Environmental investment decisions: experimental evidence of team versus individual decision making

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Abstract

We study experimentally how investment decisions are affected by equally stringent but different policy regime treatments and how differences depend on whether decisions are made individually or in groups. In our experiment, subjects decide on an investment level either individually or jointly in groups of three. In addition, decisions are made subject to either a tax or performance standard treatment. We find that investments are significantly higher and closer to the level that maximizes revenues of the hypothetical firm in the performance standard treatment. This holds for both individual and group decisions, but we find no evidence of an interaction effect. Even though groups seem to have a knowledge advantage, they are not able to benefit from it, since intragroup communication is not able to transmit the microeconomic reasoning to group members without knowledge. Also, groups are not able to attenuate the attention bias of focusing on selective information depending on the specific policy treatment.

Keywords: group behavior, investment inefficiencies, policy instruments

JEL Classification: C92, D70, H32

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1. Introduction

Individuals are often confronted with complex information when they have to make optimization decisions. In sectors where the price structure is usually nonlinear, such as the electricity or water sector, it has been found that consumers base their consumption decision mainly on the average price rather than the marginal price (Shin 1985; Binet et al. 2014; Ito 2014). Also, when it comes to allocating time between taxed and tax-exempt activities, many individuals focus on the average tax rate (de Bartolome 1995). Not only is this behavior observed among consumers making decisions, but it is also found that firms deviate from profit maximization in many situations (Armstrong and Huck 2010). One explanation for such deviations is that managers have access to limited information or the information is too complex, making it difficult to examine all investment alternatives and identify the optimum. Instead, managers might apply simplified choice rules, relying on rules of thumb. One such choice rule is to choose the first investment alternative that is considered satisfactory rather than compare all investment alternatives. Simon (1955) and Cyert and March (1963) refer to such a choice rule under bounded rationality as "satisficing."

In a recent artefactual experiment, Hennlock et al. (2017) tested how high-level industry managers and senior advisors made an investment decision under different environmental policy regimes. The authors found that managers in many cases applied choice rules that conflict with standard economic theory. Similar to the findings by Shin (1985), Binet et al. (2014), and Ito (2014), the prevalent choices decision-makers made in the experiment were consistent with minimizing the average cost of abatement in the treatments based on price instruments (tax and subsidy treatment). In a performance standard treatment, however, the choices were, on average, closer to the optimizing behavior prescribed by standard economic theory.

The question that we address in this paper is whether joint decision-making by a group of individuals can enhance investment decisions like the one presented in Hennlock et al. (2017). More specifically, we are interested in analyzing whether groups are better than individuals at taking into account the importance of marginal costs and, as a consequence, are more likely to apply choice rules that are in line with standard economic theory when information is limited.

Group decision-making is a common arrangement for overcoming informational limitations and may ameliorate any effects of bounded rationality observed at the level of the individual decision-maker (e.g., Fahr and Irlenbusch 2011). The literature on group decision-making in economics suggests that decisions can be considerably improved when made by a

group rather than individually (for an overview, see Charness and Sutter 2012). In contrast, the literature in psychology on individual versus group decision-making focuses more on the properties of the decision task to explain when individuals may or may not perform better than groups. The main distinction is made between intellective and judgmental tasks (Laughlin and Ellis 1986; see section 2.4 for further discussion). An intellective task has an objectively correct solution, whereas a judgmental task does not. Moreover, for intellective tasks, the degree of demonstrability is an important characteristic. If an individual is able to demonstrate to others the superiority of one possible solution over the alternatives, it has been shown that groups perform better than individuals at making such decisions (e.g., Laughlin et al. 2002; Maciejovsky and Budescu 2007).

In this paper, we explore group versus individual decision-making in a setting where decisions can arguably be characterized as intellective tasks, but where there are limits to the demonstrability. This setting is relevant especially in situations where decisions need to be made based on limited information, which is true in many real-world situations. To test whether choice rules differ between individuals and groups, we extend the design of Hennlock et al. (2017). We use two of their treatments, the tax and performance standard treatments, and analyze in a between-subject design whether investment decisions made by groups of three differ from those of individual decision-makers.

Our experiment was conducted with undergraduate students at the School of Business, Economics and Law at the University of Gothenburg. In the first part of the experiment, students solved a task asking them to maximize revenue of a firm by choosing an investment level, either individually or in groups of three. As a basis for the investment decision, a set of information parameters (on marginal cost, average cost, and performance level) was provided in the decision task. In the second part, all students provided individual answers to a survey.

We find significant differences in investment decisions between the tax and performance treatments. Subjects invested significantly more in the performance treatment than in the tax treatment. This is partly explained by differences in subjects' stated level of attention to information variables in the decision task. In the tax treatment, subjects reported paying more attention to cost-related variables, while in the performance standard treatment, subjects relied more on information about the performance of the investment level. These results therefore replicate the findings of Hennlock et al. (2017). Furthermore, the performance of groups did not differ significantly from that of individuals, either in the performance standard or in the tax treatment. Even though we find that knowledge about microeconomic foundations significantly increases the probability of applying the choice rule prescribed by standard

economic theory, the groups were not able to benefit more than individuals from this knowledge advantage. This suggests that communicating the economic reasoning within groups in which at least one group member has knowledge about the choice rule as prescribed by standard economic theory fails to improve decision-making. Also, we find no evidence that groups are able to attenuate the attention bias of focusing on selective information based on the policy instrument.

The paper is organized as follows. The experimental design and procedures are described in section 2. The results are presented in section 3. Section 4 concludes.

2. Survey Design and Experimental Manipulations

2.1. Population, participants, and execution of the experiment

The experiment was conducted January 18–21, 2016, at the School of Business, Economics and Law at the University of Gothenburg, Sweden. This was the first week of the spring semester, and the dates were carefully chosen to both facilitate the execution of the experiment and maximize the number of participants. The director of studies and student administrators provide general information to all classes in economics and statistics during the first lecture each semester, and we enlisted the director of studies to invite the students to participate in the experiment.

The invitation to participate in the experiment was framed as follows: At the end of the information session, the director of studies told the students about the possibility of being part of a panel that voluntary participates in experiments conducted by economics and finance researchers at the school. Further, the students would have an opportunity to participate in a classic pen-and-paper experiment that would end the information session. The students were informed that participants could earn between 40 and 100 Swedish kronor (approximately US$4.70–11.70), depending on performance. On average, students earned 82 Swedish kronor (about US$9.50). The payment was made via the Swedish finance technology app Swish, transferring the money between bank accounts using only the students' cell phone numbers, or alternatively over the counter a few days later at the student administration office. Approximately 90 percent of students chose to have the payment transferred to them using Swish.

While participation was voluntary, all students were asked to stay in their seats throughout the pen-and-paper experiment even if they chose not to participate. Altogether, students enrolled in five different undergraduate courses were invited to participate in the experiment

conducted at the end of the first lecture hour of each class: one class in basic economics, one class taking economics courses as electives, one class in intermediate economics, one class attending a specialization course in economics (econometrics at the bachelor's level), and one basic statistics class. By choosing economics students for the experiment, we wanted to guarantee that a share of students had taken basic microeconomic courses and were familiar with solving optimization tasks. The registered number of students in these courses was 862, but fewer students attended the lectures.[1] In total, 578 students participated in the experiment. Eight observations were dropped, leaving a total of 570 observations.[2]

The experiment was divided into two parts. In the first part, working either individually or in teams of three, participants solved the decision task to maximize the net return of a hypothetical firm by choosing an investment level subject to either a tax or performance standard treatment (explained in detail in sections 2.2 and 2.3). In the second part, all participants answered a survey individually. The experiment lasted for 30 to 40 minutes, and all participants were monitored by the researchers and four to six research assistants (the number of assistants varied depending on class size). See section A.2.2 in the appendix for the full survey.

