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Testing deontological warm glow motivation for carbon abatements

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ABSTRACT

Do people contribute to CO_2 abatements even when these contributions are completely crowded out by a third party? This study reports from an experimental test of contributions to carbon abatements when the contributions are completely crowded out by the experimenter. Contributions are determined to decline by 44% compared to a policy in which the contributions are spent directly on carbon abatements. Still, contributions remain at 18% of endowments and are relatively stable over six rounds of the crowding-out policy. These results support previous psychological findings that a deontological warm glow is important for motivating environmentally friendly behavior.

1. Introduction

Do people contribute to carbon abatement even when their contributions are completely crowded out by a third party? This paper reports from an experimental test of how voluntary emission reductions are affected when the already miniscule effect on the global climate is removed. Participants

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have the opportunity to donate money to carbon abatement through the EU Emission Trading Scheme market. However, any contribution is crowded out dollar-for-dollar by the experimenter. Participants play in fixed groups of three players and contributions are observed over several rounds. In a final voting round, participants reveal their policy preferences at a group level.

What motivates environmental friendly behavior in the first place? In the case of global warming, the emission reductions that one individual can provide are sufficiently small that he/she has no measurable impact on the climate. Nonetheless, many people spend money and effort to reduce even negligible amounts of CO_2 emissions. Private purchases of carbon offsets and frequent recycling of waste are two field examples of people's willingness to make an environmental effort that has only miniscule impacts.[1] Individuals who exert costly effort to reduce their negative environmental impact are often denoted as green agents (Straughan and Roberts, 1999; Nyborg et al., 2006). Andreoni (1989, 1990) proposes that such contributions to public goods are motivated by impure altruism; people care about the amount of public good, but they also receive a psychological reward from the act of giving itself, denoted as a 'warm glow of giving'. This motivation stands in contrast to 'pure altruism', in which people care only about the benefits of the public good itself.

Psychological studies confirm that intrinsic satisfaction is particularly relevant in motivating environmentally friendly behavior (De Young, 1996, 2000). A warm glow is often interpreted as arising independent of the contribution's consequences (Crumpler and Grossman, 2008; Konow, 2010; Tonin and Vlassopoulos, 2010). However, it seems reasonable that there is some underlying perception that acting environmentally friendly is the right thing to do to induce the warm glow. How do people determine the right thing to do in different environmental contexts? Two opposing moral ideals are relevant in this setting: consequentialism and deontology.

Brekke et al. (2003) propose that people determine the morally right thing to do in a public goods dilemma by answering the following question: "What would be the socially optimal thing to do, if everybody else acted like me?" This definition of morality is consistent with Harsanyi's rule-based utilitarianism (Harsanyi, 1980) and is consequentialistic in a social welfare sense (Nyborg, 2011). It is a quasi-consequentialistic moral ideal that can explain the warm glow from contributions with unobservably small environmental benefits per unit; for example, the buying of CO_2 abatements. I shall refer to this determination of the moral ideal as "consequentialism" because it defines the morality of an action by its consequences, given others' specific behavior. It should not motivate contributions with no marginal effect, as in this experiment when the contributions are completely crowded out by the experimenter.

Conversely, data from environmental surveys suggest that green agents are seldom motivated by direct environmental consequences but are more often motivated by deontological values (Stevens et al., 1991; Spash, 1997). Deontology is defined by an emphasis on given moral principles, independent of the consequences they may generate in specific situations (Greene, 2007). Kant, the leading deontologist, expresses these principles in terms of rights and duties. In environmental morality, deontologists prescribe the environment with inviolable rights and view pollution as morally wrong in any circumstance.[2] However, in regard to CO_2 emissions, every living human is bound to emit some, even just by breathing out. One deontological moral rule might be to emit as little as possible (or to contribute as much as possible to CO_2 abatements). Another related deontological moral rule might be that everyone should emit an equally low amount (or contribute an equal amount of CO_2 abatements). Such a rule is similar to Brekke et al.'s determination of a consequentialistic warm glow motivation, in which everyone should do their equal share to reach the social optimum. The difference is that the consequentialist determination takes the environmental outcome as the starting point, whereas the deontological view only considers an individual's behavior and disregards the environmental effects. In this article, the term "consequentialist" refers to people who are motivated by the environmental

[1] Similarly, in a Norwegian survey from 2010, 60% of respondents report restricting their car use for environmental concerns (NSD, 2010).

[2] The following statement provides an example of deontological morality: "As much wildlife as possible should be preserved no matter what the costs". Stevens et al. (1991) find that 67% of respondents agree with this statement. Spash (1997) finds that those strongly engaged in the environment are more likely to hold such deontological values compared to others.

consequences of their contributions, whereas the term "deontologist" refers to people whose motivation is independent of environmental consequences. Therefore, a consequentialist's motivation for CO_2 abatements should disappear when contributions are completely crowded out by a third party. A participant who continues to contribute even when the contributions are completely crowded out is assumed to be motivated by a deontological moral ideal.

