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"I don't want to be selling my soul": Two Experiments in Environmental Economics

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"I don't want to be selling my soul": Two experiments in environmental economics

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Abstract

We conducted two experiments in the context of environmental protection. We found that profit considerations and personality traits are among the essential determinants of individual contributions to the solution of environmental problems. The results show that environmental considerations are powerful motivators and subjects are willing to forgo pecuniary profits for the sake of "doing-the-right-thing". The study shows that the environmental groups can purchase carbon offsets directly from the providers at a lower-than market price and still obtain a relatively large market share.

Keywords: metaeconomics, environmental experiment, self-interest, other-interest, carbon offsets

1. Introduction

Concern about global warming is everywhere. It is one of the highest risks humanity has faced in the last years, and, in many senses, it makes people reconsider their relationship to nature (Shogren, 2002b). Affected decisions encompass many aspects such as buying green cars, switching to more efficient energy, donating to an environmental organization to offset the carbon footprint, etc. One popular approach to achieve control over, and potentially reduce, CO_2 emissions is through a cap-and-trade system of carbon allowances. Examples of these systems are the mandatory caps European Trading Scheme and the voluntary caps Chicago Climate Exchange (CCX) trading system.

In addition to carbon allowances, the CCX trades carbon offsets generated in registered carbon sequestration projects. Using an experimental approach our paper tries to predict what offset selling behavior we may observe as this market expands. Will offset providers be maximizing profit and selling their carbon offsets at the climate exchange? Or will they opt for more altruistic actions and be donating or selling the offsets at a discount to environmental agencies and organizations?[1]

Environmental groups are large supporters of the carbon emissions cap-and-trade system (Shogren, 2002b). Currently they are participating in the market by buying allowances/offsets at the Climate Exchange and retiring them. The two experiments discussed in this paper provide environmental groups with a reason for trying to work directly with carbon offsets providers. The experimental results show that such groups can go around the market and purchase offsets from the providers at prices discounted compared to the market price at the CCX.

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[1] Jouvet et al. (1999) show that protecting the environment may be a mixture of altruistic and/or egoistic motives. A bequest motive is considered to be purely altruistic, whereas a cleaner environment also appeals to the egoistic person during their own lifetime. However, individuals can only have a marginal effect on CO_2 world production, implying that decisions to retire carbon offsets are mostly of altruistic nature. Further, Popp (2001) shows that people care about future generations, also supporting arguments for the altruistic nature of monetary sacrifices to protect the environment.

Experiments in environmental economics are on the border between market and non-market settings (Shogren, 2002a). Our experiments are unique in that they consider behavior of individuals across markets. More precisely, we compare the selling of offsets in the market and in the social environment. An experimental participant, playing the role of a hypothetical carbon offset provider, chooses whether she wants to sell her offsets at a discount to the environmental agency or at the market price at the Climate Exchange. Such a set-up allows for empathy–sympathy-based environmentally conscious behavior, but also for egoistic–hedonistic, profit-maximizing actions of individuals in the ecological context.

Studies on individual environmental values in general demonstrate the participant's response to self-interest and shared other-interest as reflected in other-regarding (shared) values (Rose et al., 2002; Sturm and Weimann, 2006). They also suggest that people balance their pecuniary concerns with satisfying communal, shared goals and interests (Lynne, 2002; Lynne, 2006; Sautter et al., 2008; Czap and Ovchinnikova, 2008). The results of our experiments point to an innate desire in our subjects to engage in a shared other-interest, other-regarding…perhaps better said, mutual-regarding…behavior even without priming, and even in situations when such behavior is very costly to them.

The rest of the paper is constructed as follows. The next section provides a brief review of approaches on how to measure individuals' valuation of the environmental good. The following section discusses the results of the two experiments. The subsequent section offers conclusions and the final section presents limitations and future extensions.

2. Measurements of the individual valuation of environmental goods

There are several non-experimental and quasi-experimental approaches to the measurement of the individual valuation of environmental goods. In the direct contingent valuation method (see for example Mitchell et al., 1989; Loomis, 2006) a hypothetical situation is used to elicit willingness-to-pay (WTP) or willingness-to-accept (WTA) for an environmental item. Indirect valuation methods include contingent behavior (e.g., Grijalva et al., 2002; Chase et al., 1998), and revealed preference approaches, in particular travel cost analysis (e.g., Knetsch, 1963; Buchli et al., 2003; Loomis, 2006), and hedonic pricing (e.g., Knetsch, 1964; Dale et al., 1999; Nelson et al., 2005). Another possibility to elicit individual values is to perform choice experiments (e.g., Carlsson and Martinsson, 2001; Laury and Taylor, 2008). These approaches generally suffer from being either not incentive compatible or measuring only part of the valuation of the environment.

