Culpability and Willingness to Pay to Reduce Negative Externalities:
a Contingent Valuation and Lab Experiment

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Introduction

Several recent studies have examined the effect of providing peer information on economically relevant behavior (e.g. Beshears et al., 2010; Choi et al. 2010; Cialdini et al. 200?; Croson and Shang, 2008; 2010). Such studies have focused on how information about the average actions regarding a given behavior induces people to learn and conform to perceived social norms on that behavior. Instead of focusing on conformity, we consider instead the effect of providing subjects information about peer behavior in one domain on how those subjects behave in a different domain. To that end, we conduct two parallel experiments, one using contingent valuation methods within a climate change context and one using context-free lab experimental methods. The goal is to examine how providing subjects with information about their relative culpability in producing a public bad affects their inclination to provide a public good. Our study has three main findings consistent across both experimental settings: 1) Information about culpability presented alone without a comparison to peers has no effect; 2) Information about culpability has a "moral licensing effect;" people in all conditions reduce giving relative to those who receive no information; 3) Information about culpability has divergent effects on different sub-populations; those who are inclined to provide for the public good (for example, Democrats) give more, while those who are not inclined to give (for example, Republicans) are unaffected.

As climate change grows in public concern, economics have in the past decade used contingent valuation (or stated preference) surveys to elicit willingness to pay (WTP) values for policies that reduce the impact of greenhouse gasses (Layton and Brown, 2000; Berrens et al., 2004; Cameron, 2005; Viscusi and Zeckhauser, 2006; Cameron and Gerdes, 2007). Reflecting the substantial market for voluntary carbon offsets, estimated recently to be in excess of $236 million and doubling annually (World Bank 2008; New Carbon Finance 2009), other research has been directed toward assessing willingness to purchase voluntary carbon offsets (Brouwer et al., 2009; MacKerron et al., 2009).

A separate literature has focused on the effect of providing information about one's peers to test whether people can be induced to conform to the behavior of others. For example, Shang and Croson (2006, 2007) have found that providing information about the donation behavior of a high contributing previous callers to an NPR pledge drive causes callers to donate more. Chen et al. (2009) find that information about the volunteering activities of others on a movie website induce similar conformity. Similarly, Ayers et al. (2009), Alcott (2010), Schultz et al. (2007) have demonstrated that monitoring energy consumption and informing individuals of

their personal levels of consumption relative to neighborhood norm could provide an incentive for above-average households to reduce energy consumption. Similar effects have been found in domains ranging from retirement savings to towel re-use to music downloads.[1]

A notable omission from both bodies of research from a psychological/behavioral economics perspective has been the relationship between perceived culpability with respect to greenhouse gas emissions and individual willingness to pay.

Most past studies have focused on what we refer to as a *within commodity* effect: impacts on purchases of good X are affected by information about peers' consumption of good X. Other recent research has explored a *cross commodity* effect of green purchases (X) on other behaviors (Y) : for example, a study by Mazur and Zhang (2009) reports that allowing people to purchase green household goods instead of non-green household goods, makes them more likely to cheat on a test.

In this research we build upon and extend these ideas by exploring how WTP to prevent a public bad is affected by perceived personal culpability - defined as the amount of social damage resulting from an individual's actions - in a controlled set of experiments.

To explore the role of culpability in willingness to pay to prevent environmental harm, we use both web-based contingent valuation (CV) and real-money laboratory experiments. The contingent valuation study calculates the carbon footprint of a nationally representative sample of consumer by asking questions about their consumption habits. A carbon footprint is defined to be the number of tons of carbon dioxide emissions an individual is personally responsible for based upon his or her consumption decisions in a given year. We then provide subjects in a treatment group information about how their carbon footprint compares to those of others in the study and then elicits willingness to purchase green electricity. In an effort to parallel the field contingent valuation study, the laboratory experiment has student subject purchase "private commodities" (analogous to electricity) that generate a negative public externality (analogous to pollution) for a group in which they are a member. A treatment group is given information about the "pollution" choices of others and the subjects are subsequently given an opportunity to contribute to a fund that would reduce the negative harm created by the externality.

In the taxonomy of Harrison and List (2004) we present results from a framed field experiment coupled with a conventional laboratory experiment.

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[1] Other examples include: entree selections in a restaurant, contributions to an online community, small charitable donations, music downloads, towel re-use in hotels, taking petrified wood from a national park, and stated intentions to vote (Cai, Chen, and Fang, 2009; Chen et al., forthcoming; Frey and Meier, 2004; Salganik, Dodds, and Watts, 2006; Goldstein, Cialdini, and Griskevicius, 2008; Cialdini et al., 2006; Gerber and Rogers, 2009).

The remainder of the paper is organized as follows. In the following section, we present background on the mechanism of culpability we seek to identify. The next two sections present the experimental design and results of the contingent valuation and the laboratory experiments, respectively. The final section concludes.