Whether people's motivation for emission reductions depends on a marginal climate effect is relevant under a fixed emission policy, similar to the EU Emission Trading Scheme. If an inhabitant in one country reduces his/her CO_2 emissions, it will only reduce the liability of his/her government accordingly. In effect, the government will either buy fewer quotas from other countries or sell more of its own quotas to other countries within the trading scheme. Therefore, voluntary emission reductions by individuals only imply financial savings for the government, whereas the total emissions level is unaffected. This is the whole point with a fixed emission policy; the total amount of emissions is predetermined to the target value and no individual or government can influence the total emissions. Such a climate policy with country-specific carbon quotas makes it relevant to ask how an individual's motivation for voluntary emission reductions will respond.

Recent literature concerning moral psychology suggests that moral judgment is not necessarily based on logical reasoning and reflections but is mainly automatic responses to intuitive emotions (Haidt, 2001). Psychological experiments also indicate that intuitive, non-cognitive responses to moral dilemmas are more likely to trigger non-consequentialist moral judgments (Greene, 2007; Paxton et al., 2011). If environmental dilemmas mainly trigger emotional responses, then this may explain why deontological values are dominating among green agents.

Several experiments provide support for a non-consequentialistic motivation behind pro-social contributions (Crumpler and Grossman, 2008; Tonin and Vlassopoulos, 2010; Null, 2011). Crumpler and Grossman (2008) test charity donations that are completely crowded out by the experimenter, using an experimental design similar to the one presented in this article. Participants in their study receive $10 and choose how much of it to give to a charity organization of their choice. For every dollar the participant donates to the charity, the experimenter donates one dollar less. In spite of the complete crowding out of donations by the experimenter, 57% of participants donate a positive amount and 21% of endowments are donated in total. Hence, Crumpler and Grossman conclude that a substantial part of the motivation behind charity contributions can be attributed to a warm glow, independent of a real effect of the contribution. Tonin and Vlassopoulos (2010) repeat their design in a field experiment on work effort. Their results suggest that consequentialism does not add anything to moral motivation for charity work. Further, in dictator games with different charity organizations as recipients, Null (2011) finds that donors are partly insensitive to diversified matching rates of charitable donations. This supports the idea that contributions are at least somewhat independent of their consequences.

The results of this study reveal that 85% of participants contribute positive amounts when the contributions are spent directly on carbon abatements. Furthermore, as many as 78% of these green agents maintain positive contributions when the contributions are completely crowded out. The study finds that 44% of contributions remain and are relatively stable over six rounds of the crowding-out policy. The experimental findings reveal that a substantial number of contributors' motivation is independent of any environmental effect, determined as a deontological motivation. However, in the final voting round, as many as one-third of participants opt for the policy with actual climate benefits from contributions, even though this policy generates less money both to participants and carbon abatements. This voting behavior may be perceived as a preference for a system in which personal contributions count in contrast to a system in which personal contributions do not have any climate effects.

2. Experimental design

2.1. Basic design and treatment

In this experiment, participants are randomly allocated to anonymous groups of three, in which they choose how much of a given endowment to contribute to carbon abatements. In the beginning

of each round, each participant is given 200 Norwegian Kroner (NOK), amounting to ca $33 US. The only choice in each round is for each participant to individually determine how much of this endowment to contribute to a group account denoted as "the climate account". The experimenter adds 50% of total contributions to the climate account. The money in the climate account is spent on carbon abatements at the end of the experiment. At the end of each round, each participant is informed about the mean contributions of the other two group members, the final amount in the climate account and the equivalent amount of CO_2 abated according to the quota price that day.

The entire experiment consists of ten contribution rounds. Groups remain fixed through all rounds of the experiment (partner design). All decisions are anonymous such that neither the experimenters nor other participants can identify the players. After all rounds are completed, one of the rounds is randomly drawn to determine the participants' actual payments. The final amount in the climate account in the payment round is used to buy quotas from the EU ETS (European Union Emission Trading Scheme) carbon market, such that each donation is transformed into actual carbon abatements.

There are three different types of contribution rounds: no-target round, target round and voting round. In the control sessions, participants play ten no-target rounds. In the treatment sessions, participants first play three no-target rounds, then six target rounds and finally one voting round. The three types of rounds are explained below.

2.2. No-target contribution round

The no-target contribution rounds provide the baseline in this experimental design. In the no-target rounds, all contributions to the climate account are spent on carbon abatements. After each group member has made his/her contribution decision, the experimenters add 50% to the climate account. At the end of each round, each group member is provided with information about how much he/she contributed, the mean contribution of the two other group members, the total amount in the climate account before the experimenters add 50%, the final amount in the climate account after the experimenters add 50% and the equivalent tons of CO_2 abatements provided by this amount.

