The Global Warming Game: Measuring Consumers’ Environmental Policy Choices

Benjamin R. Searchinger

Advisor: Nicholas E. Flores

University of Colorado at Boulder

4/01/2015
Abstract

This study experimentally implements theories [14] about consumer preferences toward environmental policies that hypothetically decrease the uncertainty of consequences of global temperature increase. We first measure individual risk and time preferences, then conduct a series of choice experiments using investments in a global warming model. We find that subjects consistently spend more than their optimal consumption point as predicted by their stated preferences.

Introduction

Global warming is among the most prominent sociopolitical issues of our time, yet little action occurs due to the stalemate created by polarized opinions of policymakers and the general public [7]. Without delving into the political debate, it’s clear that uncertainty is largely to blame for the gridlock surrounding global warming progress [17].

Even the scientific community is unable to reach a consensus about how to treat global warming moving forward [16]. Integrated Assessment Models have been the standard for global warming predictions by entities like the EPA, but these models are based largely on assumptions rather than empirical evidence [13].

To address this issue, Pindyck (2014) turns to the consumer side of environmental policies, modeling willingness to pay for reductions in the drift and volatility of global temperature

---

0I would like to thank my Advisor, Nicholas Flores, and my Honors Committee Members, Leaf Van Boven and Martin Boileau. I would also like to thank Gary McClelland and Tom Dickinson for their help with the design and implementation of the Javascript animations
increase [14]. Rather than trying to predict the future, Pindyck estimates how people value policies aimed at reducing expected future damage versus future uncertainty. Pindyck’s work represents an important step in a different direction for environmental policy research, but it still relies heavily on theory and assumptions rather than empirical evidence.

The present study attempts to further investigate consumer preferences regarding environmental policy by using human subjects to test the theoretical groundwork laid so far. Similar to Pindyck’s (2014) approach, we examine individual risk and time preferences, and investment in theoretical reduction of future risk and uncertainty. This data allows us to test the differences between stated and actual preferences surrounding future risk and uncertainty mitigation in global warming policy.

**Literature**

While the main literary basis and logic behind the present research is explained above [14], details like variable measurement surveys still require discussion.

The concept of individual risk preference is central to both Pindyck’s (2014) paper and the current research. Bernoulli (1738) first observed a discrepancy between expected value and expected utility as lottery stakes increased in the St. Petersburg paradox [5]. Almost 200 years later, Binswanger (1980) was one of the first researchers to experimentally implement a lottery choice list where participants choose between a series of “safe” and “risky” gambles [6]. The current standard for risk elicitation through surveys was set by Holt and Laury’s (2002) Multiple Price List task [12]. In this task, participants choose between safe and risky alternatives for a series of ten paired gambles. The high and low payout possibilities
remain the same for each choice, but the probability of the high payout increases while the probability of the low payout decreases with each choice. Therefore, the risky choice becomes more enticing as the participant moves down the list, and the point at which he switches implies his risk preference. This method has been tested and validated numerous times [2] [9], plus it’s simple to explain and understand, so we use the MPL to measure risk preferences in the present research.

Time preferences are similar to risk preferences, and the two are usually viewed in conjunction, but they are separate phenomena [4]. Until recently, most the time preference literature focused on finding the optimal discounting function [10] without really considering non-linear individual utility functions. Andersen et al. (2008) are among the first to come up with an experimental measure that jointly measures risk and time preferences, which they call the Double Multiple Price List [1]. The DMPL collects responses from a lottery choice survey followed by an intertemporal choice survey. Risk coefficients from the first survey are used to inform the individual utility curves underlying the calculation of the discount rate from the intertemporal survey. The resulting discount rates tend to be lower than those under assumed risk neutrality [1]. Andreoni et al. (2013) examine the validity of the DMPL compared to their Convex Time Budget measure of discount rate estimation [3]. They find that their CTB measure has slightly more predictive validity than the DMPL. However, the CTB does not explicitly measure risk preferences, so the DMPL is better suited for our research.
Methods

Participants (n=56) were drawn from six upper-division economics classes at CU Boulder. The professors of those six classes sent out an email with instructions and the survey link to their class rosters. The only eligibility requirement was enrollment in one of the six classes. Over 200 invitations went out, and 56 subjects took the survey. One outlier was dropped from the dataset.