The experimental approach to the measurement of environmental valuation deals with social dilemma situations and employs public goods (PG) and common pool resources (CPR) games. These experiments are often decontextualized and use very neutral language in instructions and during the game. Such experiments demonstrate that the participant's motives include not only the private value of the public goods, but also altruism, warm glow, and confusion (Rose et al., 2002). In addition, recent findings on public good donations (Laury and Taylor, 2008) suggest that altruistic behavior of individuals in public choice experiments does not necessarily translate into higher donations for the naturally occurring public (environmental) good. Intriguingly, Laury and Taylor (2008) showed that weak free-riders more often contribute to the naturally occurring public good. In this sense a contribution to the public good, which directly benefits other group members, can be considered to be fundamentally different from a contribution to the environmental good.

Controlled, decontextualized experiments on public goods provide participants with explicit information on the private value of such goods/resources. In contrast, attitude towards and the true evaluation of naturally occurring PGs are more difficult to capture, because they include the uncertainty regarding the private value of the environmental good (Rose et al., 2002). More importantly, environmental goods have an intrinsic value to individuals (Boyce et al., 1992), which makes them try to preserve a natural resource for moral and other motives. This is of particular interest in the context of global warming, as individuals must make a very personal decision on whether to make a contribution to the global PG or not, despite knowing that each individual contribution is not going to make a substantial difference.

The two experiments presented in this paper draw on the hypothetical contextualized contingent valuation and the incentive-compatible experimental approaches. Both experiments ask individuals to imagine themselves as a farmer—carbon offset provider confronted with the decision to sell her carbon offsets. The offsets can be sold on the Climate Exchange at the market price or to the environmental organization at a discount. The participants can pursue their profit-maximization and sell all their offsets at the exchange, or they may make environmentally conscious decision and sell offsets to the environmental group. They can also do both and thus achieve a kind of peace-of-mind from having done the right thing while also earning an adequate profit. By giving up higher profits and selling offsets to the conservancy project, participants are revealing their preferences for the shared environmental good.

The crucial point of both experiments is that the participant's real earnings are the percentage of their game earnings. In this sense it is costly for a participant to reveal her preferences. The advantage of this approach compared to the traditional contingent valuation analysis is that subjects do not have an incentive to overstate their true preferences with regard to the environmental good; however, they may want to understate their preferences. The advantage of this approach over the public goods experiments is that participants are provided with an environmental context. This triggers participant's intrinsic values and buy-in to shared social norms and thus provides higher external validity of our experiments relative to the traditional PG experiments.

In addition, the experiments developed in this paper draw on the research in behavioral economics and psychology. Research on farmer's behavior has a long history of inclusion of the human dimension (Francis and King, 1997; Nowak and Korsching, 1998), psychological constraints of such behavior (Lockeretz, 1990; Luzar and Diagne, 1999), including subjective norms and environmental attitudes (Lynne et al., 1988; Lynne and Casey, 1998; Sautter et al., 2008; Ovchinnikova and Czap, 2008). Usually, economic experiments do not report any type of demographic or psychological traits statistics. However, it was found that personality types have explanatory power in bargaining and prisoners dilemma games (Boone et al., 1999; Ben-Ner et al., 2004; Swope et al., 2008) as well as common resource dilemmas (Koole et al., 2001). In this paper we include psychological traits questions measuring selfism, empathy, autism, and locus of control to test the degree to which these personality characteristics influence participants' behavior.

3. Experiment 1—balancing behavior of carbon offset providers and its determinants

3.1. Experimental procedures

Seventy-eight students from the University of Nebraska-Lincoln participated in the experiment. The experiment was programmed and conducted on MediaLab. Upon the arrival at the

experimental laboratory subjects were seated in separate rooms with a computer terminal and presented with the instructions to the experiment (understanding was checked with a multiple choice quiz). The actual experiment took 20–40 min to complete; the mean earnings paid to subjects were 26.47 dollars (standard deviation 2.05) with a minimum of $21.40 and maximum of $30.

Subjects were paid a percentage of their experimental earnings. By choosing this payment procedure over one round at random we wanted to capture the sequencing effect (in contrast to the usual procedure in choice experiments, i.e., Carlsson and Martinsson, 2001; Laury and Taylor, 2008) in the individual decisions. As the metaeconomic theory (Lynne, 2006) suggests people often try to balance self-interest and shared other-interest in forming their internalized own-interest. However this balance is not necessarily reflected in each particular decision, it rather happens within the multiplicity of decisions. Thus egoism may prevail in one situation, however the next time people may act with self-sacrifice (making the environmentally conscious decision) in the egoistic-based self-interest while they pursue the shared other-interest (and vice versa). Participants were randomly assigned to one of three treatment conditions (26 subjects in each condition). Subjects knew from the instructions that the game would proceed for "several rounds" but they were not aware of how many rounds they were actually going to play. The variation in the number of rounds (10 or 15) was used merely for randomization and is not a condition of interest. The first treatment is the shared other-interest condition, in which participants were primed to behave cooperatively. In the self-interest condition they were urged to watch out for their self-interest. In the control condition no priming occurred; subjects proceeded directly to the experiment.