Background on Culpability

Whereas the mechanisms that might induce conformity to a perceived social norm have been extensively studied in economics (see for example Banerjee, 1992; Bikhchandani, Hirshleifer, and Welch, 1992; Ellison and Fudenberg, 1993; Akerlof, 1980; Bernheim, 1994; Akerlof and Kranton, 2000; Glaeser and Scheinkman, 2003; Rege and Telle, 2003), the mechanism of culpability has received less attention.

Guilt has been explored to some extent in psychology, notably Carlsmith and Gross (1969) demonstrate a cross commodity effect where guilt is induced in subjects by having them administer electric shocks to another person, a confederate. Later, when subjects believe they have completed the experiment, they are asked to donate blood. Subjects who actually administered the shock, are much more likely to agree to donate, relative to subjects who merely observed the shocking.

In economics, Charness and Dufwenberg (2006) and Battigali and Dufwenberg (2007) present a theory of guilt as preferences about the beliefs of others. In a same-commodity experiment, Andreoni (1995) presents two groups of subjects with the same public goods game lab experiment, but with two separate framings that provided different motivations for public good provision. In one, the experiment was framed as providing a public good so that subjects would be motivated by warm glow altruism; in the other, the experiment was framed as avoiding a public bad, so that subjects would be avoided by a desire to feel the cold prickle of guilt. We seek to test the same forces in a cross-commodity framework.

In the specific area of environmental norms, Brouwer et al. test the “polluter pays principle” to find that air travelers’ perceived responsibility for climate change, awareness of the environmental impact of flying, and the frequency of flying were all positively correlated with WTP for a per-flight carbon offset program. This notion of personal responsibility in creating public harm is an extension of what Kahneman et al. (2003) refer to as an “outrage effect”, in which people are willing to pay more to avoid an environmental problem if they think it is human-caused than if they think that it is an outcome of nature (Bulte et al., 2003). Kahneman et al. and Brown et al. (2002), amongst others have demonstrated this “outrage effect” on contingent valuation responses.

Our experiment uses peer information to manipulate what subjects believe is appropriate in one domain and measures the cross-commodity effect in a different domain. We expect two main outcomes. For those who believe they are more culpable than their peers in the first domain, we expect they will be more altruistic in the second. For those who believe they are less culpable than their peers in the first domain, we expect they will be less altruistic in the second. We find support for both of these effects, but we find that the former dominates. All treatment groups behaved less altruistically than those who received no information at all. This "moral licensing" effect has been explored by Zhang and Mazur (2008) who find that those who are given the opportunity to purchase green goods are more likely to cheat on an exam. Similarly, in one field experimental test of the "broken windows" effect by Keizer et al. (2008) find that observing others violate one social norm makes subjects more likely to violate other social norms.

Our results also find that the effect is limited to those pre-disposed to be altruistic in the second domain—notably Democrats, replicating in a lab and contingent valuation context the findings of Costa and Kahn (2010) who observed the same in a field experiment on electricity conservation.

Contingent Valuation Experiment

The broad objective of the contingent valuation survey was to gather information from participants that allowed us to calculate a carbon footprint for each respondent and then elicit their willingness to pay for a green electricity program given information about their own carbon footprint and, in some treatments, their carbon footprint relative to those of another survey participant. Participants for the online hypothetical survey were recruited through The StudyResponse Project, a nationwide panel of 95,574 people. Participants were chosen at random and emailed the URL for the survey. For completing the survey, participants received $5. 520 panelists were invited to participate, and we received 420 completed surveys for an 81% response rate.

There were four steps in the survey: I) Eliciting demographic questions to calculate the subject's carbon footprint; II) Providing information about International Panel on Climate Change (IPCC) predictions on the impacts of climate change; III) Showing Subjects their estimated annual carbon footprint based on the input they; and IV) Eliciting individual demand for green electricity. For the control treatment, subjects were not provided any information about the carbon footprint of others. All other subjects received information about the carbon footprint of "Others like you who took this survey".

Part I consisted of several web pages eliciting information about energy use, including housing characteristics (type, age, size of residence, and location), home energy use (monly electric and

gas bill expenditures, type of fuel used to heat house, whether the household generates or purchases electricity); automobiles (number, models, use of each vehicle) and transportation choices (use of public transportation, frequency of short and long domestic flights, frequency of international flights). Subjects were also asked about whether they purchased carbon offsets and if so, how many had they purchased. Only 31 subjects reported having purchased carbon offsets.

Subsequent to providing the above the above information, subjects were provided with three IPCC climate policy scenarios and their anticipated consequences as presented below in Box 1. The purpose of this screen was two-fold. First, we wanted to make respondents aware of current climate projections and relative policy options ranging from "Business as Usual" to "Aggressive Emissions Reductions." To a certain extent, this information also served to induce an element of moral outrage for those concerned about climate change.