2.2. Treatments

After the invitation to participate in the experiment, the research assistants handed out envelopes. Students who chose to participate either shared an envelope in a group of three or received an envelope individually. In the envelopes that were distributed was an instruction page and additional envelopes for part one and two of the experiment. All students were instructed to leave the envelopes closed until further notice. After each participating student or group had received an envelope, the director of studies told the students to open the envelope and take out the instruction page (in yellow for ease of reference). The instructions were read out loud to the class (see section A.2.1 in the appendix for details).

Then the participants took out the envelope for part one of the experiment (in white) and started to solve the task: to choose which of six investment alternatives would yield the highest net revenue for a hypothetical firm (further described in section 2.3). The students were asked to talk quietly within the groups (figure A.1 in the appendix is a photo from one of

[1] The main reason for not attending the information session was that it was not mandatory. Especially for students who were enrolled in a course to retake an exam, the information session did not provide much new information.

[2] The observations were dropped because the student did not answer the main question (1 observation), students were talking to their neighbors (4 observations), or one of the group members left the room (3 observations).

the sessions). We did not observe any communication between groups or individuals during the sessions (other than in the dropped observations noted above), and the same protocol was followed strictly for each session. Of the 570 students who completed the experiment, 414 were assigned to groups (yielding 138 group responses) and 156 to the individual treatments.

The two treatments differed only in the instructions about the regulatory information shown in table 1. This design ensures that the stringency of the two policy instruments is identical.

Table 1. Policy instrument treatments

Treatment	Regulator's information
Performance standard	The condition for your investment decision is that the firm should meet an emissions limit of 75 grams per kWh output on an annual average basis according to the Swedish Environmental Code.
Tax	The condition for your investment decision is that the firm will pay an emissions tax of SEK 250 per kg of emissions each year.

Note: kWh = kilowatt hours; SEK = Swedish crowns; kg = kilograms

The assignment of groups and individuals to the two treatments was done in a semirandom way by successively assigning the four possible conditions.[3] To form groups of three, students sitting next to each other were asked to work together during the experiment. The main reason for not assigning treatment randomly and reshuffling students to groups was that changing the seating in the lecture halls would have been too time-consuming and probably would have led to a high dropout rate. Because groups were not assigned randomly and might differ with respect to how well group members knew each other beforehand, we asked for this information explicitly in the ex post survey.

Of the 570 students who completed the experiment, 283 were assigned to the tax treatment and 287 to the performance standard treatment. Table 2 reports the number of groups and individual subjects (by course/session and decision treatment, tax versus performance standard). Two-sided tests of pairwise comparison of all possible combinations of the four treatments does not yield significant differences in the characteristics and study programs at a 5 percent significance level.

[3] Treatment tax and individual; treatment tax and group; treatment performance standard and individual; treatment performance standard and group.

Table 2. Descriptive statistics

Variable	Description	All students (n = 570)	Tax treatment: individual (n = 76)	Tax treatment: group (n = 207)	Performance standard: individual (n = 80)	Performance standard: group (n = 207)
Background characteristics (shares)						
Female	=1 if the student is female	0.45	0.37	0.48	0.39	0.48
Age	Age in years (min 19, max 71)	23.7	23.9	23.7	24.3	23.3
Microeconomics	=1 if course taken	0.37	0.37	0.39	0.39	0.35
Study program (number of students)						
Basic economics		188	22	72	25	69
Elective courses in economics		141	21	45	21	54
Intermediate economics		100	12	39	13	36
Specialization courses in economics		64	12	21	10	21
Basic statistics		77	9	30	11	27

Note: Two-sided t-tests of pairwise comparison of all four treatments do not yield significant differences in the background characteristics and in the study program chosen, at a significance level of 5%.

2.3. The decision task and incentives

As in Hennlock et al. (2017), the decision task to maximize the net return of a firm was presented to the students as a choice among six different investment alternatives. For each investment alternative, three different categories of information were provided:

1. regulatory information about the stringency and type of policy instrument in place (*varies across treatments*; see table 1, tax versus performance standard);
2. emissions performance levels in grams of emissions per kilowatt hours (g/kWh) of output for each of the six investment alternatives (*identical across treatments*); and
3. total, average, and marginal costs of the six investment alternatives (*identical across treatments*).

The investment alternatives were presented to the subjects in the form of a choice set containing information categories 2 and 3 (see table 3). The choice set contained six different investment (abatement) levels, A through F, with varying emissions performance and abatement costs. The columns show investment alternatives A–F, and the rows provide information about outcomes in terms of the emissions performance and costs associated with each alternative.[4] Since groups were allowed to quietly discuss the investment decision, there was a small risk that individuals seated next to a group would overhear the group's decision. To prevent such incidents from biasing our results, the letters of the investment alternatives were not identical between versions.[5]

Table 3. Choice set with information variables in all treatments (information categories 2 and 3)

	Alt A	**Alt B**	**Alt C**	**Alt D**	**Alt E**	**Alt F**
Emissions performance (g/kWh)	95	90	85	80	75	70
Total annual investment cost (SEK)	21,250	25,000	31,250	40,000	51,250	65,000
Marginal cost of abatement (SEK/kg)	50	100	150	200	250	300
Average cost of abatement (SEK/kg)	430	250	210	200	210	220

The investment alternatives in table 3 were designed in such a way that the information attributes had their minimum values at different alternatives, except for the total annual investment cost and the marginal cost, which were both minimized for alternative A. The value for the emissions performance was lowest for alternative F and the average cost of abatement for alternative D. Also, the information provided to participants made it impossible by design to find the investment alternative with the highest net return numerically. Rather, subjects had to rely on choice rules that are described in more detail in section 2.4.

The underlying cost function for table 3, which was *not* known to the experiment participants, is given by the following equation:

$$Total\ cost(abatement) = 20{,}000SEK + (abatement^2)SEK/2.$$

[4] The minimum average cost, where marginal cost equals average cost, is found in alternative D. The production volume is assumed to be constant across A–F, implying that cost minimization will also maximize net revenue.

[5] Students were informed that the versions were not identical. For groups and individuals and within each treatment, there were four sets of letters for the investment alternatives, with the values A–F, D–I, G–L, and J–O. The different alternatives were given out sequentially to guarantee that subjects sitting next to each other had different letters assigned to the investment alternatives.

Without any abatement, 1,000 units of emissions are assumed to be produced. Investment alternative A abates 50 units and emissions are 950. The investment alternatives increase the abatement level by 50 consecutively, so that at alternative F, abatement is 300 and emissions are 700. Figure 1 graphically illustrates the underlying continuous cost function with each investment alternative depicted in the graph. Alternative A has the lowest investment cost, but under the performance standard, alternative E has the lowest cost that complies with the emissions limit. For the environmental tax, not only the annual investment cost has to be considered, but also the tax that has to be paid for each unit of emissions that is not abated. Figure 2 depicts the sum of these costs for each investment alternatives, and as can be seen, alternative E has the lowest total cost when the environmental tax is applied. Thus, the optimal investment choice is the same in the performance standard and the tax treatment.