Each participant received 2000 offsets at the beginning of each round. Each round consisted of two steps. The first step was the decision to sell offsets to either the Conservancy Project[2] (CP) or at the Viking Climate Exchange[3] (VCX). Participants were provided with information on the prices offered by the CP and at the VCX for each offset. These prices were increased every round as was the relative price difference. In the first round both buyers paid $1 per metric ton of offset, by the last (15th) round the VCX paid $8 whereas the CP paid only $3. After the subject indicated how much she wanted to sell to the CP and the VCX, she proceeded to the next screen showing her experimental and real payoff for that round.

The second step of each round involved answering questions on empathy, locus of control, autism, and selfism/narcissism[4] (one random question per scale, four in total).

The empathy scale was taken from the International Personality Item Pool (Goldberg et al., 2006). Answers on the scale were re-keyed so that higher numbers indicate more empathetic behavior. The locus of control scale was based on Rotter (1966). The answers were re-keyed in the way that the higher numbers on the scale mean more internal locus of control; in particular it indicates the personal belief that own actions determine the rewards. Low numbers on the scale represent more external locus of control. It reflects the personal belief that own behavior does not matter much and that rewards in life are generally outside one's own control. The autism scale was adapted from Baron-Cohen et al. (2001). It was re-keyed for the analysis so that higher numbers mean more autistic behavior. Finally the selfism/narcissism scale was developed based on Phares and Erskine (1984), with higher numbers indicating more selfish be-
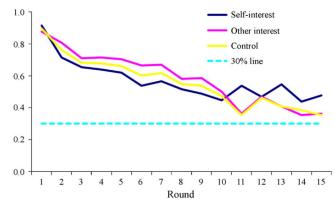

Figure 1. Average proportion of offsets sold to the Conservancy Project in Experiment 1.

allowing us to use the answers to all four of the psychological trait questions in the regression analysis.

After a subject finished all the rounds of the game she was invited to answer basic demographic questions. This completed the experiment.

3.2. Experimental results

Result 1: *With the increase in the price premium for selling at the Viking Climate Exchange the average number of offsets sold to the Conservancy Project was decreasing, however it was still above 30 percent even in the last rounds* (Figure 1). This is consistent with the theoretical discussion on preference functions as provided by Altman (2006). He argues that an increase in the price premium increases the opportunity cost of selling to the CP, which, given a not completely altruistic person, should result in an increase in the allocation of offsets to the CP. Our results offer an additional insight to his model in that there is not only a minimum level in the pecuniary dimension (he calls it physiological minimum or, alternatively, socially determined target income), but also a minimum level in the moral, other oriented dimension.

There was no significant difference found between the proportions of offsets sold to the CP in the three treatments when compared by round. Similarly, when comparing the average contribution across all rounds there was also no significant difference between treatments.[5] An intriguing observation is that the proportion of offsets sold to CP in the shared other-interest condition was slightly higher than in the other two conditions until round 10. In that round the proportion dropped and stayed below the self-interest condition in the remaining rounds.

Although statistically insignificant this suggests that people may have some sort of understanding of how much one ought to sell to the CP on average. In the first ten rounds subjects in the shared other-interest condition sold a little bit more to the CP than subjects in the self-interest condition. Later, however they may have recognized the necessity to turn to the self-interest and starting from round 11 they decreased the share going to the CP and ended up selling less to CP than players in the self-interest condition. Such decisions, though, did come at a cost to subjects. After the experiment they were commenting in private conversations that with the price difference increasing it was very hard to continue selling offsets to the CP. One participant

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[2] Standing for an environmental group; e.g. the Sierra Club.

[3] Standing for a carbon exchange market; e.g. the Chicago Climate Exchange.

[4] For the complete scales please contact the authors.

[5] Average proportion of offsets sold to the CP under the self-interest condition is 0.57; under other-interest condition is 0.58; under the control condition is 0.56.

Table 1. GLM (maximum likelihood) for Experiment 1: dependent variable prop_cp (proportion of offsets sold to the Conservancy Project)[a].

Variable	Model 1A	Model 1B
Constant	1.072***	.340***
px_pc	−.080***	−.009*
Prop_cp_lag-1		.738***
D_other	.048**	.019
D_self	−.008	−.005
D_rd10	.005	−.003
Empathy	.124***	.040***
Control[b]	−.127***	−.055***
Autism	−.050***	−.018
Selfism	−.047***	−.017*
Akaike's info criterion[c]	431.432	−348.313
Likelihood Ratio Chi-sq.	280.900	986.929
Sig. in Omnibus test[d]	.000	.000

[a] Demographic characteristics were controlled for.
[b] Internal locus of control.
[c] Information criteria are in small-is-better form.
[d] Compares the fitted model against the intercept-only model.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

even said that she did not want to be selling her soul.[6] The proportion of offsets sold to the CP in the control condition was between the other- and self-interest conditions in rounds 1–10 and thus almost coincided with the overall average (average of all three conditions). In the last five rounds the control condition average closely followed the other-interest condition (Figure 1).