In Part III, respondents were provided with an estimate of the carbon generated from their use of utilities and transportation and, after accounting for offset purchases, their estimated carbon footprint ("the total amount of climate changing greenhouse gas emissions caused directly and indirectly by your household") in tons of carbon per year. Carbon footprints were calculated using two algorithms. If participants knew their electricity and heating expenditures, information about average electricity and fuel prices in each state were used to determine annual consumption of electricity and fuel. (If participants knew their fuel expenditures but not their fuel source for heating, a weighted average of all fuel sources for the state was used.) Annual consumption of electricity was then converted into CO2 emissions using the average CO2 intensity for each state. Fuel consumption was converted into CO2 emissions using information about CO2 intensity for each fuel type. If participants did not know their electricity and heating expenditures, we gathered information about their housing structure and compared it to information about average energy consumption for houses of similar age, type and size in their state, which was then used to calculate CO2 emissions as above. Information about fuel prices, generation mix and average household energy consumption was obtained from the Energy Information Administration of the Department of Energy.

Information about participants' cars and miles driven was directly computed based on combined city/highway fuel economy information from the EPA for every make, model and year of car from 1983 to 2009. For air travel, short flights were assumed to be 100 miles each way, long flights 750 miles, and international flights 4,250 miles. Carbon offsets reduced the carbon footprint by 168 pounds for every dollar spent, equivalent to prevailing rates at popular commercial carbon offset retailers.

Median estimated carbon emissions for the sample were 17.9 tons per household per year. For subjects in the control group, no other information was provided. Individuals in the treatment

groups were informed that "Others like you who took this survey in the past had a carbon footprint of xx tons per year" and whether their contribution was MORE or LESS than this individual. The "xx" value was randomly assigned to be high (26 tons) or low (11 tons). For example, a subject with an estimated carbon footprint of 18 tons and was assigned to the "See Low" group would be told that "Others like you who took this survey in the past had a carbon footprint of 11 tons per year" and that "Your contribution to global warming is MORE than this average." Similarly, a like individual who was assigned to the "See High" treatment was "Others like you who took this survey in the past had a carbon footprint of 26 tons per year" and that "Your contribution to global warming is LESS than this average." As will be discussed below, the difference between the subject's carbon footprint and the value associated with the reference individual provided a measure of relative culpability.

Given this information contingent values (CV) were elicited using a modification of a green electricity payment card used in Champ and Bishop (2001, 2006) in which individuals were given opportunities to buy blocks of energy measured in kilowatt hours. As shown in Box 2 each block had a corresponding monthly and annual cost and estimated annual tons of CO2 averted based on information available from the Energy Information Agency of the Department of Energy.

In Part IV, debriefing and demographic questions were asked, along with ten questions designed to measure environmental concern drawn from the New Environmental Paradigm (NEP) scale (Dunlap and Van Liere, 1978; Dunlap et al. 2000) This scale is widely used in the psychology and sociology literature to characterize an individual's environmental concern based on how the extent to which they agree or disagree with various statements of environmental concern:

> "limits to growth, anthropocentrism, the fragility of the balance of nature, rejection of the idea that humans are exempt from the constraints of nature, and the possibility of an eco-crisis or ecological catastrophe. The response categories range between 1 and 5 so that high scores correspond to a stronger pro-environmental attitude than low scores (with the ordering reversed for the statements that reject the NEP-paradigm)" (Ek and Söderholm, 2008, p. 175)

Past studies of willingness to pay for green electricity have found the aggregated values across a series of NEP questions to be a a significant, exogenous explanatory variable (Kotchen and Moore, 2007; Ek and Söderholm, 2008).We also asked subjects their political party identification, and political orientation on a Likert scale that ranged from "Very Liberal" to "Very Conservative.

Twelve observations in our data set were labeled as outliers and excluded from analysis. Ten observations were excluded because at least one component of their carbon footprint was much greater than the rest of the sample, often an order of magnitude more. These observations were unrealistically high values, appearing to be incorrectly entered responses as to miles driven, airline flights, carbon offsets purchased, or housing information. The other two observations are repeated surveys. Removing these twelve observations halves the mean of the reported carbon footprint and reduces the standard deviation by an order of magnitude.

Table 1 shows summary statistics for each of our control and treatment groups. Note there are some balancing issues in terms of footprint and politics between the treatment groups so we will be sure to include controls for politics and footprint in our regression analysis.

Table 2 demonstrates our first result. Restricting attention to only the control group that received no information about the behavior, we examine the effect of the carbon footprint information on intent to purchase green electricity. We see there is no difference in green behavior between those who learned they had a low, medium, or high carbon footprint. There are of course endogeneity concerns that we address in the lab experiment and in an earlier experiment not reported here. In the earlier experiment, we compared the green electricity choices of a treatment group that received information about their own footprint only compared to a control group that answered the same questions but did not receive footprint information, and found no significant difference in their intent to purchase green electricity.