Subjects completed a series of three surveys followed by a choice experiment, all through Qualtrics. The surveys were explained to participants as measures of general information and beliefs, as well as risk and time preferences. Subjects were instructed that they would be paid a $5 for their participation, and that their responses to the surveys would not effect their eventual payout.

The choice experiment was framed as a Global Warming Game, where subjects could choose to invest any amount of their $5 credit to mitigate simulated global temperature increase as modeled by a random distribution. Participants received $5 less their investment during their class following the conclusion of the study. Three weeks later, they received some amount of money based on a random draw from their shifted distribution.

Details about each component are as follows:

Surveys

General Information

Participants first indicated their gender, followed by the highest level of statistics coursework they completed. Subjects then used a sliding Likert scale to report their overall understand-
Participants then answered a series of questions about their global warming beliefs, beginning with whether or not they think global warming is happening. Subjects then indicated their perceived global warming risk by answering four questions on sliding Likert scales. These questions asked about perceived threat level, immediacy, concern and activism in promoting global warming awareness.

The full version of this survey is provided in Appendix A.

**Multiple Price List**

Participants completed the Multiple Price List Task [12], which consists of choices between a “safe” gamble (Option A) and a “risky” gamble (Option B) for ten pairs of gambles. These choices are presented in Figure 1. The payoffs for Options A ($10 vs $2) and Option B ($19.25 vs $1) remain the same, but the probability of the high payoff increases. The assumption is that participants will choose a series of safe options before switching to the risky option, and that the number of safe options chosen suggests the degree of risk aversion.

Figure 1: MPL and Risk Coefficients

<table>
<thead>
<tr>
<th>Option A</th>
<th>Option B</th>
<th>$E(A)$</th>
<th>$E(B)$</th>
<th>Expected Difference</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/10 of $10; 9/10 of $8</td>
<td>1/10 of $19.25; 9/10 of $1</td>
<td>$8.20</td>
<td>$2.83</td>
<td>$5.38</td>
<td>(-∞, -0.97)</td>
</tr>
<tr>
<td>2/10 of $10; 8/10 of $8</td>
<td>2/10 of $19.25; 8/10 of $1</td>
<td>$8.40</td>
<td>$4.65</td>
<td>$3.75</td>
<td>(-0.97, -0.51)</td>
</tr>
<tr>
<td>3/10 of $10; 7/10 of $8</td>
<td>3/10 of $19.25; 7/10 of $1</td>
<td>$8.60</td>
<td>$6.48</td>
<td>$2.13</td>
<td>(-0.51, -0.17)</td>
</tr>
<tr>
<td>4/10 of $10; 6/10 of $8</td>
<td>4/10 of $19.25; 6/10 of $1</td>
<td>$8.80</td>
<td>$8.30</td>
<td>$0.50</td>
<td>(-0.17, 0.13)</td>
</tr>
<tr>
<td>5/10 of $10; 5/10 of $8</td>
<td>5/10 of $19.25; 5/10 of $1</td>
<td>$9.00</td>
<td>$10.13</td>
<td>$-1.13</td>
<td>(0.13, 0.39)</td>
</tr>
<tr>
<td>6/10 of $10; 4/10 of $8</td>
<td>6/10 of $19.25; 4/10 of $1</td>
<td>$9.20</td>
<td>$11.95</td>
<td>$-2.75</td>
<td>(0.39, 0.66)</td>
</tr>
<tr>
<td>7/10 of $10; 3/10 of $8</td>
<td>7/10 of $19.25; 3/10 of $1</td>
<td>$9.40</td>
<td>$13.78</td>
<td>$-4.38</td>
<td>(0.66, 0.95)</td>
</tr>
<tr>
<td>8/10 of $10; 2/10 of $8</td>
<td>8/10 of $19.25; 2/10 of $1</td>
<td>$9.60</td>
<td>$15.60</td>
<td>$-56</td>
<td>(0.95, 1.35)</td>
</tr>
<tr>
<td>9/10 of $10; 1/10 of $8</td>
<td>9/10 of $19.25; 1/10 of $1</td>
<td>$9.80</td>
<td>$17.43</td>
<td>$-7.63</td>
<td>(1.35, 1.8)</td>
</tr>
<tr>
<td>10/10 of $10; 0/10 of $8</td>
<td>10/10 of $19.25; 0/10 of $1</td>
<td>$10.00</td>
<td>$19.25</td>
<td>$-9.25</td>
<td>(1.8, ∞)</td>
</tr>
</tbody>
</table>
The point at which this switch occurs infers the participant’s risk coefficient $r$. The coefficient is bounded because the indifference point lies somewhere between two discrete choices, so an exact number cannot be estimated.