To establish the determinants of the individuals' selling behavior a regression analysis was conducted for the proportion of offsets sold to the CP (dependent variable: *prop_cp*) using a generalized linear model. The first specification (Model 1A in Table 1) did not include the previous round as an independent variable, whereas the second specification (Model 1B) did.

Both Models, 1A and 1B, were constructed on the basis of the full data set (15 rounds). To check for robustness we constructed two additional models based on the first ten rounds only. Results were very similar.

All the regression coefficients have expected signs. The price premium of the Viking Climate Exchange over the Conservancy Project (*px_pc*) has an economically significant negative effect on the amount of offsets being sold to the CP. For every one dollar increase in the price premium, the share of offsets sold to the CP decreases by 8 percentage points. Intriguingly, the subjects are responding to the priming for other-interest (*d_other*) but not for self-interest (*d_self*). This is economically quite significant as the environmental agency can considerably increase its' share (in this case by 5 percentage points) by appealing to the environmental consciousness of the offset providers.

Result 2: *Psychological scales have significant predictive power for environmentally conscientious behavior*. As expected, higher levels of empathy made subjects contribute more to the CP, whereas higher internal locus of control, autism, and selfism/narcissism reduced the amount of offsets sold to the Conservancy Project. Responding to psychological scales after each selling decision encouraged participants to reflect on their personalities and the way they wish to be treated by others. It is important to stress the economic relevance of these effects, as the coefficients on empathy and locus of control are both about fifty percent larger than the coefficient on the price premium. Autism and selfism

are less important, but still account for about five percentage points of the overall allocation (equivalent to a more than a sixty cent increase in the price premium).

An increase in the price premium was a powerful disincentive to continue selling offsets to the CP, however the price changes per se may not necessarily be the sole cause for changes in selling behavior each round. To estimate the effect of past decisions we included the proportion of offsets sold by the participant to CP in the previous round (*prop_cp_lag-1*) into the model (Model 1B). Including this variable renders the experimental manipulations insignificant. However, the psychological dispositions (except autism) remained statistically significant predictors of the willingness to sell to the Conservancy Project at a low price. Here we observe the tradeoff between pecuniary incentives and non-pecuniary factors. Controlling for the previous behavior, the price premium becomes less economically important in explaining the individual behavior than the psychological traits of empathy and locus of control.

Result 3: *There is hysteresis in giving*. An increase in contribution in the previous round causes individuals to also have a higher than average share going to the Conservancy Project in the next round, as demonstrated by the highly significant and positive coefficient on the proportion of offsets sold to the CP in the previous round (*prop_cp_lag-1*). This mean reverting process is economically quite essential, as subjects carry more than 70 percent of the increase over to the next round. One possible explanation for this observation is that there may be some spillover warm glow effect. Subjects deciding to sacrifice some profits to sell to the CP may feel good about doing-the-right-thing and may be compelled to do so in the next round as well. At the same time they feel that they cannot completely sacrifice their own interest and slowly move back to the "equilibrium" position of inner balance between self- and other-interest.

4. Experiment 2 — price changes and altruism of carbon offsets providers

4.1. Experimental procedures

Sixty students of the University of Nebraska-Lincoln participated in the experiment. The procedure was similar to the one described for Experiment 1. The experiment took 15–20 min to complete. Subjects received 0.017% of their experimental earnings as payment. The mean payoff equaled $18.46 (standard deviation $2.18) with a minimum of $12.41 and a maximum of $21.17. As before, participants of the experiment were randomly assigned to one of the treatments (30 subjects in each of the price increase and price decrease condition).

Experiment 2 had the following modifications compared to Experiment 1: participants played 25 rounds, psychological traits questions were not asked, and a new pricing schedule was implemented. In this pricing schedule only one price (of the Viking Climate Exchange or Conservancy Project) was changing each round. The new pricing schedule included two conditions: price increase and price decrease.

In the price increase condition prices of both buyers equal $1 per metric ton of carbon offsets in round 1. Starting from round 2 the price at the VCX increases by 10% each round until it reaches $3.14 in round 13. The price of the Conservancy Project is kept constant at $1. Starting from round 14 the price of VCX is frozen at the level of $3.14 while the CP price increases by 10% each round until it equates to the VCX price of $3.14 in round 25.

In the price decrease condition prices of VCX and CP started at the high level — $3.14 per metric ton of carbon offset in round

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[6] Which is where the title of our paper is coming from.