Table 3 shows the basic results from the control and two treatments. We see that those who were shown a high carbon footprint were less willing to purchase green electricity than those who were shown a low carbon footprint. We also see that on the whole the difference comes entirely from the low culpability treatment reducing their altruistic behavior relative to the control and see no mean effect on the high culpability treatment.

Now consider a simple measure of culpability, where culpability is defined as the subject's total carbon footprint minus the perceived footprint of others. In this case, we manipulated the perceived footprint of others to be either 11 or 26 tons depending on whether the subject was in the high or thes low culpability treatment. One concern with using the culpability variable is that there is an issue of selection. Those who are more culpable are also the people who have higher footprints, while people who are less culpability by our measure, are the people who on average have lower footprints. We will address this using an instrumental variable analysis, but will address this more fully in the lab experiment where we experimentally control each subject's contribution to the negative externality.

Table 4 presents our main regression results of willingness to purchase green electricity on culpability. Column 1 finds our main effect in a regression on the entire sample, which assumes

that those who saw no peer information has culpability zero, or effectively that they believed that their footprint matched the footprint of their peers. Column 2 restricts our analysis to only those who were given peer information. Columns 3 and 4 present evidence for our third main result, that the effect is driven primarily by those who were already inclined to contribute, in this case, Democrats. Sub-dividing the sample by those with a high or low NEP score yields similar results.

Columns 5 and 6 reproduce the Democrat/Non-Democrat result using a Tobit regression to account for the fact that negative choices are not allowed. Columns 7 and 8 report the results of an Instrumental Variable analysis, where we use the treatment condition as an instrument for culpability. Random assignment guarantees that the treatment condition is an exogenous variable, and is a highly significant predictor of the relative culpability.

Data from the Energy Information Administration about the estimated cost of wind energy were used to construct the payment card choices. The extra cost (above average retail electricity rates) for wind energy was used to calculate an estimated monthly and annual cost for seven sized blocks of renewable energy. Following previous work on using maximum likelihood (ML) estimation to evaluate payment cards (Cameron and Huppert, 1989), Table 5 repeats the analysis of columns 1-4 in Table 4 with ML estimation methods. In this analysis, we assume that the underlying distribution of true willingness to pay for green electricity was log normal. Thus, the coefficients reported in the table are for the natural log of the amount spent on green energy.

This analysis confirms the results in Table for OLS, Tobit and IV methods. Democrats are the most strongly affected by culpability, an order of magnitude more than non-democrats and significant at the 2% level. NEP increased WTP and was significant for every group except democrats, where it was smaller in magnitude as well. This may be explained by the fact that democrats in our sample have a higher mean NEP and a lower standard deviation, so there is less variability amongst democrats than non-democrats. The same may be true about politics for democrats. The constant term was also the highest for democrats, so not only were democrats more affected by their culpability about the relative size of their carbon footprint, they also had a higher base level of WTP for green electricity.

Lab Experiment

We endeavored to develop a parallel experimental economics laboratory in which subjects purchase “private commodities” (analogous to electricity) that generate a negative public externality (analogous to pollution) for a group in which they are a member. The subjects are subsequently given an opportunity to contribute to a fund that would reduce the negative harm created by the externality, akin, we believe to the opportunity to purchase green electricity.

Subjects (n=240) were recruited from a variety of undergraduate business and economics courses at Cornell University. Pen and paper experimental sessions were conducted in the Laboratory for Experimental Economics and Decision Research in cohorts ranging in size from 10 to 20. A session lasted approximately 45 minutes and average earnings were $14.41.

Subjects were randomly assigned into groups of five anonymous participants including themselves. Adapting Plott's (xxxx) seminal externality experiments, each individual was given a balance of $9 at the beginning of each of five rounds and a per-unit value (demand) function for a commodity that could be purchased at a cost of $1 (experimental dollars were converted to real dollars at a rate of $15 experimental = $1 real.) Subjects in each group were randomly assigned into high, low and medium demands and the choices offered to individuals were presented as in Box 3 below.

In addition to private return for each commodity unit purchased, subjects were informed that each unit purchased would impose a negative externality on the entire group,

> *Your group also shares a GROUP FUND. This group fund began with 300 experimental dollars, and at the end of the experiment, any dollars in this group fund will be divided equally between all members of the group. Your actions and the actions of other people in your group in Round 1 may have reduced the total amount of dollars remaining in the group fund.*
>
> *In Round 2, every unit of the commodity that you purchase decreases the number of experimental dollars in the group fund by 1.25. (Because there are five people in your group, every unit of the commodity that you purchase reduces the amount in the group fund by 0.25 dollars per person. Likewise, every unit of the commodity purchased by everyone else in the group reduces the amount in the group fund by 1.25 dollars and therefore costs everyone else 0.25 dollars.)*

Hence, the optimal private decision would be to purchase only those commodities with a value of $1.25 or higher. Examples were worked through with the entire session on a whiteboard at the front of the lab, and after each decision, subjects were asked to calculate and report their own private returns and the impacts of their private decisions on other members of the group.

