternative. In the second part of the experiment, participants were asked to state their beliefs about the production and donation decisions of the producers.[4] In the third part, policymakers were asked to make their own production and donation decisions under the *Voluntary Compensation* scheme. This part had a 10% chance of being selected as payoff-relevant. The experiment ended with a short questionnaire. In the questionnaire, we elicited participants' age, gender, field of study, political attitudes, as well as self-reported measures of risk and time preferences.

After collecting the data from the policymakers, in a second experiment we elicited the responses from the producers. The procedures of this experiment were as follows. First, participants received written instructions explaining the two-part nature of the experiment, the task of the policymakers, their own task, and how the CO_2 externality would be implemented. Participants then had to correctly answer a set of control questions testing their understanding of the setup. After that, participants had to make their production and donation decision for each of the five possible scenarios.[5] The order in which participants saw the different scenarios was randomized at the individual level. At the end of the experiment, producers were assigned to one randomly selected policymaker. The policymaker's most preferred scenario then determined which situation would be payoff-relevant for the producer. Experimental sessions ended with a short questionnaire with questions about the participant's age, gender, political attitude, and field of study.

Our two experiments were conducted online in 2021. Participation in the experiment was voluntary and participants were informed that all decisions and payments would be anonymous and confidential (ethical approval was obtained by the Ethics Review Board (ERB) of XXX). Moreover, it was explained to the participants that all decisions and associated payoffs would be implemented in exactly the same way as described in the experimental instructions (see Appendix B for an English copy of the instructions), and that, a few weeks after the experiment, they could see a proof of their donations and the CO_2 emission certificates bought by us on a pre-announced website.

We recruited a total of $N = 315$ participants. Since we are mainly interested in the responses of the policymakers, we assigned more participants to the role of policymakers ($N = 219$) than producers ($N = 96$). Because we had more policymakers than producers in our experiment, we randomly selected the responses from a subset of policymakers that were implemented for the producers.[6] Participants were students from various disciplines at the University of XXX, recruited via the online platform ORSEE. Of our participants, 47% were female, and their mean age was 25.6 years (SD: 3.99). The experiments for the policymakers were programmed and executed via Limesurvey. The experiment took around 20 min and participants earned an average of 10.49€. The experiments for the producers were programmed using z-Tree (Fischbacher, 2007) and executed via z-Tree Unleashed (Duch et al., 2020). Producers completed the experiment in about 12 min and earned, on average, 6.87€.

3. Results

Figure 1 indicates the mean ranking of the five measures by the policymakers. The most preferred policy is *Earmarked Carbon Price*, followed by *Voluntary Offsetting*, *Carbon Price*, and *Cap*. *No Intervention* is ranked lowest. Pairwise comparisons based on Wilcoxon signed-rank

[4] To incentivize beliefs, we used data from a pilot experiment with $N = 32$ decision-makers. For this, one guess was chosen at random at the end of the experiment and then compared with the actual production/donation decision of the decision-makers. The closer the guess was to the actual value, the higher the chance of winning a prize of 2€. The probability of winning the 2€ was determined as follows: Prob(2€) = 100 – (8 × (guess – actual value))^2.

[5] For the *Cap* scenario, decision-makers were asked to make a production decision for each possible level of the cap using the strategy method.

[6] This procedure is consistent with what has been used in related previous studies (see, e.g., Ackfeld and Ockenfels, 2021; Ambuehl et al., 2021) and was explained to the policymakers at the beginning of the experiment.