Figure 1. Total annual investment cost for each investment alternative (not shown in the experiment)

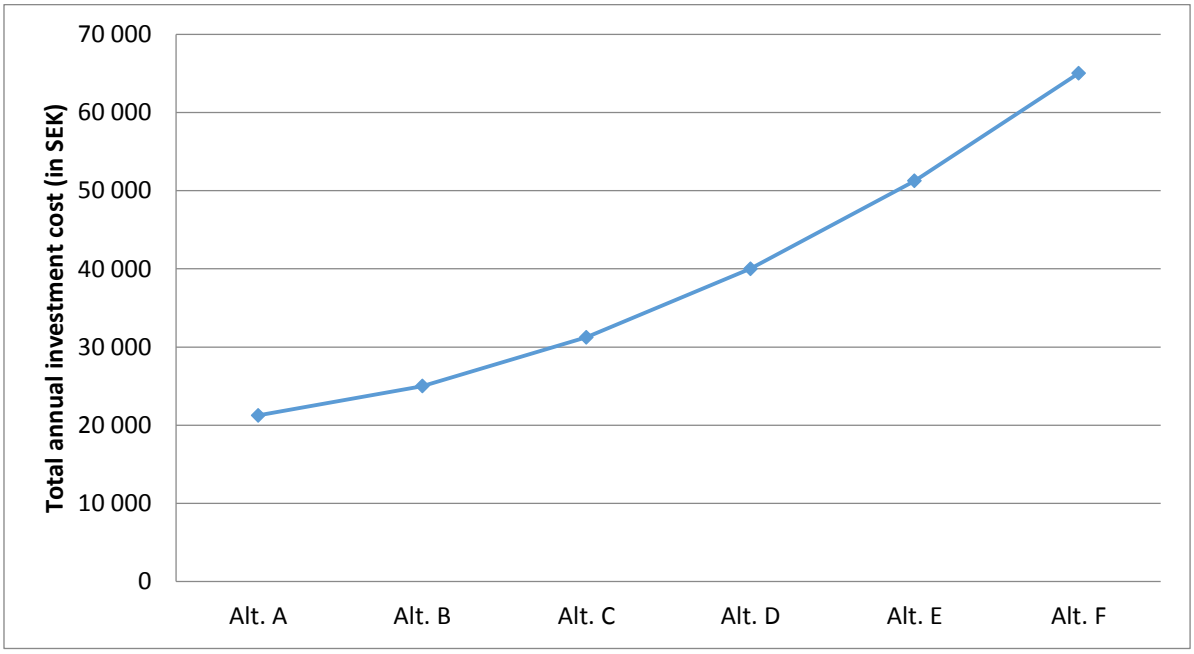
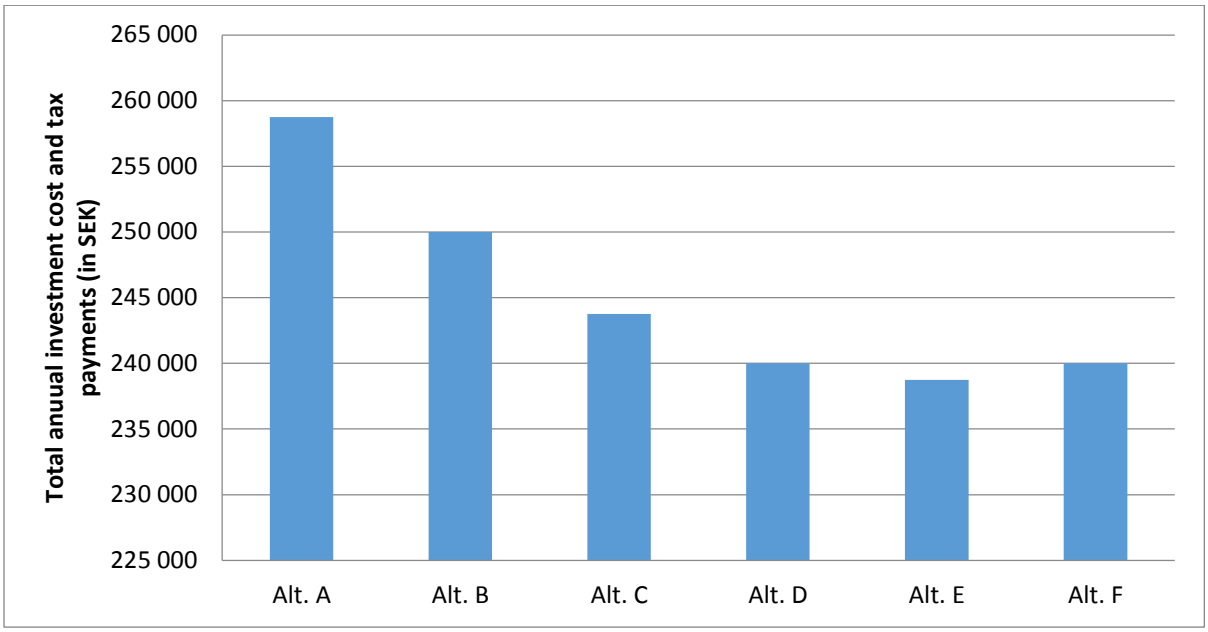


Figure 2. Total cost for each investment alternative in the tax treatment (not shown in the experiment)



Immediately after making the investment choice, subjects were asked to grade, on a six-item Likert scale, how relevant each information attribute was for their choice.

The participants were informed that their payoff would be determined by their performance—that is, the higher the corresponding net return from the investment (as given by the underlying cost function), the higher the payoff to the individual or group. The investment alternatives gave the following payoffs: alternative E yielded a payoff of 100 SEK, D or F yielded 80 SEK, C yielded 70 SEK, B yielded 60 SEK, and A yielded 40 SEK. For those in a group, each member received the full payoff for the alternative the group chose.

2.4. Definition of the task

Economic experiments of group decision-making have mainly focused on error rates when evaluating probabilities.[6] Researchers have studied variations of the conjunction fallacy experiment, first introduced by Tversky and Kahneman (1983). The setting in these tasks is chosen in such a way that the correct solution can be easily calculated by applying logical reasoning but is in contrast to the intuitive heuristics many people base their decisions on. It is found that groups are systematically better in identifying the correct solution in such cases (Charness et al. 2007, 2010).

[6] A variety of group experiments in economics have been conducted in interactive settings, such as beauty contest or market entry games (see, for instance, Cooper and Kagel 2005; Kocher and Sutter 2005; Kugler et al. 2012). In this class of experiments, the task is mainly to update beliefs about the behavior of the other players' actions correctly, so the tasks are quite different from those in our setting and therefore are not discussed here in detail.

The psychology literature makes a distinction between intellective and judgmental tasks. An intellective task is defined by having a correct solution, such as a mathematical optimization problem. In contrast, a judgmental task lacks such a correct answer, and the solution might depend on individuals' preferences and beliefs. If a task is intellective, it can be further defined by the extent to which the correct solution is demonstrable to other group members (Laughlin 1980). The degree of demonstrability of a task depends on four characteristics: First, group members must have a common conceptual system (for example, a mathematical or verbal system). Second, they must have sufficient information to solve the problem. Third, group members must be able to understand the reasoning of the person knowing the answer. And fourth, the person knowing the correct answer must be able to explain the correct solution to the other group members (Laughlin and Ellis 1986). The higher the degree of demonstrability, the better the performance of groups should be compared with individuals in solving a task. Given that at least one group member knows the correct solution, it should be easier to convince the other group members of the solution the higher the demonstrability of the task. Empirical evidence in psychology has shown that groups have an advantage over individuals when solving tasks with a high degree of demonstrability (Laughlin et al. 2002; Maciejovsky and Budescu 2007).