Constant Relative Risk Aversion is assumed, so we use the utility function

$$U(x) = \begin{cases} 
\frac{x^{1-r}}{1-r} : & r \neq 1 \\
\ln(x) : & r = 1 
\end{cases}$$

where $r < 0$ suggests risk-seeking preferences, $r = 0$ implies risk neutrality, and $r > 0$ is associated with risk aversion. The choice set is defined such that four safe choices followed by six risky choices implies risk neutrality, with $r \in (-.17, .13)$. The rest of the risk coefficients are shown in Figure 1.

**Intertemporal Multiple Price List**

Next, participants completed the Intertemporal Multiple Price List [2], or IMPL, to elicit their time preferences. The form of the survey is very similar to the MPL, but subjects

<table>
<thead>
<tr>
<th>Option A</th>
<th>Option B</th>
<th>Ratio</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>$19.00</td>
<td>$20.00</td>
<td>1.05</td>
<td>(0.93,1)</td>
</tr>
<tr>
<td>$18.00</td>
<td>$20.00</td>
<td>1.11</td>
<td>(0.88,93)</td>
</tr>
<tr>
<td>$17.00</td>
<td>$20.00</td>
<td>1.18</td>
<td>(0.83,88)</td>
</tr>
<tr>
<td>$16.00</td>
<td>$20.00</td>
<td>1.25</td>
<td>(0.76,83)</td>
</tr>
<tr>
<td>$14.00</td>
<td>$20.00</td>
<td>1.43</td>
<td>(0.63,76)</td>
</tr>
<tr>
<td>$11.00</td>
<td>$20.00</td>
<td>1.82</td>
<td>(0.52,63)</td>
</tr>
</tbody>
</table>

---

1 Participants were shown only the first two columns—the probabilities associated with each choice.

2 The payoffs are very similar to those used by Holt and Laury (2002), scaled up by five.
choose between $20 in three weeks (Option B), or a smaller amount of money today (Option A) for six pairs of serial choices. The present amount of money associated with Option A decreases with each choice, so individual discount rates for the three week time horizon are elicited by examining the switch point from Option A to Option B. For example, someone who chooses Option A five times before switching to Option B has a very high discount rate, and values present income significantly more than future income. The equation used to calculate the discount rate is 

$$U(M_k) = U(M_{k+t}) \frac{1}{(1+d)^t}$$

where k signifies the delay before the initial payment, t equals the time elapsed between payments, and d represents the discount rate [4]. For the present survey, k=0, t=21, and $M_0 = 20$. The utility function here is the same CRRA function as above, and d is calculated for each unique (r, M) pair. For simplicity, I will use the discount factor \( \delta = \frac{1}{(1+d)^t} \) from this point on. Figure 2 shows the payouts for each option, and the implied range of discount rates associated with each choice.\(^3\)

**The Global Warming Game**

The experimental portion of the study was presented as a global warming simulation. Participants read about a scenario called the Global Warming Game, in which they receive a $10,000 check tomorrow, and will receive another check for an amount inversely proportional to the global temperature increase in ten years. They’re told that they could invest some of the current income to mitigate against future temperature increase, and therefore decrease the likelihood of a future bad outcome.\(^4\) The point of this anecdote is to prime subjects to

\(^3\)For simplicity, only the discount factors calculated at the midpoint of the risk neutral interval (r=-.02) are shown.
think about global warming mitigation, and to provide tangible context for the somewhat complicated tasks that follow.