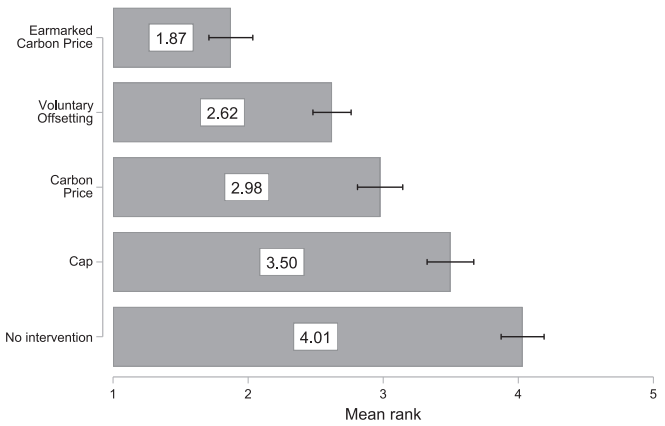

Fig. 1. Policymakers' preferences over alternatives. The figure shows the mean ranking of the five alternatives where 1 corresponds to "most preferred option" and 5 corresponds to "least preferred option." Whiskers correspond to 95% Confidence Intervals.

(WSR) tests reveal that the difference in ranks between any two alternatives is highly significant (in all cases $P < 0.015$).

Policymakers did not hesitate to intervene in the decision-making of others: *No Intervention* is by far the least preferred policy, and only 4.6% rank this option first. One potential reason for why there is so little support for *No Intervention* might be that *Voluntary Offsetting* can be seen as a substitute from a libertarian perspective: *Voluntary Offsetting* also does not restrict the producers' emission choices and the profitability of emission-inducing production, like *No Intervention*, and is thus a similarly attractive libertarian policy (Ambuehl et al., 2021). Indeed, 40% of those who rank *No Intervention* first or second also rank *Voluntary Offsetting* first or second. However, in absolute terms, only a very small minority of 12 out of 219 policymakers are libertarian in this sense and in most cases (58%), *Voluntary Offsetting* is not ranked in the direct neighborhood of *No Intervention*. This indicates that *Voluntary Offsetting* is mostly *not* chosen by libertarian policymakers as a substitute to *No Intervention*. Instead, it is used to induce behavioral change in a non-intrusive way – and successfully so, as we show below.

A few policymakers, 29 of the 219 (13%), rank *No Intervention* before *Voluntary Offsetting*, although *Voluntary Offsetting* seems to dominate *No Intervention* as it only gives an additional option to producers. Perhaps, this is to protect producers from social pressure to contribute to the common goal, as theoretically argued by Khalmetski and Ockenfels (2023) and shown empirically by, e.g., Andreoni et al. (2017).

The large majority of policymakers, however, apparently see emission-inducing activities as a collective problem, not an individual choice problem, and are thus willing to intervene. But if their goal was just to minimize emissions, they could have chosen a zero emissions cap. This is not what we observe. The *Cap* is surprisingly unpopular in the preference ranking (Fig. 1); only 25 out of 219 (11%) policymakers rank this policy as their most preferred option and only six (3%) chose a cap of zero. Instead, the average cap of 6.99 chosen by policymakers is only one unit below the profit-maximizing production level (8), and thus hardly binding at all (compare Fig. A1 in Appendix A). Simulations in which we hypothetically match each producer and their production decision under *No Intervention* with each policymaker and their cap decision, reveals that the cap is binding in only 33.7% of cases. The stringency of the cap is related to the relative popularity of this policy: we find a strong and significant positive relationship between the size of the cap and its rank among the policy measures (Spearman rank correlation, $\rho = 0.41$, $P < 0.001$).

One might hypothesize that the *Cap*'s unpopularity stems from the fact that policymakers who want to minimize emissions can choose an even better option: *Earmarked Carbon Price* also avoids any emissions (assuming that offsetting is fully effective), yet it has the additional advantage that it leaves more autonomy to the producer. However, if this hypothesis was correct, we would expect policymakers who prefer *Earmarked Carbon Price* to also give the *Cap* a high rating (in case *Earmarked Carbon Price* is not chosen to be implemented), yet the correlation of ratings for those two measures is in fact negative (Spearman rank correlation: $\rho = -0.190, P = 0.005$). This choice pattern suggests that policymakers do not merely wish to minimize emissions, they also care about *how* emissions are reduced.