In line with the description above, we characterize the tasks in both the tax and performance standard treatment as intellective, since in theory each has a correct and unique cost-minimizing solution. However, based on the information provided in the treatments, this solution is not numerically verifiable by participants in the experiment. Instead, the task has to be solved using a simplified choice rule. Based on economic theory, the choice rule that maximizes the net revenue for the firm in the case of the performance standard is the one that does not exceed the emissions limit and has the lowest total cost of abatement among the remaining options. In the tax treatment, the choice rule maximizing the net revenue for the firm corresponding to standard economic theory is to set the marginal cost of abatement equal to the emissions tax rate. Given the information provided, it is also possible to apply choice rules that do not necessarily maximize the net revenue for the firm. An overview of possible choice rules is given in table 4. Independent of the treatment, subjects might base their decision on minimizing a specific cost variable, which would lead to different investment alternatives as summarized under "General choice rules" in table 4. There also exist treatment-specific choice rules, such as choosing the investment alternative where the tax equals the average cost of abatement in the tax treatment. In the performance standard

treatment, minimizing any of the cost variables conditional on not exceeding the emissions limit will lead to the same investment alternative choice.

Table 4. Possible choice rules when choosing an investment alternative

Possible choice rules	**Investment alternative**
General choice rules	
Minimize emissions performance	F
Minimize total annual investment cost	A
Minimize marginal cost of abatement	A
Minimize average cost of abatement	D
Choice rules in the performance standard treatment	
Minimize total annual investment cost/marginal cost of abatement/average cost of abatement given that the emissions limit is not exceeded	E
Choice rules in the tax treatment	
Tax equal to marginal cost of abatement	E
Tax equal to average cost of abatement	B

The extent to which the choice rules that maximize the net revenue for the firm are demonstrable to other group members varies broadly between the two treatments. In the performance standard treatment, the information provided to participants states that the emissions should not exceed 75 grams per kWh output. Looking at the information variables given for the investment alternatives, it should be relatively easy to identify that the emissions performance from investment alternatives A to D exceeds the allowed emissions and therefore should not be taken into account. This reasoning should also be easy to demonstrate to other group members, since one just has to point at the row with the emissions performance of the different investment alternatives. As a second step, groups have to decide between alternatives E and F. The optimization rule here is to take the investment alternative with the lowest total annual investment cost (E). If all group members have sufficient knowledge of microeconomic foundations to understand this reasoning, it should be relatively easy for one group member to explain which alternative to choose and convince the other group members. Without the knowledge, the demonstrability of the choice rule is lower, but the alternatives to choose from should at least be narrowed down to two out of the six investment alternatives (E and F, which comply with the performance standard), as summarized in table 4.

In the tax treatment, the degree of demonstrability of the revenue-maximizing alternative depends on the knowledge of the optimality condition that the marginal cost of abatement should be equal to the tax rate in order to minimize costs. If at least one group member has this knowledge and is able to explain the reasoning to the other group members, the degree of demonstrability is relatively high. If none of the group members has this knowledge, it is hard or even impossible to demonstrate the choice rule to other group members.

Hence, we argue that the demonstrability is in general higher in the performance standard than in the tax treatment. However, this does not necessarily mean that groups are more likely than individuals to choose the investment level that is in line with the net revenue-maximizing choice rule under the performance standard. If finding the net revenue-maximizing choice rule is relatively simple for individuals under the performance standard such that most are able to identify it, there may not be an advantage for group members to demonstrate this choice rule to each other. Therefore, *we hypothesize that groups will perform at least equally well as individuals in the performance standard treatment*.

In the tax treatment, we expect that the demonstrability within groups is relatively high if (i) groups have at least one member with knowledge of the optimality condition, (ii) the group member with the information is able to explain the reasoning to the other members, and (iii) the other members are able to follow the reasoning of the knowledgeable group member. *We hypothesize that groups will be more successful than individuals in identifying the revenue-maximizing choice rule (in accordance with standard economic theory) given that conditions (i)–(iii) are fulfilled in the tax treatment.*

3. Results

3.1. Treatment effects

We start by analyzing differences between the tax treatment and the performance standard treatment. Summary statistics of the investment alternatives chosen are shown in table 5 and figure 3. Comparing differences in the distribution between the two policy treatments (and aggregating decisions made by groups and individuals), we find that investment levels are significantly lower in the tax treatment compared with the performance standard ($p < 0.01$, Mann-Whitney test). This result holds when the difference between the tax and the performance standard is compared within the individual treatments and within the group treatments.[7] Furthermore, in the tax treatment, choices appear slightly more evenly distributed across alternatives compared with the performance treatment, where alternative E is the most frequent choice. This holds in both the individual and the group treatments.

In the performance standard treatment, the most frequently chosen alternative is E; 59 percent (individual) and 49 percent (groups) chose this alternative. This alternative has the lowest total annual investment cost between the two alternatives that comply with the standard. In the tax treatment, only 11 percent of individuals and 4 percent of groups chose investment alternative E. The most commonly chosen alternative in the tax treatment was instead alternative D (44 percent of individuals and 49 percent of groups), consistent with a choice rule of minimizing average cost in the task. Hence, the results comparing policy treatments are overall consistent with the results found in Hennlock et al. (2017). Our results are also in line with the findings of Shin (1985), Binet et al. (2014), and Ito (2014). These studies find that individuals, when faced with a complex decision situation, tend to base their consumption decision mainly on average price rather than marginal price.

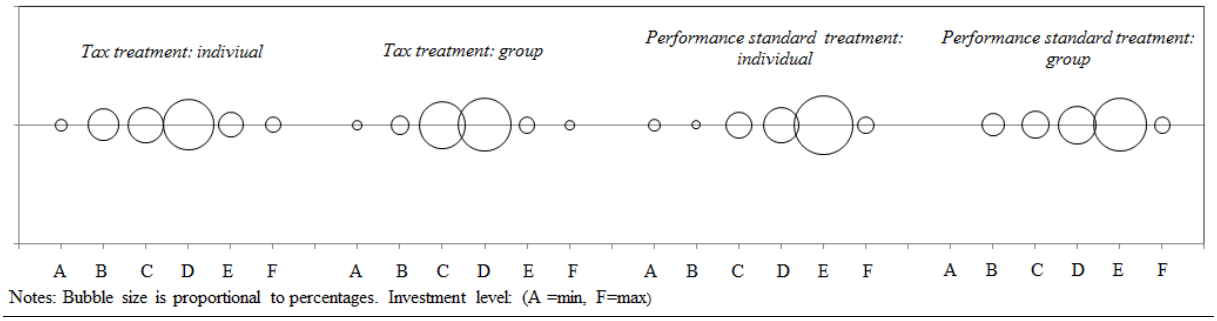
[7] $p < 0.01$ for Mann-Whitney tests in both subsamples.

Table 5. Summary statistics of investment decision: the percentage of subjects choosing the different investment alternatives in each treatment

Choice alternative	A	B	C	D	E	F
Tax						
Individual	0.02	0.17	0.21	0.44	0.11	0.04
Group	0.01	0.06	0.38	0.49	0.04	0.01
Performance standard						
Individual	0.03	0.01	0.11	0.21	0.59	0.05
Group	0.00	0.09	0.13	0.25	0.49	0.04

Note: The cells highlighted in gray show the modal response in the particular treatment.

Figure 3. Investment choice by treatment



A comparison between individual and group treatments shows that the distribution of frequencies in the tax treatment seems to be more dispersed in the individual treatment than in the group treatment, in which alternatives C and D have relatively larger frequencies. A Mann-Whitney test, however, does not detect any significant difference between the individual and group treatments (p = 0.7487). In the performance treatment, the differences are less clear, and again a Mann-Whitney test does not yield any significant difference (p = 0.1940).