Subjects were asked to sum their commodity purchases over the first five rounds and write this number down on a "passing sheet" which was submitted to the experimental moderator. Following a design in which the experimental moderator passed these sheets back to the

subjects, who were asked to record their own total purchases and the amount of total purchases that they saw on the sheet that was passed to them. Those in the high culpability treatment received the sheet of someone else with low demand, those in the medium culpability treatment received the sheet of someone with medium demand, those in the low culpability treatment received the sheet of someone with low demand, and those in the control received their own sheet back again.

In the sixth round of the experiment, subjects were informed that "Based on the purchase decisions in the first 5 rounds made by you and others in your group, the total amount of dollars in the group fund has declined" (See instructions in the Appendix). Once again each subject was endowed with $9. However, in this round individuals participated in a standard public goods contributions game in which each dollar contributed was multiplied by 1.25 and distributed equally across all members of the group.

Following this last round individuals were asked a series of debriefing questions and the same NEP questions used in the CV field experiment.

Table 6 provides summary statistics and a balancing test. The control and the three treatment groups do not vary from one another in terms of total purchases in rounds 1 through 5, NEP or politics. Own minus saw, which is the total purchases made by the participant minus the purchases made by the person whose information was provided in rounds one through five varies across the treatments because of the different information being passed: large-type participants purchase more than small-type participants.

Table 7 looks at mean contributions of those in the no peer information control group. Here, while we continue to see no difference between those who were induced to have low or medium demand, those with high demand did contribute more to the public good.Table 8 provides more evidence that it is the moral licensing effect that dominates. Any information received as to the actions of another person after Round 5 in the laboratory experiment reduced average donation to the public good: the Control group had the highest average contribution to the public good.

Table 9 presents the regression results of contributions on culpability using the same specification and the same Controls as before except we now have experimental session dummies as well. Here, while we find no effect in the complete sample, we see that again,

when we partition our analysis between Democrats and Non-Democrats[2] we replicate the earlier results.

In columns 1 and 2 of Table 9, the effects of culpability (the difference between a subject's own purchases in rounds 1 through 5 and the purchases of the subject whose information he or she saw) has no significant impact on purchases of the public good in round 6, even when we restrict our sample to just those subjects who received information not there own. However, when we split our sample between those who self-identify as Democrats versus those who do not, we see a significant, positive impact on culpability and footprint on contribution, compared with those who do not self-identify as Democrats. (Compare columns three and four.)

Columns five and six repeat this analysis of sub-sections of the data with a Tobit model, to check for biased estimates of coefficients due to censoring of allowed values of the contributions to the public good below zero.

Finally, instrumental variables are used to control for the confounding effects of people who voluntarily purchase less than the privately optimal amount of the goods in rounds 1-5 on contribution to the public good. Such a subject would have already made a sacrifice by forgoing possible earnings in the first five rounds in order to cause less harm to the group, and thus their culpability is affected. By using a dummy for the type of subject (small or large) they received from as an instrument for culpability, we can control for this effect, and confirm the positive correlation between culpability and contribution to the public good for Democrats.

Conclusions

In parallel contingent valuation and lab experiments, we find evidence that peer information can influence contributions to a public good through a channel beyond just conformity. Our results show that our proposed mechanism of culpability requires the peer information context to be effective, that the moral licensing effect dominates the guilt effect, and that culpability works primarily on those who are already inclined to contribute.

The use of peer information "nudges" has been greeted with excitement in the policy domain as an inexpensive and potentially libertarian method to achieve policy goals. We show that the use of peer information can be used not just to induce conformity, but operates through other channels as well.

[2] This being an undergraduate sample Non-Democrats should not be interpreted as Republican. They are mostly independents, but the group self-reports as significantly more conservative than those who identify themselves as Democrat.

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Figures

Box 1: IPCC Climate Options: The IPCC has presented several options for reducing climate change, each with different final levels of carbon and impacts on the global climate:

	Business as Usual	Small Emissions Reductions	Aggressive Emissions Reductions
Mean Percent change in Carbon Emissions from 2000 to 2050	115% Increase	55% Increase	70% Decrease
Global Average Temperatures Increases	8.8-11 degrees (4.9-6.1 degrees Celsius)	7.2-8.8 degrees Fahrenheit (4-4.9 degrees Celsius)	3.6-4.3 degrees Fahrenheit (2-2.4 degrees Celsius)
Sea Level Increases	12-24 inches (0.3 - 0.6 meters) Millions at risk of coastal flooding	10-24 inches (0.26 - 0.6 meters) Millions at risk of coastal flooding.	Less than 17 inches (0.45 meters)
Extinction Risk	More than 40% of species face some risk	More than 40% of species face some risk	30% of species face some risk
Crops and Famine	Crop productivity is expected to decrease. Global food production is expected to decrease, causing an increased risk of famine.	Crop productivity is expected to decrease. Global food production is expected to decrease, causing an increased risk of famine.	Crop productivity may increase in some regions and decrease in others. Increased risk of famine in some areas.
Other effects	Increase in intensity and frequency of heat waves. Increased range for tropical diseases. Together, these will cause death and sickness, placing a substantial burden on health services.	Increase in intensity and frequency of heat waves. Increased range for tropical diseases. Together, these will cause death and sickness, placing a substantial burden on health services.	Increase in intensity and frequency of heat waves.