2.3. Target contribution round

In the target contribution rounds, the amount spent on CO_2 abatements is kept fixed such that any contributions are completely crowded out by the experimenter. The group is given a target of total group contributions at 300 NOK. If the total group contributions do not reach this target, the experimenter provides the missing amount. If the group's total contributions exceed the target, the experimenter withdraws the excess amount. Therefore, there will always be 300 NOK in the climate account after the contributions of the individual group members. In addition, the experimenter adds 50% to the target, similar to the no-target rounds, so that the final amount in the climate account always becomes 450 NOK when the rounds are over. At the end of each round, participants are informed about their own contribution, the mean contribution of the two other group members, the total amount in the climate account before the experimenter adds 50% (always 300), the final amount in the climate account after the experimenter adds 50% (always 450 NOK) and the equivalent tons of CO_2 abatements provided by this amount (fixed, depending on the quota price that day). Repeating this information after each round facilitates the understanding that the amount of carbon abatements is independent of the group's contributions.

2.4. Voting round

In this round, participants vote to determine which of the two policies to implement. Participants choose between a target and a no-target policy. Those voting for a target policy also specify their preferred target level for the group, which can take any integer value between 0 and 600. The policy in the voting round is determined by the group majority and implemented at the group level. If the group majority opts for the target policy, a target round is implemented for all groups. The target value

is the average of the preferred target values of group members who opted for the target policy, which varies among groups.

2.5. Experimental execution

The control and treatment sessions are identical for the first three rounds. In the first set of instructions, participants are informed that there will be a total of ten rounds and how the first three rounds will run. After the first three rounds are completed, new instructions are handed out. In the control sessions, these instructions inform participants that the remaining seven rounds will run in the same manner as the three previous rounds.[3] In the treatment sessions, the new instructions inform participants that there will be six rounds with the new rules. After these six rounds have been completed, new instructions are handed out for the last voting round. All instructions are handed out to the participants as written copies. The participants are first given time to read the instructions themselves, before the instructions are read aloud by the experimenters.

Individual earnings are transferred to the participant's bank account some days after the experiment. The CO_2 reductions are bought the same day of the experiment through the Norwegian Climate and Pollution Agency (KLIF). The agency then buys out quotas from the European Union Emission Trading Scheme (EU ETS). An online certificate from KLIF is produced for each experimental session, to verify the emission reductions for the participants. The certificates are publicly available on KLIF's internet site a number of weeks after the experiment, at a specific web address provided in the instructions. The instructions also provide information about how the quota system works and examples of CO_2 emission amounts produced by specific household activities. This information was taken directly from KLIF's internet site. After the experiment is completed, the participants answer a short survey about environmental behavior and motivations.

This design extends to that of Crumpler and Grossman (2008) in three dimensions. First, in this study, participants donate over several rounds and the same participants play both no-target and target rounds. In contrast, Crumpler and Grossman implement a one-shot donation opportunity with a between-subjects design. Making the same participants play both types of rounds allows us to categorize participants into types depending on their contributions in both types of rounds. Starting with the no-target rounds, participants are also given the opportunity to show off as nice people in the no-target rounds, so they do not need to use the target-rounds to show that they are actually good guys.

Second, participants play in groups. The experiment concerns contributions to a public good and making the decision in a group is therefore considered a more natural situation. With consequentialist reasoning, contributions to CO_2 abatements in general only make sense if there are many people doing the same thing. Similarly, a deontological motivation of "doing one's share" depends on there being a group of people and associated shares to do so. In the target rounds, the group design allows us to differentiate between the deontological motivation of contributing as much as possible (i.e., contributing the maximum amount of 200 in each round) and another deontological motivation of doing one's equal share within the group (i.e., contributing one-third of the target, amounting to 100). Because environmental moral norms are likely to be affected by social norms, social learning is also potentially important. Participants are expected to draw inferences about social norms in the particular setting from others' contribution levels. The group aspect allows us to study whether participants adapt their behavior to that of the other group members. Note that payoffs do not depend on the actions of the other group members. The main group mechanisms are the framing of the climate account, as shared by the group, and the information about the two other group members' mean contribution at the end of each round.

[3] In one of the three control sessions, there is only one set of instructions, which is given to the participants at the beginning of the experiment. These instructions inform that there are ten identical rounds and explain the rules of the no-target rounds. In the two other control sessions, instructions are divided into two sets, in order to make the first set of instructions for the first three rounds identical between the control and treatment sessions. Contributions do not differ significantly in these two executions of the control sessions in any of the first three rounds. However, in round four, the contributions are significantly higher in the control sessions in which participants received new instructions, which is interpreted as a new-start effect.