Figure 2. Average proportion of offsets sold to the Conservancy Project in the Price Increase condition in Experiment 2.
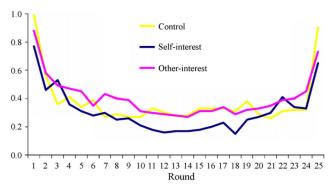

Figure 3. Average proportion of offsets sold to the Conservancy Project in the Price Decrease condition in Experiment 2.

1. In rounds 2–13 the CP was decreasing its price by 10% per round until it reached $1. The price at the VCX was kept constant at $3.14. In rounds 14–25 the VCX price was decreasing by 10% while the CP price remained the same. In round 25 prices of both buyers equated at the low $1-level.

This pricing schedule was designed to examine: first, the reaction of subjects to the change in each price separately, keeping the other price constant; second, the difference in the effect of decreasing prices and increasing prices (with the same change in the price premium); third, the tolerable level of price premium for which subjects would still sell to the Conservancy Project. This is intended to determine the willingness-to-pay for the protection of the environment. In the earlier rounds it is not very costly for the participants to sell their offsets to the environmental agency. As the price premium paid by the VCX over the CP increases (rounds 2–13) it becomes more and more tempting to maximize the individual pecuniary payoff and sell a significant proportion of offsets on the VCX. The subsequent decrease in the price premium (in rounds 14–25) allows examining whether the behavior reverts back to the corresponding levels in earlier rounds.

4.2. Experimental results

In line with our expectations the proportion of offsets sold to the Conservancy Project followed the dynamics of the price premium. In both, the Price Increase and the Price Decrease condition, the proportion allocated to the Conservancy Project decreases until about round 13 and then rises (Figure 2 and Figure 3). However, the proportion of offsets sold to the CP did not get back to the initial levels.

Result 4: *There is no significant difference between the proportion of offsets sold to the Conservancy Project in the Price Increase and Price Decrease condition with equal price premiums*. We matched one round in the Price Increase condition to the respective round in the Price Decrease condition with the same price premium. For instance round 2 of the Price Increase condition was matched with round 24 of the Price Decrease condition (in both cases the price premium was $0.1). We hypothesized that there would be two possible effects working in opposite directions for the difference in proportions. The first effect is loss aversion: we expect that the proportion of offsets sold to CP will be lower in the Price Decrease condition since subjects may find it harder selling at a lower price to CP when their profits are falling already. The second effect is warm glow (Andreoni, 1990): we expect that the proportion of offsets sold to CP will be higher in later rounds because subjects may feel good about doing-the-right-thing by selling to the CP, which reinforces their desire to sell more in the next round. The absence of a significant difference would signify that both effects cancel each other out.
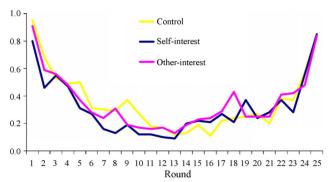
A two-factor ANOVA demonstrated that there is no significant difference between the proportion of offsets sold to CP in two conditions (given equal price premiums), with the exception of two rounds. Thus, in general we can assert that the influence of loss aversion and possible warm glow cancel each other out.

Comparing the results of the first and second experiment we observe that in Experiment 2 the proportion falls below the level found in Experiment 1. One possible explanation of this is that during Experiment 1 subjects were asked psychological questions after each round. Two out of four questions asked were targeted at empathetic concerns and altruism, which may have positively affected the subsequent decision regarding selling offsets (see Section 6). Another explanation is that answering the questions required time and attention and thus separated selling decisions in two consequent rounds. Some participants may have forgotten the previous prices and/or selling decision. In this sense the selling decision in Experiment 1 could have been more independent of the decision in the previous round whereas in Experiment 2 participants were observing screens with prices in more rapid succession and might have inferred the pattern of price changes.

In the econometric model we included prices offered at the VCX and by the CP separately. The coefficients of the generalized linear models (Table 2) are statistically significant and have the expected signs. Every dollar increase in price proposed by the Conservancy Project (*price_CP*) increases the proportion of offsets sold to the CP by 0.16 (Model 2F). The effect of the price at the Viking Climate Exchange (*price_VCX*) is negative, but

Table 2. GLM (maximum likelihood) for Experiment 2: dependent variable *prop_cp* (proportion of offsets sold to the Conservancy Project)[a].

Variable	Model 2F	Model 2G
Constant	.449***	.190***
Price_CP	.161***	.061***
Price_VCX	−.130***	−.051***
Prop_cp_lag-1		.707***
d_other	.001	.001
d_self	−.073***	−.017
d_pr incr	.018	−.002
d_pr prem_incr	.036**	−.074***
d_1st round	.427***	
d_25thround	.327***	
Akaike's info criterion[b]	733.802	−226.298
Likelihood Ratio Chi-sq.	423.197	1219.846
Sig. in Omnibus test[c]	.000	.000

[a] Demographic characteristics were controlled for.
[b] Information criteria are in smaller-is-better form.
[c] Compares the fitted model against the intercept-only model.
** Significant at 5% level.
*** Significant at 1% level.

relatively smaller than that of the price of the CP. This is consistent with the theoretical discussion by Altman (2006). A simultaneous increase in both prices increases the subject's income for a given allocation of offsets. As predicted theoretically, this leads to increased willingness to sacrifice in the pecuniary domain.