To test whether the treatments can provide an explanation for observed investment choices, we use a multinomial logit model with the investment choice as the dependent variable and the treatments as independent dummy variables. The marginal effects are discrete changes compared with the baseline level (individual decisions in the performance standard treatment). Table 6 contains the predicted probabilities and marginal effects of the multinomial logit model.

Table 6. Predicted probabilities and average marginal effects on choice in the multinomial logit model

Multinomial logit model						
Choice alternative	**A**	**B**	**C**	**D**	**E**	**F**
Tax	-0.000	0.208***	0.072	0.166**	-0.430***	-0.014
	(0.018)	(0.080)	(0.067)	(0.083)	(0.067)	(0.026)
Group	-0.251***	0.152*	0.074	0.085	-0.054	-0.006
	(0.011)	(0.084)	(0.047)	(0.069)	(0.046)	(0.022)
TaxXGroup	0.221**	-0.236**	0.112	0.047	-0.123	-0.022
	(0.106)	(0.094)	(0.100)	(0.127)	(0.128)	(0.050)
Predicted average	**0.017****	**0.078*****	**0.204*****	**0.350*****	**0.313*****	**0.037*****
Probability	**(0.008)**	**(0.015)**	**(0.023)**	**(0.027)**	**(0.023)**	**(0.011)**
Prob > chi^2 0.000						
Observations	294	294	294	294	294	294

Note: Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The differences in choices between groups and individuals are indicated by the "Group" dummy variable in the regression. Here, groups are significantly less likely than individuals to choose alternative A, while they are more likely to choose B. However, there is no difference between groups and individuals in choosing the cost-minimizing alternative E. Also in the tax treatment, there is no significant difference in choosing alternative E between groups and individuals (see coefficients for "TaxXGroup"). In contrast to the performance standard, the choices between alternatives A and B are reversed: groups are significantly more likely than individuals to choose A, while they are less likely to choose B.

3.1. Investment choice and background knowledge

In the questionnaire following the experiment, we asked all subjects for the optimality condition for a firm to maximize its net revenue in response to an environmental tax according to standard economic theory. Out of four possible answers, only one was correct. The question was number 6 in the survey, so we refer to it as "Q6" in the following discussion. The exact wording can be found in section A.2.3 in the appendix.

We assume that individuals who answer this question correctly are more likely to choose alternative E, which is in line with the revenue-maximizing choice rule. Table 7 gives an overview of how the participants answered Q6. As can be seen in the first two columns, in the tax treatment, 54 percent of groups had at least one member that answered the question

correctly, whereas only 29 percent of individuals chose the correct answer.[8] These numbers are close to the percentages we would expect if individuals would randomize over alternatives in Q6. Choosing one of the four alternatives in Q6 at random, we would expect that 58 percent ($= 1 - 0.75^3$) of groups have at least one member that chooses the correct answer and 25 percent of individuals answer correctly. However, individuals who have taken the basic microeconomic course before participating in the experiment were more likely to answer question 6 correctly (see table A.1 in the appendix). If the answers were completely random, we would not expect to see a correlation between the two variables.

Table 7. Summary statistics of the correct answer to question 6

	Share of answers to question 6 (number of observations in parentheses)		**Frequency of number of group members answering question 6 correctly (number of observations in parentheses)**			**Total number of observations**
	Incorrect	Correct*	1	2	3	
Tax						
Individual	0.71	0.29				
	(54)	(22)				(76)
Group	0.46	0.54	0.39	0.10	0.04	
	(32)	(35)	(27)	(7)	(1)	(67)
Performance standard						
Individual	0.83	0.18				
	(66)	(14)				(74)
Group	0.54	0.46	0.36	0.09	0.01	
	(37)	(32)	(25)	(6)	(1)	(69)

* Group observations were counted as answering the question correctly if at least one group member answered the questions correctly.

Further, if answers to Q6 were completely random, we would not expect that it has a significant influence on choosing the cost-minimizing investment alternative, either. Table 8 shows results for a multinomial logit model where the answer to Q6 is the regressor and the different investment alternatives serve as dependent variables. The table depicts estimates for average marginal effects, and predicted probabilities are shown for the tax treatment. The upper part, sample A, includes only the observations of the tax treatment for individuals.

[8] For the performance standard, the answers to Q6 were similar, as shown in the lower part of table 7. Since it is of little importance to know the optimality condition to identify the cost-minimizing investment alternative E under a performance standard, we do not discuss this case further.

Table 8. Predicted probabilities and average marginal effects on choice in the multinomial logit model: within-treatment difference for the tax treatment

Multinomial logit model						
Choice alternative	**A**	**B**	**C**	**D**	**E**	**F**
			Sample A: Tax treatment, individuals			
Q6 correct (dummy)	–0.348	0.022	–0.018	0.124	0.198***	0.021
	(0.252)	(0.097)	(0.116)	(0.164)	(0.069)	(0.040)
Predicted average	0.026	0.171***	0.211***	0.447***	0.105***	0.040*
Probability	(0.018)	(0.043)	(0.047)	(0.057)	(0.033)	(0.023)
Prob > chi^2 0.000						
Observations	76	76	76	76	76	76
			Sample B: Tax treatment, groups			
Q6 correct (index)	–0.591	–0.068	0.194	0.305	0.137	0.022
	(0.610)	(0.113)	(0.300)	(0.366)	(0.089)	(0.024)
Predicted average	0.015	0.044*	0.377***	0.507***	0.044*	0.015
Probability	(0.014)	(0.025)	(0.058)	(0.060)	(0.023)	(0.015)
Prob > chi^2 0.000						
Observations	69	69	69	69	69	69

Note: Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

For individuals, knowing the correct answer to Q6 increases the likelihood of choosing the cost-minimizing alternative E by about 20 percent. Given the results, we can assume that the answers to Q6 were not completely random, or otherwise the answer to the question should not have had an effect on choosing the cost-minimizing investment alternative. Further, the results indicate that individuals are able to apply theoretical microeconomic knowledge to the specific task in the experiment. Hence, having knowledge of the microeconomic foundation seems to be sufficient to identify the cost-minimizing investment alternative, at least for a considerable share of the individuals. Therefore, we can assume that the second condition for a task to be demonstrable (namely, to have sufficient knowledge to solve a task) is fulfilled in the tax treatment for individuals answering Q6 correctly.

The regression results for groups are depicted in sample B in table 8. Here, the explanatory variable for answering Q6 is not a binary dummy, but rather an index indicating the share of group members answering Q6 correctly (taking the value 0, ⅓, ⅔, or 1). Since the scaling of the explanatory variable differs between samples A and B, the size of the coefficients cannot be compared directly. In column 5, the coefficient for having group members who answered Q6 correctly shows no significant influence on choosing investment alternative E.

To learn more about the group decision-making process, we analyze the role members had in the group discussion. In the ex post survey, we asked all group members to evaluate how they perceived the other members' influence during the discussion. This gives us two independent observations on each group member, which we aggregate to an average index of the two evaluations. The evaluation consisted of three statements: (i) "Member X had influence on our collective group decision"; (ii) "Member X had a leading role in the group"; and (iii) "The group decision coincided with member X's personal opinion." Each of these statements was rated on a Likert scale ranging from 1 ("Do not agree at all") to 4 ("Agree fully"). Especially in the group tax treatment, group members who knew the optimality condition (and answered Q6 correctly) might have been seen as experts and could have taken a leading role in the discussion.

In table 9, we therefore focus on individuals in the TaxXGroup treatment and analyze to what extent knowledge about the optimality condition can serve as an explanatory variable for the role a group member had during the discussion. As the regression results suggest, knowledgeable group members did not have significantly more influence on the group decision (column 1), nor did they take a leading role within the group (column 2). If knowledgeable group members tried to explain the choice rule to set marginal costs equal to the tax rate to other group members but failed, we would expect to see that knowledgeable group members did not agree to the investment level chosen by the group. However, we do not see that knowledgeable group members are significantly more likely to disagree with the decision taken.