A third extension to Crumpler and Grossman is the introduction of a final voting round in which groups themselves choose whether to have a no-target or target round. This voting round is implemented to elicit participants' policy preferences. The target rounds allow for maximizing the sum of individual earnings and the climate account and therefore, might be expected to be preferred by most participants. However, it also removes the consequentialistic moral incentive for contributing. If consequentialist participants have stronger preferences for consequentialistic contributions than for private earnings, then they might prefer no-target rounds. On the other hand, deontologist participants might prefer a no-target policy which induces everyone to contribute.

A possible weakness with the experimental design is the possible bias if participants have preferences for the experimenter's costs. Such preferences would incentivize contributions in the target rounds. However, previous experimental results suggest that participants do not care about the experimenter's costs (Frank, 1998). If participants do have preferences for the experimenter's costs, this effect should be similar to the governmental savings effect of voluntary emissions reductions under the Kyoto treaty.[4]

3. Results

Five experimental sessions were conducted: three sessions during April and June 2009 (two control sessions and one treatment session) and two sessions during September 2011 (one control session and one treatment session). All sessions were held at the University of Oslo with a total of 87 participants, mainly undergraduate students from different disciplines. There were 39 participants in the control sessions and 48 in the treatment sessions. The price per ton of carbon offsets was 136 NOK (ca $22 US) in the 2009 sessions and 125 NOK in the 2011 sessions.[5] The experiment was run with the software z-Tree (Fischbacher, 2007).

3.1. Result 1: Contributions decline when the target is introduced

Fig. 1 illustrates the average contribution per round in the treatment and control sessions, respectively. There is no significant difference in contributions between the treatment and control sessions in the three no-target rounds. In these rounds, the average contribution across sessions is 75 NOK (37.5% of endowments). In the treatment sessions, contributions immediately decline when the target is introduced in round 4 to an average of 47 NOK from an average of 81 NOK in the three first no-target rounds. Average contributions during the target rounds are 36 NOK in the treatment sessions. The average contributions during the comparable no-target rounds (i.e., rounds 4–9) in the control sessions are 68 NOK.[6] In the control sessions, contributions increase somewhat in round 4, although the increase is not significant, presumably due to a "new-start effect".[7] The control session contributions are relatively stable after round 4, until they are slightly declining the last rounds.

[4] If participants care about experimental costs, they might assume that the experiment is financed by public research funds, eventually paid by taxpayers and hence similar to governmental savings. This reduced governmental cost is the same effect of marginal emission reductions under a cap and trade regime like the Kyoto treaty.

[5] The price corresponds to the daily EU ETS market price plus a 20 NOK administration charge by KLIF.

[6] Statistical *t*-tests using individuals as independent observations reveal a significant difference between contributions in the treatment and control groups at the 10% level in round 4 and the 5% level in each of rounds 5–9. The *t*-tests using mean group contributions (i.e., groups as independent observations) reveal a significant difference between contributions in the treatment and control groups at the 10% level in round 5 and the 5% level in rounds 6–9. All statistical tests referred to in this article are *t*-tests.

[7] Remember that two of three control sessions get repeated instructions after the first three rounds. For the control sessions in which participants are instead initially informed about the rules for all ten rounds, the average contributions decline from the third to the fourth round.

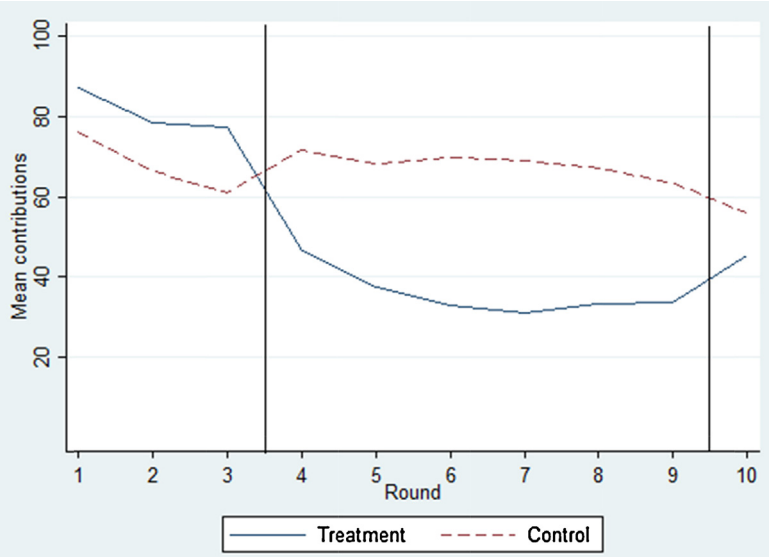

Fig. 1. Average contributions in the control and treatment sessions per round. Treatment sessions consisted of three no-target rounds first, followed by six target rounds and one voting round. The control sessions consisted of ten no-target rounds.