In contrast to the first experiment priming for shared other-interest (*d_other*) does not make a significant difference here, however priming for self-interest (*d_self*) decreases the proportion of offsets sold by the individual to the Conservancy Project.

The dummy for the price increase condition (*d_pr_incr*) is not significant, but the dummy for the price premium increase relative to the previous round (*d_pr_prem_incr* = 1 for rounds 2–13) is statistically significant and economically moderately important. In rounds 1 and 25 prices offered at the VCX and by the CP are equal. In this case it is not costly for an individual to behave environmentally conscious and sell offsets to the Conservancy Project. Therefore we may expect that the coefficients in front of the dummies for the first (*d_1st round*) and twenty fifth round (*d_25th round*) would be roughly the same. However in the estimated model they differ by 0.1. As the price premium of VCX compared to CP decreased, participants were selling higher proportion of offset to the CP, however, the proportion did not get all the way back to the initial level. This supports the notion that decisions in previous rounds have an impact on subsequent rounds. Furthermore, the size of the coefficients for rounds 1 and 25 is comparatively large, indicating that there is a spike in the willingness to support the environmental initiative.

Similar to the analysis of the first experiment, Model 2G addresses the question of hysteresis of past selling decision on the current round. The coefficient of the proportion of offsets sold to CP in a previous round (*d_prop_cp_lag-1*) is slightly lower in Experiment 2 than in Experiment 1, however it is still economically highly significant at above 0.7. The introduction of path dependency reduces the influence of both prices, but they remain economically relevant determinants of individual actions. Other variables in the model are not significant, except the dummy for the increase in the price premium (*d_pr_prem_incr*). In rounds 2–13 when the price premium rises, it becomes relatively costly to be environmentally conscious. Participants respond by selling less offsets to the Conservancy Project, presumably to protect their profits from falling.

5. Effect of psychological traits on individual behavior: comparison of Experiment 1 and 2

In order to compare the results of the first and the second experiment we run a new set of estimations using a generalized linear regression model with (Models 1I and 2I in Table 3 using data from Experiment 1 and 2, respectively) and without (Models 1H and 2H) the previous round as an independent variable. This allows us to observe the strength and robustness of the relationship between the price premium of VCX over CP and the proportion of offsets sold to the CP as well as the effect of asking psychological questions.

Models 1H and 2H have similar intercepts (*Constant*) for the proportion sold to the CP: 58–65 percent of offsets. Our manipulation of playing 10 or 15 rounds in Experiment 1 and Price Increase vs. Price Decrease conditions is not significant for the selling behavior of offset providers and is therefore not included in these models.

Result 5: *The effect of the price premium (px-pc) is more pronounced in Experiment 2 (Model 2H) as compared to Experiment 1 (Model 1H).* In the former the coefficient of the price premium equals −0.205 whereas it is only −.081 in the latter. This is likely due to the difference in the design of the experiment. Whereas each round in Experiment 1 was separated by psychological questions these questions were not asked in Experiment 2. *It suggests that the constant reflections on one's actions through for instance empathetic concerns and thoughts about one's selfism and control have a positive effect on individual contributions to the environmental good.* Previous research (Carlsson et al., 2004) shows that the inclusion of prices changes preferences by decreasing the importance of attributes associated with emotive ethical concerns. Our estimation demonstrates that the stress on the self-reflections on "who I am" and "how do I treat others" decreases the impact of prices on individual choices. This is consistent with metaeconomics, where such stirring/irritating of subjects to "think-about-it" brings about truly rational choices; choices that integrate and balance over the I & We, self- and shared other-interest.

Result 6: *The effect of priming for shared other-interest (d_other) is significant in Experiment 1, but not in Experiment 2. At the same time priming for the self-interest (d_self) made an economic difference in Experiment 2, but not in Experiment 1 (the coefficient is less than half in Experiment 1 compared to the coefficient in Experiment 2).* These two outcomes basically speak to the same idea as in the previous paragraph that the self-reflections on "who I am" and "how do I wish to be treated by (and how, then, I will treat) others" elucidate the importance of environmental concerns and, encouraged by the other-interest priming, results in a higher proportion of offsets sold to the Conservancy Project in Experiment 1. In contrast, making uninterrupted selling decisions in Experiment 2 leads to more habitual, more primary profit seeking actions. Further encouraging self-interest results consequently in a relatively low proportion sold to the CP in Experiment 2.