Table 9. Effect of answering Q6 correctly on perception of other group members regarding the role of the individual during the discussion (tax group treatment only)

OLS Model			
Evaluation of group members	**Member X had influence on our collective group decision**	**Member X had a leading role in the group**	**The group decision coincided with member X's personal opinion**
Q6 correct	–0.127	–0.083	–0.021
	(0.108)	(0.137)	(0.094)
Observations	180	180	180

Note: Observations are considered only of groups where all members evaluated all other members. Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Thus, the demonstrability conditions three and four do not seem to have been fulfilled. Knowledgeable group members did not seem to be able to explain the reasoning for why E was the cost-minimizing alternative to the other group members or the other group members were not able to understand the reasoning. As a consequence, groups did not have an advantage and were not more likely to choose the investment level in line with the microeconomic choice rule, as shown in table 6.

3.3. Subjects' attention to information

After making their choices in the experiment, subjects (individuals and groups) rated the importance of each information variable for their investment decision. Figure 4 illustrates how much attention individuals and groups attributed to the different information variables in the tax treatment. Except for the emissions performance variable, there was no significant difference in the weighting of the information variables between groups and individuals.[9] For the performance standard treatment, illustrated in figure 5, there was no significant difference in the distribution of the importance of the different information variables between groups and individuals. Thus, overall there is no significant difference between groups and individuals in the importance attributed to the information variables.

[9]Mann-Whitney test, p-value = 0.0247 for emissions performance.

Figure 4. Stated relevance of information types in the tax treatment

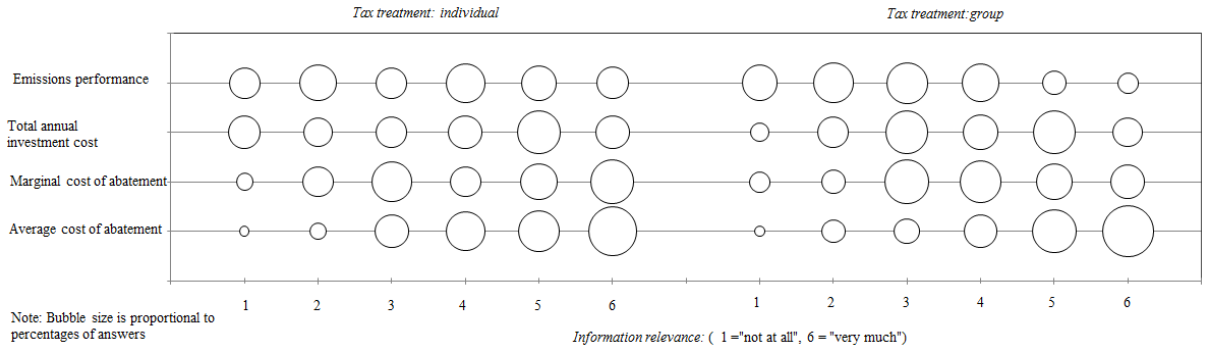
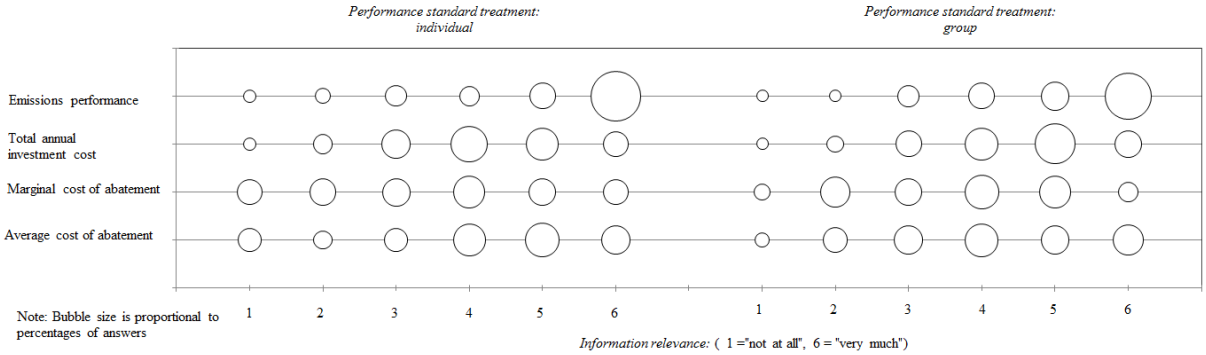


Figure 5. Stated relevance of information types in the performance standard treatment



Within each treatment, the weight given to the four information variables can be analyzed, comparing each possible combination of variables with a two-sided t-test. The results are shown in table A.2 in the appendix. Starting with the tax treatment, we find that the information about the average cost of abatement is given a significantly higher weight than the other three remaining information parameters. This holds for individuals as well as groups in the tax treatment. Most interestingly, the information about the average cost of abatement is weighted higher than information on the marginal abatement cost, for both individual and group decisions. Looking at the influence of the stated relevance of information parameters on the actual investment decision, a multinominal logit model is run, and the results are shown in table A.3 in the appendix. Groups weighting the information about the average abatement cost high were also significantly more likely to choose the investment alternative with the lowest average abatement cost. For individuals, the point estimate is positive but not significantly different from zero.

In contrast, in the performance standard treatment, the information about the emissions performance was ranked highest among all information parameters. As the results of the multinominal logit regression show (see table A.4 in the appendix), a higher-weighted

relevance attributed to the emissions performance information leads to a significantly higher probability of choosing investment alternative E and significantly lower probabilities of choosing alternatives B–D.

In summary, groups do not differ from individuals in the perception of the relevance of the information provided when making the investment decision. Most interestingly, in the tax treatment, groups do not identify the marginal cost information as the most relevant information attribute to a larger extent than individuals. In fact, the groups base their investment decision more so than individuals on the average cost of abatement.

4. Conclusion

This study is related to that of Hennlock et al. (2017), who show that different policy regimes influence the investment choice of experienced managers, even though the different policy instruments are equally stringent. One potential objection to the validity of this finding is that firm managers rarely make investment decisions on their own. When the decision is made in a group, biases in decision-making might disappear, and the investment level chosen might no longer be dependent on the policy instrument.

In this study, we do not find any evidence that groups are more likely than individuals to choose the investment level that is in line with a microeconomically founded choice rule under different policy instruments. In the performance standard treatment, in which there is an upper allowed limit of emissions, both individuals and groups to a large extent use a choice rule that minimizes the cost of the firm. Since this task is fairly straightforward, it is not too surprising that group behavior does not differ significantly from that of individuals.

More surprisingly, this is also true for the tax treatment. We do not find a difference between the investment choices made by groups and individuals. What we can say from our analysis is that individuals who have knowledge about the optimization rule are significantly more likely to choose the investment level in line with the microeconomic choice rule. Since groups have the advantage of being composed of several individuals, we would expect that they would be more likely to identify the cost-minimizing investment alternative. However, this is not the case, and groups are not better than individuals at identifying marginal cost as the important information variable. Analysis of the group discussion shows that this seems to be because knowledgeable group members did not lead the discussion or try to explain the microeconomic foundation to the other group members. A potential reason for this behavior might be related to country-specific norms, as it can be argued that it is seen as socially inappropriate in Sweden to stand out as in individual in a discussion. However, such

explanation is purely speculative, and future research should try to disentangle group discussions even further in order to get a better understanding of the mechanisms at play when investment decisions are made in groups.