Another hypothesis, following standard Pigouvian reasoning in economics (Marron and Toder, 2014), would be that policymakers care only about setting good incentives for producers, who should pay for the damage they induce. From this perspective, whether the resulting emissions are offset or not could be irrelevant; the revenue from a carbon tax could be used, say, to lower other distortionary taxes. If this hypothesis is correct, one might expect *Carbon Pricing* to be a substitute to *Earmarked Carbon Price* as both create identical marginal incentives to reduce emissions. However, perhaps not surprisingly, we do not find evidence for this hypothesis: The correlation of preference ratings for both options is almost zero and far from being significant (Spearman rank correlation: $\rho = 0.010, P = 0.890$).

So, what principles organize the pattern of interventions in our laboratory setting? Fig. 2 shows that our impartial policymakers rank the available policies pretty much according to their effectiveness in avoiding emissions. But avoiding emissions is not the only goal, as illustrated by the unpopularity of the cap and the cap size chosen. Rather, our policymakers act as if they prefer to leave the responsibility for production to producers (Ackfeld and Ockenfels, 2021).

Within the set of pricing tools, policymakers prefer tools that clearly specify the use of revenues to support emissions reductions. *Earmarked Carbon Price* shares with *Carbon Price* the fact that it forces producers to pay proportionally for their production decision, but it has the additional advantage that it also leads to lower emissions (assuming that offsetting is an acceptable and effective policy; see discussion section). This explains why *Earmarked Carbon Price* is the most preferred option. But why is *Voluntary Offsetting*, which creates no financial incentive for climate action at all, so popular? The answer appears to be that policymakers expect producers to be willing to voluntarily offset some of the emissions at their own cost (see Fig. 2), and believe that this voluntary climate action would lead to a better outcome, both in terms of emissions and in terms of the producers' profits, than *Carbon Price* where such an offsetting is not possible.

While producers produce more with offsetting (*Voluntary* and *Earmarked*) than with *Carbon Price* without offsetting (two-sided WSR tests, in both cases $P < 0.009$, compare Fig. A4 in Appendix A), they do offset all emissions (*Earmarked*) or a significant portion (56.3%, compare Fig. A5 in Appendix A) of their emissions (*Voluntary*). This leads to less pollution under both offsetting policies (two-sided WSR tests, in both cases $P < 0.001$) compared to *Carbon Price*, while earnings are either higher than in *Carbon Price* (*Voluntary*; two-sided WSR test, $P < 0.001$) or the same (*Earmarked*; two-sided WSR test, $P = 0.085$). That is, policymakers are willing to take a risk and rely on individuals' willingness to voluntarily abate emissions – and their expectations are not disappointed.

Finally, we find that the policymakers' preferences for the different alternatives vary systematically with their own willingness to abate emissions. Our analysis relies on the third part of the experiment in which policymakers were asked to make their own production and donation decisions under the *Voluntary Compensation* scheme. Based on their decisions, we classify policymakers into high or low-emitting types depending on whether their emissions are above or below the median of 52.5 kg.[7] We find that low-emitting types have a significantly stronger

[7] On average, policymakers produce 7.26 (SD: 1.81) units of the fictitious good and voluntarily donate 1.46€ (SD: 1.46) to offset parts of their emissions. This leads to average CO_2 emissions of 63.11 kg (SD: 71.61) per policymaker.