Similar to Result 4 above, it was found that the regression coefficients of the proportion of offsets sold to the CP in the previous round (*prop_cp(lag-1)*) are both positive, economically and statistically significant, and very close in magnitude. This outlines once again the importance of hysteresis of the individual decisions. Intriguingly, the introduction of the past proportion into the regression equation in Experiment 1 (Model 1I as compared to Model 1H) overrides the effect of the price premium change (the coefficient in front of *pc_px* becomes very small and statistically insignificant). In Experiment 2, however, this does not happen. The coefficient of the price premium in Model 2I (as compared to Model 2H) decreases but stays economically and statistically significant.

6. Discussion and environmental policy implications

The estimation of experimental results strongly supports that the price premium is a significant determinant of the proportion of offsets being sold to the environmental agency. An increase in the price premium at the climate exchange over the environmental agency leads to an increase in the share sold at the climate ex-

Table 3. GLM (maximum likelihood) comparing Experiment 1 and 2: dependent variable *prop_cp* (proportion of offsets sold to the Conservancy Project).

Variable	Model 1H	Model 1I	Model 2H	Model 2I
Constant	.649***	.080***	.578***	.170***
px_pc	−.081***	−.005	−.205***	−.063***
Prop_cp_lag-1		.792***		.692***
d_other	.062**	.023	.012	.004
d_self	.026	.009	−.056***	−.014
Akaike's info criterion[a]	588.535	−329.070	881.032	−196.005
Likelihood ratio Chi-sq.	105.797	947.685	257.967	1175.553
Sig. in Omnibus test[b]	.000	.000	.000	.000

[a] Information criteria are in smaller-is-better form.
[b] Compares the fitted model against the intercept-only model.
** Significant at 5% level.
*** Significant at 1% level.

change. The good news is, however, that *there is a powerful intrinsic motivation for individuals to protect the environment*. Even if prices are more than 300% higher at the climate exchange, still about ten percent of offsets are sold to the environmental agency (thirty percent in Experiment 1). This implies that environmental groups can purchase offsets at a significant discount. Conversely, people care also about economic performance and try to balance the allocation of offsets. This became apparent in the cases in which the price premium was zero and the proportion of the offsets sold at the climate exchange still reached ten percent.

Important for environmental groups is the result that *the impact of a change in price offered by the environmental group on the share allocated to the environmental group is larger than the impact of a change in price offered at the climate exchange*. This implies that the environmental group has some leverage that it can use in their purchasing decisions in the market. The key will be in keeping the issue before the sellers, stimulating them to consciously reconsider, and, then, rationally choose to sell more offsets.

Psychological traits are important predictors of individual behavior in the environmental context. The influence of empathy and locus of control dominates the pecuniary incentives represented by prices. Furthermore, we found that the very fact of asking subjects to reflect on their life attitudes significantly increases (more than twice) the proportion of offsets sold to the environmental agency. As alluded to above, this suggests that an effective way for promoting the cause of environmental interest groups is to combine advertising campaigns with targeted questionnaires asking offset providers to reflect on their belief structure and their attitudes regarding environmental protection.

The effect of priming for shared other-interest was found to be significant in the first experiment. Priming for self-interest made a difference in the second experiment. Based on the argument in the previous paragraph this can be explained in that *the self-reflection questions in the first experiment stress the environmental concerns and enhance the impact of the priming for the shared other-interest*. In the second experiment these questions were not asked and selling decisions occurred in rapid succession, which may have stressed profit-maximizing behavior, and thus resulted in relatively low proportion sold to the environmental groups. This implies that environmental agencies could increase their market share by running an advertising campaign about societal attitudes and how much others contributed. In conjunction with the targeted questionnaires mentioned before, this could provide a significant increase in offsets sold to environmental groups.

In both Experiment 1 and 2 subjects displayed hysteresis of behavior in the sense that high contributions to the environment in the past tended to result in higher contributions in the future. *This suggests that high "one-time" contributions are preferable for environmental groups[7] as they tend to motivate subjects to make higher subsequent contributions*.

7. Conclusion

In the U.S. the carbon dioxide emission allowances market and the related carbon offsets market is just now being developed. Our paper tries to predict what selling behavior for carbon offsets we may observe as this market expands. In particular we ran two experiments addressing the question whether carbon offset providers will be maximizing their profit and selling their carbon offsets at the climate exchange or if they will be following environmental concerns and be donating or selling the offsets at a discount to environmental agencies. In addition we tested for psychological dispositions as a determinant for altruistic behavior of carbon offset providers.

The two experiments provided in this paper combine a contextualized, hypothetical approach to estimate the individual value of environmental good and a context-free, induced value experimental approach. The decisions made by participants were strongly connected to monetary incentives—taking decisions with the intention of protecting the environment was costly. At the same time our contextual experiments partially are able to address the commonly criticized low external validity of abstract laboratory experiments (Sturm and Weimann, 2006).

Our experiments are also related to the work done on the testbedding of institutional arrangements to solve environmental problems. To our knowledge the two experiments discussed in this paper are the first attempts to take a look at the selling side of carbon offsets. Previous experiments have explored permit markets by designing auctions for the initial distributions of emission allowances and by setting up emission trading schemes (Sturm and Weimann, 2006). The two experiments in this paper are elucidating the attitudes and behavior of carbon offsets providers who have not yet entered the market.