3.2. Result 2: Even in the target rounds, contributions amounts to 18% of endowments and are relatively stable

Average contributions in the treatment sessions decline from 47 NOK in round 4 to 38 NOK in round 5. Between rounds 5 and 9, contributions remain relatively stable, with a minimum level of 31. There are no signs of a gradual decline in contributions over the six target rounds. The results show that 44% of the initial contributions per round in the no-target rounds are maintained in the target rounds. Contributions of the treatment sessions are significantly larger than zero in all rounds.

To study the distribution of behaviors under the target policy without a climate effect of the contributions, participants in the treatment sessions are categorized according to whether their motivation for climate contributions is more in line with consequentialism, deontologism or free riding. First, 7 of 48 participants in the treatment sessions are classified as free riders because they contribute less than 10 NOK, on average, during the three no-target rounds.[8] Of the remaining 41 participants, 9 are categorized as behavioral consequentialists because they either contribute less than 10 NOK, on average, during the six target rounds or because they only have positive contributions in round 4 and not in rounds 5–9. The latter restriction on positive contributions in rounds 5–9 is included because positive contributions only in round 4 might be due to misunderstandings because it is not continued in subsequent rounds. The remaining 32 participants are defined as behavioral deontologists. The term "consequentialist" refers to people who are motivated by the environmental consequences of their contributions, whereas the term "deontologist" refers to people whose motivation is independent of environmental consequences.

[8] This definition includes only one participant with positive contributions in the no-target rounds, who contributed 0, 0 and 3 during the three rounds, respectively.

Table 1
OLS regression: contributions with individual random effects.

	(1)	(2)
Target round	−28.76***	−20.47***
	(−6.99)	(−3.52)
Year 2011	33.94***	33.00***
	(3.83)	(3.71)
Lagged sum of other group members' contributions	0.119***	0.148***
	(5.35)	(5.59)
Target round × Lagged sum of other group members' contributions		−0.0760**
		(−2.02)
Constant	36.56***	32.88***
	(5.54)	(4.79)
Observations	783	783

The dependent variable is the contribution per round. Observations are at the participant level per round (87 participants in 9 rounds, excluding round 1, yields 783 observations). A fixed effects regression of Model 1 without the 2011 year dummy yields a similar result. The *t* statistics are in parentheses.
** $p < 0.05$.
*** $p < 0.01$.

3.3. Result 3: Contributions in target rounds concentrate at 0 and 100

Contributions in the treated groups are relatively uniformly distributed between 0 and 200 in the no-target rounds, whereas contributions tend to cluster approximately 0 or 100 in the target rounds. This pattern suggests that those who continue to contribute in the target rounds are trying to "do their share" (a contribution of 100 is one-third of the target), as opposed to contributing as much as possible (which would impose a contribution of 200). The high frequencies of contributions at zero or 100 implies that participants either do their share or they do not contribute at all.

Contributions above 100 are frequent in the no-target rounds (35%) but rare in the target rounds (2%). Therefore, the ideal seems to change from "doing as much as possible" in the no-target rounds to "doing one's share" in the target rounds. Hence, part of the decline in contributions can be ascribed to this changing ideal from 200 to 100. To estimate the reduction in contributions without this changed ideal effect, all contributions are censored to an upper level of 100, in both the no-target and target rounds. The censored contributions are then analyzed at the introduction of the target policy. With the censoring, the average contributions in the treatment sessions are 61 in the no-target rounds and 35 in the target rounds, implying a reduction of 43%. When censoring the control session contributions in the same manner at an upper level of 100, the average contribution in rounds 1–3 are 51 while the average contribution in rounds 4–9 are 50, implying a 2% reduction. The censored contributions are significantly lower in the treatment sessions than in the control sessions for rounds 6–9 only (significant on a 5% level in rounds 6–8 and 10% level in round 9). In the remaining analyses, non-censored contributions are used.

3.4. Result 4: Group effects are significant

The contributions of the other group members in previous rounds have a significantly positive effect on contributions. The group effects can be studied in the OLS regressions shown in Table 1, with non-censored contributions being the left side variable. When the two other group members increase their contribution by 1 NOK, the third member increases his/her contribution by 0.19 NOK, on average, in the following round. Strong group effects are normally observed in standard public goods games but might be more surprising in this experiment where the outcomes—both private earnings and the amount spent on carbon abatements—are independent of the other group members'

actions. Rather, in the target rounds, one might instead expect negative group effects if participants prefer that the group in total exactly reaches the contribution target. Low contributions by others should then push higher contributions in order for the group in total to reach the target and vice versa. Model 2 in Table 1 adds an interaction variable of target rounds and the lagged contributions of the other group members to the regression. The results show that group effects are significantly smaller in the target rounds than in the no-target rounds. However, a model with reversed coding of the round variable reveals that group effects are significantly positive in the target rounds as well. Participants also reciprocate the other group members' behavior in the target rounds, although not to the same extent as in the no-target rounds. One is more likely to do one's share if the others do their shares.