Box 2: The Green Electricity Contingent Valuation Question

Suppose your electric utility were to offer you renewable energy appropriate to your area. For example, wind, solar, geothermal, or tidal power could all be offered, depending on your geographical location. Choose the option that you would like to purchase from the table below. (Information from the Energy Information Agency of the Department of Energy)

	Size of Block	Extra Cost per Month	Extra Cost per Year	Tons of CO2 Averted per Year
○	0 kilowatt hours	$0.00	$0.00	0 tons
○	50 kilowatt hours	$2.80	$33.60	0.405 tons
○	100 kilowatt hours	$5.60	$67.20	0.81 tons
○	200 kilowatt hours	$11.20	$134.40	1.62 tons
○	300 kilowatt hours	$16.80	$201.60	2.43 tons
○	400 kilowatt hours	$22.40	$268.80	3.24 tons
○	500 kilowatt hours	$28.00	$336.00	4.05 tons
○	600 kilowatt hours	$33.60	$403.20	4.86 tons

Submit

Box 3: Sample High Demand Function and Choice Setting

Units of Commodity	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Value of the unit	2.20	2.05	1.90	1.75	1.60	1.45	1.25	1.15	1.00
Cost of the unit	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Appendix 1: Sample Experimental instructions

Consent Form for an Experimental Investigation of Decision Making

Background Information: You are invited to participate in a research study about how individuals and groups of individuals make decisions in a variety of economic contexts. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

Procedures and Compensation: You and the other participants will have the opportunity to earn cash through your decisions. The experiment will take approximately 1.0 hour to complete.

Voluntary Nature of Participation: Your participation is strictly voluntary. You may refuse to participate before the study begins or discontinue at any time. If you withdraw from the experiment, you will be paid the cash you earned before withdrawing.

Risks and Benefits of Participating in the Study: The risk for participating in this experiment is minimal. You have no greater physical, financial, or psychological risk from the experiment than you would from doing a similar amount of routine paperwork in any similar Cornell University classroom. There are no substantial benefits to you from this research. By learning more about people's decision-making, we hope that the research will benefit society by helping economic institutions understand people's behavior.

Confidentiality: Your decisions during the experiment will be kept confidential. All data will be recorded so that no individual participant can be identified with the results from the study. Please note that if you were recruited for this experiment via e-mail there is a chance that the information you communicated could be read by a third party.

Contacts and Questions: Please ask questions you have about the study before agreeing to participate. After the experiment, Professor Antonio Bento (amb396@cornell.edu), Professor Benjamin Ho (bth26@cornell.edu), or Professor Gregory L. Poe (glp2@cornell.edu) will be glad to answer any additional questions that you may have. You may contact the Cornell University Institutional Review Board for Human Participants (IRB) at 607-255-5138. The Cornell University web site is http://irb.cornell.edu.

You may request to receive a photocopy of your signed consent form after the experiment.

I understand the information above and agree to participate in this study:

Your Name (Please print): _____

Your Signature: _____ **Date:** _____

I am 18 years or older (circle): **Yes** **No**

Consent form approved by the IRB on November 16, 2009

This is an experiment in the economics of decision-making. If you follow these instructions closely and make careful decisions, you can earn money. Please do not communicate with any other student during the experiment.

This experiment consists of 6 rounds, and your final earnings will be determined by your decision in each of the rounds. Since your decisions will affect how much money you can earn, it is important to make a careful decision in every round. You will earn experimental dollars during the experiment, which will then be redeemed for real money at the end of the experiment, at a rate of 15 experimental dollars to $1 in real money. So, if you earn 300 experimental dollars, you would earn $20 of real money at the end of the experiment.

PLEASE DO NOT TURN TO THE NEXT PAGE UNTIL INSTRUCTED TO DO SO.

ROUND 1 INSTRUCTIONS:

For this experiment, you will be in a group composed of five anonymous people.

In Round 1 of the experiment, you will be endowed with 9 experimental dollars. You can keep these experimental dollars, or you can use some or all of them to purchase up to 9 units of the commodity. Assume that you are buying this commodity for the purpose of reselling it to the experimental facilitator at the end of the experiment. The value listed below each quantity in the table below is the value that you could sell that unit to the facilitator. Each unit of the commodity costs one experimental dollar to purchase.