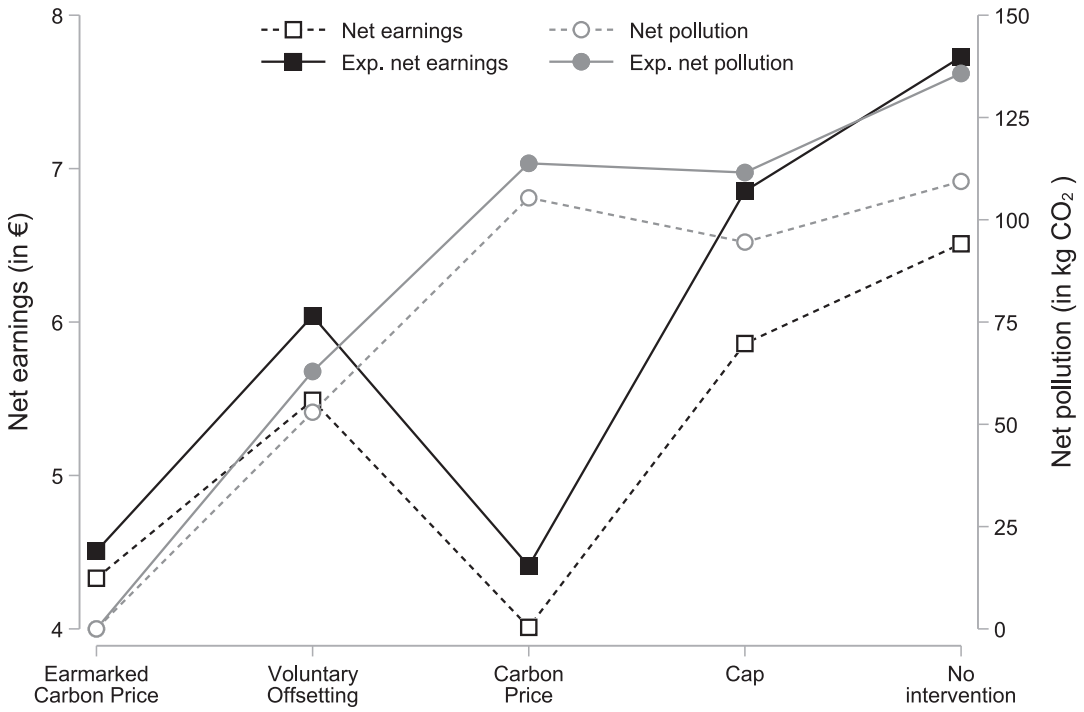

Fig. 2. Earnings and pollution. The figure shows the expected level of earnings net of payments (taxes, compensation) for the producers and the expected level of CO_2 emissions for each of the five alternatives (solid lines) as well as the actual levels of earnings and CO_2 emissions (dashed lines). Expected earnings and pollution are calculated based on the policymakers' beliefs about the producers' production and voluntary donation decision (compare figs. A2 and A3 in Appendix A).

preference for *Earmarked Carbon Price* (mean rank: 2.15 vs. 1.58; two-sided Mann-Whitney *U* test, $P = 0.004$) and a weaker preference for *No Intervention* (mean rank: 3.79 vs. 4.28; two-sided Mann-Whitney *U* test, $P = 0.002$), relative to high-emitting types. For the remaining alternatives, we observe no significant differences across types (two-sided Mann Whitney *U* tests, all $P > 0.330$, compare Fig. A6 in Appendix A). These results are in line with recent evidence from Ambuehl et al. (2021), showing that intervention decisions can often be explained by projective paternalism, that is, when intervening in the choices of others, many policymakers base their intervention decisions on their own preferences in the relevant situation.

With regard to the measures elicited in the post-experimental questionnaire, we find that, relative to women, men exhibit a stronger preference for *No Intervention* (mean rank: 4.26 vs. 3.65; two-sided Mann-Whitney U test, $P < 0.001$) and a weaker preference for *Earmarked Carbon Price* (mean rank: 1.63 vs. 2.27; two-sided Mann-Whitney U test, $P < 0.001$). In addition, participants who self-identified as more conservative (on a political scale from 0 "left" to 10 "right") were found to have a stronger preference for *No Intervention* (mean rank: 3.85 vs. 4.22; two-sided Mann-Whitney U test, $P = 0.033$) and a weaker preference for *Cap* (mean rank: 3.68 vs. 3.11; two-sided Mann-Whitney U test, $P = 0.019$).[8]

4. Discussion and conclusions

Carbon offsetting is popular among impartial policymakers in our study. Part of the reason is that offsetting, unlike a cap, allows for production autonomy and, unlike *Carbon Price* (without the option of additional voluntary offsetting), reduces more emissions by encouraging voluntary climate action. Moreover, all revenues from the carbon price in *Carbon Price* go to the experimenter while any payments for offsets are transferred to the NGO Atmosfair and thereby reduce actual CO_2 emissions. This difference in how the revenues are used can explain the relative popularity of *Earmarked Carbon Price* relative to *Carbon Price,* echoing the popular demand to use carbon tax revenues for the protection of the environment. The finding that the acceptance of taxes depends on how the revenues are used is in line with the literature (Baranzini and Carattini, 2017; Carattini et al., 2017; Kallbekken et al., 2011).