The regressions shown in Table 1 also reveal that contributions are substantially higher in the 2011 sessions than in the 2009 sessions. This might be due to a lower carbon price at the time of the experiments in 2011 than in 2009 but may also reflect increased environmental concern in 2011.

3.5. Result 5: One-third of participants vote against the target policy, even though it generates higher individual earnings and more carbon abatements

Thirty participants in the treatment sessions (63%) vote for a target policy in the last round. As a result, a target policy is implemented in 12 of 16 groups based on a majority vote. The implemented target size varies from 167 to 600 NOK, with an average of 390 NOK, based on the preferences of those who opted for the target policy within the group. The popularity of the target policy can be explained by both higher participant earnings and more carbon abatements in the target rounds compared to the no-target rounds (45 out of 48 participants earn more in the target rounds than in the no-target rounds and more carbon abatements are bought for 11 out of 16 groups in the target rounds compared to the no-target rounds). Thus, why do as many as 37% vote for the target policy? This voting behavior may be perceived as a preference for a system in which personal contributions count in contrast to a system in which personal contributions do not have any climate effects. Such a preference may be observed for both consequentialists and deontologists.

Having experienced higher private earnings in either policy is not significantly correlated with voting behavior. Having experienced more carbon abatements being provided by the group in one of the policies also does not predict voting behavior. Instead, the summed contribution of the two other group members in the target rounds has a positive effect on the likelihood of voting for the target policy (i.e., significant at a 10% level, $p = 0.056$). There is no significant effect from the other members' contributions in the no-target rounds. Still, these results indicate that policy preferences may depend on how one expects the policy to affect others' behavior. People are less willing to vote for a target policy if they do not expect the other group members to contribute in such a setting.

Voting behavior does not differ to any significant degree between those who behaved as deontologists and those who behaved as consequentialists in the experiment; it also does not differ between those two groups and free riders. However, behavioral deontologists, on average, vote for a significantly lower target than behavioral consequentialists (only those voting for the target policy specify their preferred target level). This is reasonable, as behavioral deontologists most likely plan to contribute a considerable share of the target under a target policy and hence, face a real cost that increases with the target size. Meanwhile, behavioral consequentialists do not plan to contribute in a target policy and therefore, are best off with a target as high as possible, assuming that they care about carbon abatements. Table 2 shows the votes by type.

3.6. Comparing experimental behavior and survey responses

To investigate whether experimental behavior matches behavior outside the lab, a post-experimental survey records participants' reported environmental behavior in their everyday life. The following question elicit people's stated motivations for climate friendly behavior: "To what extent does each of the following aspects contribute to increasing your motivation to act in climate friendly

Table 2
Voting by type.

Type	Observations	Share opting for target policy	Mean target size chosen
Behavioral consequentialist	9	0.67	517
Behavioral deontologist	32	0.65	355
Free rider	7	0.43	450

Note: Only the treatment sessions faced policy voting before the final round and are included in the table, $N = 48$. Participants can vote either for the baseline policy or the emissions cap policy to be applied for their group in the final round. The final round policy is determined by majority voting. Participants who vote for the emissions cap policy additionally vote for a specific target size.

Table 3
Stated importance of different motivational factors of everyday climate friendly behavior, given as a percent of participants in the control sessions and for each behavioral group in the treatment sessions.

A good feeling	*N*	Not important	Somewhat important	Very important	Don't know
Control sessions	39	18%	44%	38%	–
Consequentialist	9	11%	89%	–	–
Deontologist	32	22%	53%	22%	3%
Free rider	7	34%	57%	–	–
Being a good example	*N*	Not important	Somewhat important	Very important	Don't know
Control sessions	39	13%	51%	36%	–
Consequentialist	9	33%	56%	11%	–
Deontologist	32	25%	50%	22%	3%
Free rider	7	14%	57%	29%	–
Duty or moral obligation	*N*	Not important	Somewhat important	Very important	Don't know
Control sessions	39	8%	41%	49%	3%
Consequentialist	9	22%	11%	67%	–
Deontologist	32	19%	50%	22%	9%
Free rider	7	14%	71%	14%	–
Actual climate benefits	*N*	Not important	Somewhat important	Very important	Don't know
Control sessions	39	15%	49%	23%	13%
Consequentialist	9	11%	67%	22%	–
Deontologist	32	44%	44%	13%	–
Free rider	7	29%	57%	14%	–
Social approval	*N*	Not important	Somewhat important	Very important	Don't know
Control sessions	39	41%	38%	8%	13%
Consequentialist	9	56%	44%	–	–
Deontologist	32	41%	41%	9%	9%
Free rider	7	71%	14%	14%	–

ways?" For each motivational argument, the results are tabulated in Table 3 for the total sample and by type, as defined from experimental behavior in the treatment sessions. The most important motivational argument was a sense of duty or moral obligation to act in climate friendly ways, which was stated as 'somewhat important' or 'very important' by 81% of the total sample. Being a good example for others was stated as somewhat or very important by 79%, whereas obtaining a good feeling was stated as somewhat or very important by 78% of the total sample.