The table below shows the value and costs for each unit that you may purchase in Round 1.

Units of Commodity	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Value of the unit	2.20	2.05	1.90	1.75	1.60	1.45	1.25	1.15	1.00
Cost of the unit	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Your group also shares a GROUP FUND. This group fund begins with 300 experimental dollars, and at the end of the experiment, any dollars in this group fund will be divided equally between all members of the group. Your actions and the actions of other people in your group may change the total amount of dollars remaining in the group fund.

In Round 1, every unit of the commodity that you purchase decreases the number of experimental dollars in the group fund by 1.25. (Because there are five people in your group, every unit of the commodity that you purchase reduces the amount in the group fund by 0.25 dollars per person. Likewise, every unit of the commodity purchased by everyone else in the group reduces the amount in the group fund by 1.25 dollars and therefore costs everyone else 0.25 dollars.)

Example: Suppose you choose to purchase zero units of the commodity, and the rest of the group buys a total of 20 units. Your total earnings in this round would be the 9 experimental dollars that you chose to keep from your endowment. The group fund would be reduced by 25 experimental dollars (20 units x 1.25 dollars/unit). 275 dollars would be left in the group fund (55 dollars per person).

Example: Suppose you choose to purchase 4 units of the commodity, and the rest of your group buys a total of 10 units. Your total earnings in this round would be 12.90 experimental dollars (2.20 + 2.05 + 1.90 + 1.75 dollars in value from buying four units, plus 5 dollars from the remaining portion of your initial endowment). The group fund would be reduced by 17.50 dollars (14 units x 1.25 dollars per unit). 282.50 dollars would be left in the group fund (56.50 dollars per person).

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ROUND 6 INSTRUCTIONS:

Based on the purchase decisions in the first 5 rounds made by you and others in your group, the total amount of dollars in the group fund has declined.

In Round 6 of the experiment, you will again be endowed with 9 experimental dollars. You can keep these dollars, or you can put some or all of them into the group fund. Every dollar that you put into the group fund in this round of the experiment increases the number of dollars in the group fund by 1.25 dollars. Because there are five people in your group, every dollar you spend increases the amount in the group fund by 0.25 dollars per person, including yourself.

You will also be given information as to the total amount of the commodity that a random member of your group bought in the first 5 rounds. You may get your own information back.

Example: Suppose there were 50 experimental dollars left in the group fund at the end of Round 5. In Round 6, suppose you chose to spend 5 dollars to increase the size of the group fund, and the rest of the group chose to spend 15 more dollars to increase the size of the group fund. The group fund would increase by 25 dollars (1.25 dollars/unit x 20 units), to equal 75 dollars (15 dollars per person.) In addition, you would have 4 dollars left from your endowment, because you spent 5 dollars from your initial endowment of 9 tokens.

Example: Suppose there were 50 experimental dollars left in the group fund at the end of Round 5. In Round 6, suppose you chose to keep all of your endowment, and the rest of the group chose to spend 10 dollars to increase the size of the group fund. The group fund would increase by 12.5 dollars (1.25 dollars/unit x 10), and would total 62.5 dollars (12.5 dollars/person). In addition, you would have 9 experimental dollars left from your endowment, because you only spent 0 dollars from your initial endowment of 9 dollars.

Tables

Table 1:

Table 1: Summary Statistics for Online Experiment

	Control	Saw Small	Saw Large
CO2 Total	23.47 (2.30)	20.8 (1.78)	25.01 (2.52)
Culpability		4.62 (0.85)	-5.87 (1.42)
NEP	34.01 (0.80)	35.33 (0.66)	34.90 (0.79)
Politics	2.48 (0.20)	2.36 (0.17)	2.73 (0.20)
Age	37.2 (1.18)	37.4 (1.16)	40.66 (1.42)
Democrat	0.41 (0.05)	0.44 (0.05)	0.33 (0.05)
N=	81	117	88

Table 2:

Table2: Green Electricity Choices when given No Peer Information, by Footprint

	$CO_2 \leq 11$	$11 < CO_2 \leq 26$	$26 < CO_2$
Green Electricity	195.8	210.9	216.7
	(42.9)	(39.3)	(34.5)
N=	24	32	27

Standard Errors in Parentheses

Table 3:

Table3: Green Electricity Choices by Treatment Group

	Control	Saw High Footprint	Saw Low Footprint
Mean Green Electricity	208.4	206.4	156.5
	(22.3)	(17.3)	(18.0)
N=	83	124	92

Standard Errors in Parentheses

Table 4:

Table 4: Effect of Culpability on Green Electricity Choice

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				Tobit		IV	
	Full	Treated	Dem	Non-Dem	Dem	Non-Dem	Dem	Non-Dem
culpability	2.554**	3.784**	6.032**	2.407	7.295**	3.023	6.032**	2.407
	(1.212)	(1.671)	(2.861)	(2.089)	(3.390)	(2.768)	(2.766)	(2.041)
co2 footprint	0.920	-0.731	-3.890	0.881	-4.840	0.801	-3.890	0.881
	(0.767)	(1.807)	(3.325)	(2.211)	(3.950)	(2.940)	(3.214)	(2.161)
NEP	5.934***	5.773***	3.682	6.816***	5.139	10.45***	3.682	6.816***
	(1.567)	(1.762)	(3.295)	(2.091)	(3.983)	(2.885)	(3.185)	(2.044)
politics	-19.10***	-16.32**	-18.35	-17.26*	-18.03	-22.84*	-18.35	-17.26**
	(6.300)	(7.137)	(15.25)	(8.712)	(17.79)	(11.72)	(14.74)	(8.515)
Constant	3.409	18.04	145.5	-41.17	82.68	-190.1	145.5	-41.17
	(67.14)	(79.24)	(148.9)	(94.93)	(178.7)	(130.8)	(144.0)	(92.78)
Observations	270	188	76	112	76	112	76	112
R-squared	0.145	0.154	0.110	0.191			0.110	0.191

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5

Table 5: Effect of Culpability on Green Energy Choices

	(1)	(2)	(3)	(4)
	MLE			
	Full	Treated	Dem	Non-Dem
culpability	0.1149	0.0202*	0.0388**	0.0076
	(0.0072)	(0.0106)	(0.0170)	(0.0137)
co2 footprint	0.0073	-0.0043	-0.0224	0.0078
	(0.0045)	(0.0115)	(0.0198)	(0.0145)
NEP	0.0445***	0.0440***	0.0290	0.0522***
	(0.0096)	(0.0114)	(0.0199)	(0.0141)
politics	-0.0992***	-0.0774*	-0.0446	-0.0904
	(0.0380)	(0.0454)	(0.0895)	(0.0576)
Constant	3.4582***	3.5506***	4.3389***	3.0813***
	(0.4102)	(0.5121)	(0.8945)	(0.6409)
Observations	268	187	76	111

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6

Table 6: Summary Statistics for Laboratory Experiment

	Control	Received High	Received Medium	Received Low
Culpability		-6.59	-1.93	7.60
(Own Purchases – Saw)		(1.76)	(2.67)	(1.27)
	20.2	18.63	19.55	21.32
Total Purchases, Rounds 1-5	(1.07)	(0.99)	(2.10)	(1.15)
	24.18	23.05	23.07	24.84
NEP	(0.61)	(0.78)	(0.87)	(0.72)
	3.27			
Politics	(0.19)	3.11 (0.20)	3.29 (0.29)	3.43 (0.21)
N=	86	63	29	62

Standard Errors in Parethenses

Table 7

Table 7: Contributions when given No Peer Information, by Demand

	Low Demand	Medium Demand	High Demand
Contributions	2.76	2.52	4.41
	(0.59)	(0.76)	(0.63)
N=	33	19	34

Standard Errors in Parentheses

Table 8

Table 8: Contribution to Public Good by Treatment

	Control	Received High	Received Medium	Received Low
Mean Contribution to Public Good	3.36	2.76	2.72	2.5
	(.39)	(.39)	(.60)	(.37)
N=	86	63	29	62

Standard Errors in Parethenses

Table 9

Table 9: Effect of Culpability on Contribution to a Public Good

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				Tobit		IV	
	Full	Treated	Dem	Not Dem	Dem	Not Dem	Dem	Not Dem
Culpability	-0.0022	-0.00285	0.166***	-0.0352	0.240***	-0.0556	0.158**	0.0108
	(0.0287)	(0.0327)	(0.0521)	(0.0503)	(0.0710)	(0.0652)	(0.0705)	(0.0734)
Footprint (Total Contribution, Rounds 1-5)	0.00119	0.0106	-0.230***	0.0488	-0.366***	0.0687	-0.220**	-0.00598
	(0.0368)	(0.0534)	(0.0825)	(0.0807)	(0.114)	(0.105)	(0.102)	(0.0989)
NEP	0.0124	-0.0435	-0.145*	-0.0227	-0.213*	-0.0674	-0.143**	-0.0220
	(0.0470)	(0.0539)	(0.0818)	(0.0748)	(0.111)	(0.101)	(0.0707)	(0.0642)
Politics	-0.120	-0.192	-0.674*	-0.193	-0.783	-0.250	-0.665**	-0.245
	(0.166)	(0.200)	(0.368)	(0.316)	(0.498)	(0.406)	(0.316)	(0.279)
Session Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.128***	5.598***	12.14***	-0.197	10.37***	3.638	8.649***	5.322
	(1.554)	(2.034)	(3.350)	(3.866)	(3.731)	(4.340)	(2.838)	(3.335)
Observations	183	119	58	61	58	61	58	61
R-squared	0.064	0.177	0.474	0.246			0.474	0.232

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1