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Appendix

A.1. Additional analysis

Table A.1. Effect of taking a course in microeconomics on answering Q6 correctly.

Probit Model			
Dependent variable	**Q6 (Yes = 1/No = 0)**		
	Whole sample		Tax treatment only
Microecomics taken	0.419***	0.428***	0.423**
	(0.120)	(0.120)	(0.167)
Age		–0.011	–0.003
		(0.0137)	(0.0175)
Constant	–0.934***	–0.671**	–0.771*
	(0.078)	(0.328)	(0.418)
Observations	565	565	282

Table A.2. Weight attributed to the information variables when making the investment decision

	Mean (standard deviations in parentheses)				Differences (standard errors in parentheses)					
	EP	TAIC	MC	AC	EP-TAIC	EP-MC	EP-AC	TAIC-MC	TAIC-AC	MC-AC
Tax treatment										
Individuals	3.55	3.77	4.11	4.61	–0.22	–0.55*	–1.05***	–0.33	–0.84***	–0.50*
	(1.65)	(1.69)	(1.56)	(1.29)	(0.16)	(0.29)	(0.27)	(0.31)	(0.26)	(0.25)
Groups	2.94	3.84	3.92	4.78	–0.91***	–0.98***	–1.84***	–0.08	–0.94***	–0.86***
	(1.45)	(1.42)	(1.36)	(1.34)	(0.21)	(0.25)	(0.30)	(0.27)	(0.27)	(0.23)
Performance standard treatment										
Individuals	4.99	4.06	3.53	3.96	0.93***	1.46***	1.03	0.54**	0.10	–0.44**
	(1.46)	(1.32)	(1.61)	(1.59)	(0.21)	(0.28)	(0.26)	(0.24)	(0.25)	(0.19)
Groups	4.91	4.37	3.69	4.06	0.53**	1.22***	0.85***	0.68***	0.31	–0.37
	(1.37)	(1.21)	(1.41)	(1.45)	(0.22)	(0.26)	(0.29)	(0.24)	(0.23)	(0.23)

Note: In columns 5–10, pairwise two-sided t-tests are performed; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3. Tax treatment: predicted probabilities and average marginal effects

Multinomial logit model						
Choice alternative	**A**	**B**	**C**	**D**	**E**	**F**
			Tax treatment, individual			
Emissions performance	0.007	–0.043	0.011	0.033	–0.041*	0.054*
	(0.011)	(0.043)	(0.036)	(0.064)	(0.024)	(0.031)
Total cost information	0.015	0.063	0.007	–0.087	–0.007	–0.012
	(0.014)	(0.042)	(0.036)	(0.064)	(0.023)	(0.013)
Marginal cost information	–0.013	0.025	0.028	–0.154***	0.066***	0.027
	(0.025)	(0.028)	(0.031)	(0.052)	(0.024)	(0.019)
Average cost information	–0.066	0.034	–0.019	0.033	–0.001	0.003
	(0.045)	(0.035)	(0.030)	(0.062)	(0.016)	(0.014)
Predicted average	**0.027**	**0.149*** **	**0.216*** **	**0.459*** **	**0.108*** **	**0.041***
Probability	**(0.017)**	**(0.041)**	**(0.046)**	**(0.052)**	**(0.030)**	**(0.021)**
Prob > chi^2 0.004						
Observations	74	74	74	74	74	74
			Tax treatment, groups			
Emissions performance	—	0.003	–0.081	0.128*	–0.026	0.000*
	—	(0.012)	(0.050)	(0.072)	(0.031)	(0.000)
Total cost information	—	0.016	0.138***	–0.198***	–0.010	–0.000*
	—	(0.012)	(0.040)	(0.071)	(0.012)	(0.000)
Marginal cost information	—	–0.014	0.043	–0.080	0.047*	0.000**
	—	(0.012)	(0.042)	(0.063)	(0.028)	(0.000)
Average cost information	—	–0.000	–0.108**	0.169**	–0.027	–0.000*
	—	(0.009)	(0.045)	(0.073)	(0.017)	(0.000)
Predicted average	—	**0.031**	**0.375*** **	**0.531*** **	**0.047***	**0.016*** **
Probability	—	**(0.022)**	**(0.054)**	**(0.055)**	**(0.025)**	**(0.000)**
Prob > chi^2 0.000						
Observations		64	64	64	64	64

Note: Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4. Performance treatment: predicted probabilities and average marginal effects

Multinomial logit model						
Choice alternative	**A**	**B**	**C**	**D**	**E**	**F**
			Performance standard treatment, individual			
Emissions performance	0.004	–0.000**	–0.052***	–0.134**	0.130***	0.000
	(0.005)	(0.000)	(0.020)	(0.066)	(0.040)	(0.017)
Total cost information	0.005	0.000**	0.009	–0.020	0.023	–0.024
	(0.014)	(0.000)	(0.021)	(0.043)	(0.032)	(0.016)
Marginal cost information	0.017	0.000	0.008	0.079**	–0.082***	0.006
	(0.012)	(0.000)	(0.024)	(0.038)	(0.028)	(0.018)
Average cost information	–0.014	0.000	0.011	–0.039	0.006	0.031*
	(0.012)	(0.000)	(0.027)	(0.042)	(0.035)	(0.018)
Predicted average	**0.025**	**0.013*** **	**0.113*** **	**0.213*** **	**0.587*** **	**0.050** **
Probability	**(0.017)**	**(0.000)**	**(0.033)**	**(0.041)**	**(0.043)**	**(0.023)**
Prob > chi^2 0.000						
Observations	80	80	80	80	80	80
			Performance standard treatment, groups			
Emissions performance	—	–0.058***	–0.052***	–0.320**	0.203***	–0.021
	—	(0.019)	(0.019)	(0.145)	(0.036)	(0.022)
Total cost information	—	0.034*	–0.011	–0.113	0.024	0.008
	—	(0.020)	(0.023)	(0.069)	(0.026)	(0.014)
Marginal cost information	—	0.028	0.024	–0.079*	–0.008	0.011
	—	(0.030)	(0.032)	(0.047)	(0.024)	(0.016)
Average cost information	—	–0.026	–0.008	0.176***	–0.034*	–0.014
	—	(0.038)	(0.026)	(0.055)	(0.019)	(0.014)
Predicted average	**—**	**0.077*** **	**0.108*** **	**0.262*** **	**0.508*** **	**0.046***
Probability	**—**	**(0.027)**	**(0.034)**	**(0.037)**	**(0.039)**	**(0.026)**
Prob > chi^2 0.002						
Observations		65	65	65	65	65

Note: Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.2. Materials used in the experiment

A.2.1. Experimental instructions (read out loud to all participants before the start of the experiment)

Thanks for taking your time to take part in this research study. The objective of this research study is to better understand the effects of different policy instruments on the environmental investments of businesses.

The project is financed by the governmental Foundation for Strategic Environmental Research (Mistra), which, among others, has the aims of creating strong research environments, solving environmental problems, and strengthening Swedish competitiveness.

The study consists of two parts, 1 and 2. In part 1, you have to make an investment decision. The instructor will tell you when part 1 starts and ends. You will have 8 minutes to answer part 1.

If you are a person who got an envelope on your own, you should make the decision on you own without discussing it with anybody else in the room. If you belong to a group you have received one envelope for the group, and you should make the decision together for the group. You are allowed to discuss with a low voice within the group.

When you have finished with part 1, wait until the instructor tells you to open part 2.

Part 2 consists of answering a survey. Even the persons who belonged to a group should fill in the survey individually on their own without discussing it with anyone in the room.