Those who behaved like deontologists in the experiment are not more likely to be motivated to undertake everyday climate friendly behavior by emotional rewards or as a pure duty. There are no behavioral consequentialists who report that obtaining a good feeling is very important for their

motivation to act climate friendly, whereas 22% of behavioral deontologists do. However, the sum of respondents stating that a good feeling is a somewhat or very important motivational argument is high in both behavioral groups (i.e., 89% of behavioral consequentialists and 75% of behavioral deontologists, with no significant difference between the types), indicating that a warm glow is indeed an important motivator for both groups. The percent who report the duty or moral obligation of acting climate friendly as a somewhat or very important motivational factor is similarly high in both groups (i.e., 78% among behavioral consequentialists and 72% among behavioral deontologists, with no significant difference between the types).

Result 6: Behavioral consequentialists are more likely to be motivated to undertake climate friendly behavior with its real climate benefits

Those who behaved like consequentialists in the experiment are more likely to be motivated to undertake everyday climate friendly behavior by the actual climate benefits. The results show that 89% of behavioral consequentialists report that the actual climate benefits are somewhat or very important as a motivating factor, whereas only 56% of behavioral deontologists report the same. This difference is weakly significant ($p = 0.0757$). There are no significant differences between behavioral types in the reported importance of the other motivational arguments. Note that the survey is answered directly after the experiment has finished; hence, a wish to answer consistently with experimental behavior or to justify experimental behavior might have affected participants' answers.

Result 7: Deontologists are more skeptical of the morality of quota trade

The exit survey reveals that 61% agree or somewhat agree with the claim: "The EU's quota trade system is a morally wrong approach to combat global warming". It is mainly the behavioral deontologists who agree or somewhat agree with the above claim; 72% of behavioral deontologists agree, whereas only 22% of behavioral consequentialists agree, which is a significant difference ($p = 0.006$). This confirms that behavioral deontologist also possess deontological perceptions in other questions related to climate change policy.

Participants are also asked directly about the importance of an actual climate effect, by stating their level of agreement with the claim: "If my effort to reduce emissions would have resulted in somebody else emitting an equal amount somewhere else in the world, I would not have done it". Only 47% of participants agree or somewhat agree with the claim (40% disagree and 13% do not know), suggesting that consequentialism is a critical motivational factor of climate friendly behavior for less than half of the sample. Among those who behaved like consequentialists in the experiment, 56% agree with this claim, whereas only 41% of behavioral deontologists agree, which is a statistically insignificant difference ($p = 0.438$).

3.7. Sensitivity to type definition threshold

The above analysis is based on a definition of behavioral types depending on experimental contributions and defining positive contributions at a rather arbitrary threshold of 10 NOK (i.e., 5% of endowments). The following tests how sensitive the above results are to the threshold value, using increased threshold values of 25 NOK (i.e., 12.5% of endowments) and 50 NOK (i.e., 25% of endowments) for the type classification. Participants with mean contributions below the threshold in the no-target rounds are classified as free riders; the remaining participants are classified either as behavioral consequentialists, if their mean contributions are below the threshold in the target rounds, or as behavioral deontologists, if their mean contributions are at the threshold or higher in the target rounds. The number of participants in each type classification, with the respective threshold values, is presented in Table 4. Even with a threshold at 50 NOK, the behavioral deontologists are the largest of the three groups. The shares of both free riders and behavioral consequentialists increase with the threshold.

Table 4
Sensitivity to the type classification threshold.

Type	Threshold 10 (5% of endow.)	Threshold 25 (12.5% of endow.)	Threshold 50 (25% of endow.)
Behavioral consequentialist	9 (19%)	13 (27%)	16 (33%)
Behavioral deontologist	32 (67%)	22 (46%)	17 (35%)
Free rider	7 (15%)	13 (27%)	15 (31%)

Note: Free riders are defined as those contributing less than the threshold, on average, in the no-target rounds. The others are classified as behavioral consequentialists if they contribute less than the threshold, on average, in the target rounds or as behavioral deontologists if they contribute at the threshold or above, on average, in the target rounds.