An additional difference between our paper and other experiments presented in the literature is that our experiments consider behavior of individuals across markets. More precisely, our study compares the selling of offsets in the market context and in the social environment. Our experiments deepen the assertion of Shogren (2002a) that environmental experiments deal with non-market and socialized market settings: a participant has a choice to sell her offsets to the environmental agency or on the exchange.

Furthermore, contrary to the general practice of encouraging and stimulating rational and self-interested behavior, our experiments were encouraging self-reflection, shared other-interest, thinking of communal norms, and environmental consciousness.

There is a parallel in our paper to the current U.S. practice with respect to the carbon allowances market. The Chicago Climate Exchange is a completely voluntarily system with self-enforced actions of environmentally conscious companies. Similarly, in our experiments participants are making decisions about voluntarily forgoing profits. These decisions are not observed, enforced, induced, and even do not have well-defined incentives except for the feeling of doing-the-right-thing. The fact that these decisions are costly to subjects makes the results particularly strong.

While the findings of this study are tentative we can expect that the willingness to contribute to environmental groups will increase over time. As Krutilla (1967) argued, there is an inelastic supply of environmental goods. With technological progress, the supply of other goods increases over time, which increases the relative scarcity and thus price of the environmental good. In addition there is a shift of preference towards the environmental good through a learning-by-doing effect (i.e. people learn to enjoy outdoor activities). This will further increase the relative price and valuation of environmental goods.

Finally, both experiments provide general support for the overall metaeconomic framework, especially for its three most fundamental features. First, subjects in the experiments demonstrated overall tendencies to seek balance within their own-interests as between the egoistic–hedonistic pursuit of material gain and the empathy–sympathy-based pursuit of shared other-interest as reflected in providing an environmental good. Second, subjects were willing to sacrifice more in one domain or the other as they oriented and reoriented their interests in going through the various phases of each experiment, giving new meaning to the notion of altruism, as metaeconomics proposes. Third, by stirring their thought processes in the priming and

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[7] Compared to continuous small contributions.

the psychological questioning, we stirred rational consideration and reconsideration, moving choice out of the domain of only intuition-based habitual behavior, within which the pursuit of self-interest is likely more primal, as the play of the experiment evolved. By stirring thought, this self-interest is tempered and conditioned by the consideration of shared other-interest, leading to a truly rational choice. We hope these findings stimulate more efforts in helping further test, build and elaborate the metaeconomics approach and framework.

8. Limitations and future extensions

In both experiments we assumed that transaction costs are the same for selling offsets at the climate exchange and directly to the environmental agency. However, in real life we may expect that selling directly to an environmental group would imply less transaction costs, especially for a small farmer who would not need to join the Offset Aggregator. While this will not change our qualitative results it may change the exact response that we will observe in the real marketplace to factors that we have determined as significant.

Participants in these two experiments were undergraduate and graduate students who were asked to imagine themselves in the place of farmers and carbon offsets providers. The magnitude of the experimental results may be affected by the choice of subjects. However, we believe that the difference between the decisions of our subject pool and actual farmers is rather small. Our belief is grounded on two points. First, we not only provided detailed instructions explaining the context, and the potential effect of their choice on the environment, but we also quizzed subjects on their understanding of the instructions. Due to the nature of the university, a high proportion of students come from farm families, have relatives who are farmers, or are somehow connected to the agricultural land. Therefore a large part of our subject pool was not unfamiliar with the background of the experiment. Second, the literature on the context of induced-value experiments (Dyer et al., 1989; Smith et al., 1988), voting responses in hypothetical and real referenda (Bjornstad et al., 1997; Cummings and Taylor, 1998; Cummings and Taylor, 1999; Taylor, 1998), and contributions to an environmental project (Maguire et al., 2003) found that the behavior of student and adult subjects are statistically similar in hypothetical and real surveys, and experiments.

Our results could have been affected by the fact that the experiment was largely hypothetical. By making an environmentally conscious decision and selling offsets to the environmental agency, subjects were only indicating/voting with their money for their choice, but not actually making a contribution to improve the environment. There was a possibility that the subject might have decided that her decision to sell offsets to the Conservancy Project, and thus indicating that she cares about the environment, is not worth the forgone earnings, because such decision would not affect the environment. So in this particular situation she might have chosen to sell all offsets to the Climate Exchange to avoid the decrease in profits. If, however, she believed that her sacrifice of the earnings would have a positive effect on the environment she might have chosen to sell more offsets to the Conservancy Project. Thus the results of our experiments may have suffered from a downward bias. This further strengthens our results in the sense that if the decisions were not hypothetical, but real, we could have observed even higher proportions of offsets sold to the Conservancy Project.

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