After the end of the study, every person will get an amount that varies between 40 and 100 Swedish crowns and that is determined by the total cost that the business has to bear as a consequence of the investment decision you have chosen in part 1. The higher the net revenue of the investment, the higher the amount you will get. Even the persons who belong to a group will get between 40 and 100 Swedish crowns per person, depending on the net revenue that the group decision generated for the business.

If you want to be paid via Swish, you will be asked to write down your mobile phone number at the end of the survey in part 2.

You are anonymous. Your answer will be identified only by the number at the bottom of the answer sheet, and the final result will be presented on an aggregate level, without the possibility of connecting your answer to you as a person.

The investment decision in part 1 is unique for every person or group, and we ask that you therefore focus on the decision that was assigned to you.

A.2.2. Instructions for the investment decision[10]

Below we will ask you to make an investment decision in your group. You can discuss within the group, but we ask that you speak quietly in order not to disturb the other groups.

All investment decisions in the room are unique, and we ask that you therefore focus on the decision that was assigned specifically to you.

Investment decision

We would like to ask you to assume a situation in which you are part of making a decision about an environmental investment that a business will make in order to decrease its environmental impact from environmentally hazardous emissions. There are 6 investment options, each of which gives rise to specific emissions reductions. The table below shows the different investment alternatives, including the effects each investment has on the emissions of the business and investment costs.

When making your decision, you should take into account that the company needs to pay an environmental tax equal to 250 SEK per kg each year for the emissions according to the table. An investment that reduces the emissions causes a yearly investment cost but also means that the company's environmental tax expenses are reduced. The aim of the investment is to generate the highest net return to the company.

Please indicate which investment alternative, Alt A to Alt F, you think the company should choose. All alternatives A to F have the same economic lifetime.

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Yearly average emissions (g/kWh)	95	90	85	80	75	70
Total annual investment cost (SEK)	21 250	25 000	31 250	40 000	51 250	65 000

[10] This was the version given to groups in the tax treatment.

Marginal cost for emissions reduction (SEK/kg)	50	100	150	200	250	300
Average cost for emissions reduction (SEK/kg)	430	250	210	200	210	220

Choose <u>one</u> of the following alternatives from the table above

☐ Alternative A
☐ Alternative B
☐ Alternative C
☐ Alternative D
☐ Alternative E
☐ Alternative F

Indicate which information in the table was most important <u>for you as a group</u> in order to make a decision. Level 6 indicates very important information and level 1 very unimportant information.

	1	2	3	4	5	6
Yearly average emissions (g/kWh)						
Total yearly investment cost (SEK)						
Marginal cost for emissions reduction (SEK/kg)						
Average cost for emissions reduction (SEK/kg)						

Please fold the paper and put it back in the <u>white</u> envelope when you are done!

A.2.3. Postexperimental survey[11]

There are a number of questions below that we ask you to answer individually. <u>Thus, you should answer these without discussing with anybody else in the room.</u> By answering these questions, you are also confirming that you have participated in the experiment.

1. First, here are three statements about how you experienced the discussion in your group in part 1 of the experiment. Fill in how well you think the statements below coincide with your own experience:

[11] This was the version handed out to groups; individuals only had to answer question 6 and onward.

	Do not agree at all			*Agree fully*
	1	2	3	4
I participated actively in the discussion.	☐	☐	☐	☐
Everybody participated equally in the discussion.	☐	☐	☐	☐
One person took a leading role in the discussion.	☐	☐	☐	☐

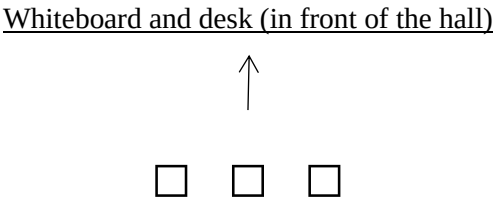
2. Next, here are two questions about <u>your collective</u> decision in part 1 of the experiment. Fill in how well you think the statements below coincide with your own experience:

	Do not agree at all			*Agree fully*
	1	2	3	4
I would have made the same decision as the group even if I were on my own.	☐	☐	☐	☐
The discussion in the group changed my opinion.	☐	☐	☐	☐
The group thought that the task to choose an investment level was difficult.	☐	☐	☐	☐

3. Below are a couple of questions where we want to know <u>how the members in your group influenced the discussion and your collective decision</u>.

First, here is a figure of how you were seated in the room. Indicate the place where you sat with an X. Indicate the other two members in your group with an A and a B in the figure.

You and your group members' placement:



4. Now, here are three statements about member A in your group (according to your own figure above). Indicate how well the statements coincide with your own experience:

	Do not agree at all			***Agree fully***
	1	2	3	4
Member A had influence on our collective group decision.	☐	☐	☐	☐
Member A had a leading role in the group.	☐	☐	☐	☐
The group decision coincided with member A's personal opinion.	☐	☐	☐	☐

5. Next, here are three statements about member B in your group (according to your own figure above). Indicate how well the statements coincide with your own experience:

	Do not agree at all			*Agree fully*
	1	2	3	4
Member B had influence on our collective group decision.	☐	☐	☐	☐
Member B had a leading role in the group.	☐	☐	☐	☐
The group decision coincided with member B's personal opinion.	☐	☐	☐	☐

To sum up, here are a knowledge question and a couple of questions about your education and background.

6. Indicate which of the following general statements yields the highest net revenue for a company:

☐ The company has chosen the investment with the lowest marginal cost in order to decrease the emissions.

☐ The company has chosen the investment that implies that the average cost to decrease the emissions is equally high as the environmental tax (crowns per kg) for the emissions.

☐ The company has chosen the investment that implies that the marginal cost to decrease the emissions is equally high as the environmental tax (crowns per kg) for the emissions.

☐ The company has chosen the investment that gives the lowest average cost in order to decrease the emissions.

7. I have taken and finished courses at university level in:

☐ microeconomics

☐ environmental economics

☐ mathematics and physics

8. How many finished (passed) university credits (uc) do you have in total if you would ask for a certificate from Ladok today?

☐ 0–15 uc
☐ 16–30 uc
☐ 31–45 uc
☐ 46–60 uc
☐ 61–90 uc
☐ 91–120 uc
☐ >120 uc

9. How large do you think your share of ”pass with distinction” grades is for the courses you have finished?

☐ 0–25%
☐ 26–50%
☐ 51–75%
☐ 76–100%

10. In what year were you born? _____

11. Sex:

- ☐ Female
- ☐ Male
- ☐ Do not want to report/other

12. Specialization in your studies (if you are not sure, mark the specialization that you think you will specialize in):

- ☐ Economics
- ☐ Business
- ☐ Logistics
- ☐ Social science environmental program with specialization in economics (SMIL)
- ☐ Other

13. How many of your group members did you know before?

- ☐ 0
- ☐ 1
- ☐ 2

Thanks a lot for your participation!

By participating in the experiment, you have earned 40 crowns, but depending on your answer in part 1 of the experiment, you may have earned in total up to 100 crowns. We will willingly pay you via Swish if you indicate your mobile phone number on the line below (write clearly):

My mobile phone number:

If you do not have access to or do not want to use Swish, you will be able to pick up your payment. If you choose this alternative, you have to tear off the voucher below on this page. Take the voucher with you for payment of the amount you have earned in the experiment. The payment will take place on the following days and times at the student expedition (economics and statistics) on level 5, E-house: February 1–3, 3 to 4 p.m.

If you want to know more about the experiment and which investment level gave the highest net revenue, this information will be posted at the student expedition on level 5 in the E-house the first two weeks of February.

Figure A.1. Photo from the experimental session on January 18, 2016