4. Conclusions

The results reported in this article reveal that a substantial share of volunteer contributions to carbon abatement is not dependent on any direct climate effect. It suggests that the introduction of a fixed emission policy does not necessarily reduce volunteer contributions to the extent that an environmental consequentialist reasoning would imply.

People feel good when doing what they perceive is the right thing to do. For some, the right thing to do in an environmental context depends crucially on the action's environmental consequences. Others seem to hold what they perceive as environmentally friendly behavior as a general rule of thumb. The complexity of the link between personal carbon emissions and the global climate may increase the need for such a rule of thumb. When the actual consequences are less salient, they might also be less important for the motivation. An important rule of thumb regarding carbon abatement is that someone should always contribute one's share. The underlying reasoning may be that if someone does not contribute one's share, then someone else must do it.

It is likely that participants interpreted the experimental setting as a shared responsibility for the group to reach the target contributions. The revealed reciprocity in the experiment also suggests that this is the case. Many participants contribute their exact share as long as the others contribute their shares. They stop contributing if the other group members do not contribute. Finally, in this experiment it is the experimenter who must pay when the group members do not pay. Therefore, preferences for the experimenter's costs may be a potential non-environmental motivation for contributions. If preferences for the experimenter's costs are partly driving the results, then such preferences are only reflected in the target rounds when the experimenter adds to group contributions not reaching the target (i.e., as those who contribute in target rounds do not restrain contributions in the no-target rounds, when the experimenter adds 50% to every contribution). It is possible that the participant starts caring for the experimenter's costs only in the situation when the experimenter offers to pay if the participant does not. If so, it might be that contributions in this setting are partly motivated by reciprocity toward the experimenter; when the experimenter is "nice" and willing to pay the participant's part if he/she does not, then it might make the participant more willing to pay.

The implication of such reciprocity may also be important in a larger setting with country-specific tradable carbon quotas, as in the EU Emission Trading Scheme. When the government softly asks all members of society to do their share to limit carbon emissions and at the same time pays the bill for those who does not, it might still obtain a substantial amount of volunteer emission reductions in return.

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Appendix.

See Fig. A1.

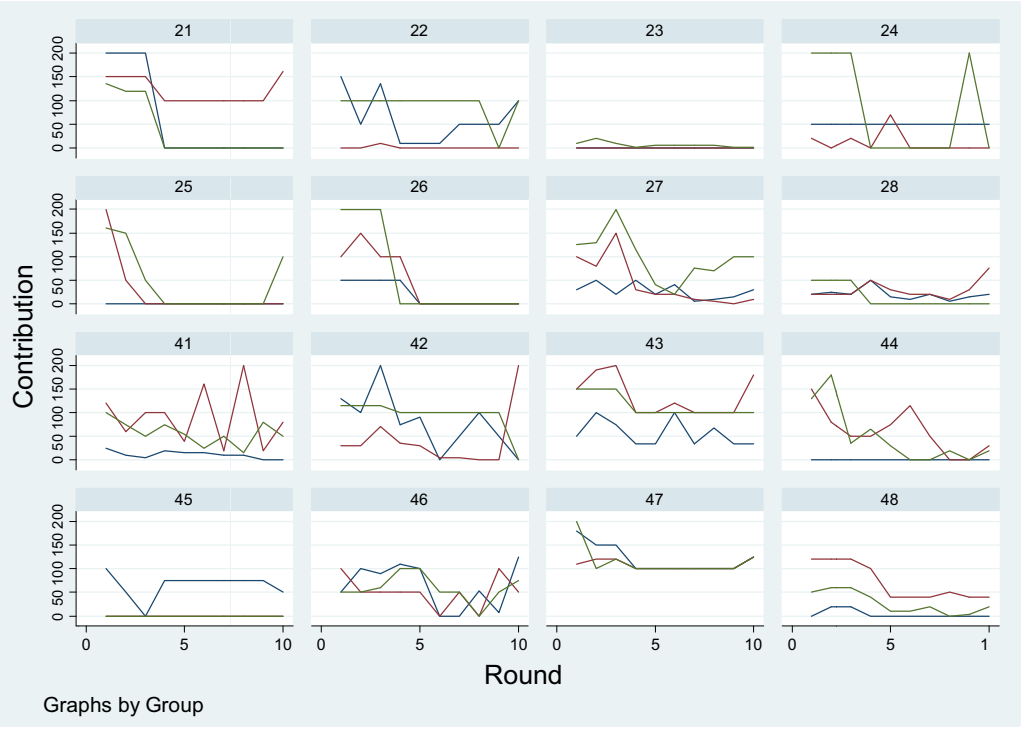

Fig. A1. Contribution per round of each individual participant by group in the treatment sessions ($N = 48$). Rounds 1–3 are no-target rounds, rounds 4–9 are target rounds, and round 10 is a voting round (12 of 16 groups elected a target policy).

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