This result contributes to the debate over the ethics and effectiveness of carbon offsetting in the social sciences as well as within the environmental movement (Anderson, 2012; Hyams and Fawcett, 2013). While our study is silent on the problems of offsetting in practice, it suggests that, e.g., mandating customers to buy emission certificates from certified national emission trading systems could turn such carbon offsets into a more widely acceptable and effective climate policy. Indeed, our findings are consistent with recent research demonstrating some people's willingness to offset emissions, as well as companies' and organizations' willingness to offer offsetting opportunities (Berger et al., 2022a, 2022b; Liebe et al., 2021). Our study highlights that impartial policymakers approve of this approach and even prefer it to many other policies.

We finally note that our popular *Earmarked Carbon Price* policy is related to cap-and-trade. Any emission in cap-and-trade is automatically offset since one needs to buy the corresponding emission rights from another party. However, the *Earmarked Carbon Price* policy does not come with the behavioral disadvantages related to the need to cap overall emissions, as shown in previous studies (Ockenfels et al., 2020; Schmidt and Ockenfels, 2021). For instance, Ockenfels et al. (2020), like

[8] In addition, participants who self-reported to be risk-loving (on a scale from 0 "not willing to take risks at all" to 10 "fully willing to take risks"), exhibit a stronger preference for *No Intervention* (mean rank: 3.82 vs. 4.23; two-sided Mann-Whitney *U* test, $P = 0.003$) and a slightly weaker preference for *Earmarked Carbon Price* (mean rank: 2.06 vs. 1.70; two-sided Mann-Whitney *U* test, $P = 0.051$) and the *Carbon Price* (mean rank: 3.14 vs. 2.82; two-sided Mann-Whitney U test, $P = 0.071$). Other factors such as the participants' field of studies as well as a self-reported measure of patience are not significantly correlated with policy preferences.

our study, finds that many people are willing to reduce carbon emissions even when it comes at a personal financial cost. Yet, while a cap-and-trade policy by design eliminates the impact of voluntary individual climate action, the mandatory and voluntary climate actions that we investigate in our study do not come with such a disadvantage, which might contribute to their acceptability. The option of taking effective individual climate actions is especially important if climate change will further increase people's willingness to do so (Howe et al., 2019).

Our study set out to investigate preferences over climate action policies in a highly controlled environment. Future research could incrementally increase the complexity of the experimental decision situation, to achieve a more complete understanding of policy preferences. For example, our experimental setup excludes the possibility of using or developing alternative technologies that would loosen the link between the producers' income and production emissions. Such technologies may become available in the long run, which could change the preferences for policies. Moreover, actual policies often consist of a combination of several instruments. Thus, one could explore a setting in which policymakers can implement more than one policy at the same time. Furthermore, in our experiment the decisions of the policymakers affected only one producer, while policies typically affect a larger group of individuals or firms. Testing whether the number of affected people matters for preferences over climate action policies would be a valuable next step in this line of research. Finally, future work could extend our setup by investigating settings with higher stakes, a double-blind design (i.e., no observability of individual choices by the experimenter), or with heterogenous producers that are affected differently by the interventions.

Code availability

The data was analyzed with the software Stata. A Stata do-file that allows for the replication of the analyses reported in our paper is available on request. Upon acceptance, the analysis code associated with this paper will, together with our dataset, be made available via a public depository.

CRediT authorship contribution statement

Felix Kölle: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Dorothea Kübler:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **Axel Ockenfels:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data and experimental code are available on request from F.K. Upon acceptance, the data will be made available via a public depository.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecolecon.2024.108348.

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