Participants are then informed that they have received a $5 credit for their completion of the surveys, which represents their current income as they perform three independent tasks similar to the Global Warming Game. They are reminded that the $5 less their investment in the randomly chosen task will be available during their next class, and that money based on a random draw from their altered distribution will be available in three weeks.\footnote{The exact explanation provided to participants can be found in Appendix C.}

Note that the next three sections describe the remainder of the procedure without going into detail about the underlying mathematics. I save the bulk of this discussion for the Technical Notes section, which follows immediately after.

\footnote{The exact explanation provided to participants can be found in Appendix B.}
Task 1: Adjusting $\alpha$

Participants are told that they will adjust the "location" parameter, or expected value, of the distribution. They indicate how much they would like to spend by moving a slider between $0$ and $5$, which also displays how much the expected value increases. Figure 3 shows the point at which total utility begins to decrease under assumed risk neutrality (cost=$.5$) and Figure 4 depicts the maximum input (cost=$5$).

Task 2: Adjusting $\beta$

Participants are now instructed that they will be adjusting the "scale" parameter, or variance, of the distribution. They again move the slider between $0$ and $5$ to indicate their input, and the numerical decrease in variance is shown alongside the distribution animation. Figure 5 illustrates the point at which total utility begins to decrease under assumed risk neutrality (cost=$.5$) and Figure 6 shows the maximum input (cost=$5$).
Task 3: Adjusting $\alpha$ & $\beta$

Participants next adjust both parameters $\alpha$ and $\beta$. The underlying cost functions for $\alpha$ and $\beta$ remain the same, but the input is now two-dimensional. This means the slider is constrained to the triangle defined by $c_{\alpha} + c_{\beta} \leq 5$ with $0 \leq c_{\alpha}, c_{\beta}$. Participants can move the slider anywhere inside the triangular plane. Figure 7 shows the upper-bound for positive net utility (cost=($0.5, 1$)) and Figure 8 represents one of the maximum inputs (cost=($2.44, 2.66$)).

Technical Notes

Distribution

We use the following unnamed variation of the logistic distribution\(^6\) for all three tasks:

$$F(x) = 1 - \frac{e^{\frac{x}{\mu}}}{(e^{\frac{x}{\mu}} + e^{\frac{-x}{\mu}})^2}$$

\(^6\)To my knowledge, this is an original distribution, and this paper marks the first use of it.
f(x) = \frac{2e^{\alpha x}}{\beta(e^{\alpha x} + e^{\beta x})^3}

E[x] = \frac{\alpha}{2} - \beta \quad Var[x] = \frac{\beta^2(\pi^2 - 3)}{3}

This distribution is useful because the two parameters can easily be disentangled so that \( \alpha \) alone determines the mean and \( \beta \) the variance—a rarity for skewed two-parameter distributions. The PDF graph also resembles the normal distribution, which most people have been exposed to. The distribution also has fat-tails, which is consistent with the potential for catastrophic climate change outcomes [15]. However, payouts in the study were bounded below by zero and unbounded above, so we had to reduce the variance and therefore the area in the tails to hedge against the potential for an extremely costly study.

Each task begins with \( \beta = 2 \) and \( \alpha = 12 \), meaning that to start, \( \mu = 4 \) and \( \sigma^2 = 9.16 \). Both parameters “shift” the distribution in response to the movement of a slider. The slider serves as the input of two functions: \( \alpha = 12 + 2\sqrt{c} \) and \( \beta = 2 - \frac{\sqrt{c}}{2} \) with \( 0 \leq c \leq 5 \) where \( c \) represents the cost of changing the distribution and is subtracted from the initial $5 endowment. Therefore, on the first task \( \alpha \) moves between 9 and 16.47, and \( E[x] \in (4, 6.24) \). These functions were constructed such that the optimal consumption point for a risk-neutral individual would be relatively low, and reducing \( \beta \) would be about twice as costly as reducing \( \alpha \).

Since we wanted \( \beta \) to only shift the variance in the distribution, we had to modify the expected value equation for the second two tasks. For these cases, \( E[x] = \frac{12 + \alpha}{2} - 2 \times (2 - \beta) \) so that the expected value stays constant as \( \beta \) moves between .88 and 2, meaning \( 1.74 \leq Var[x] \leq 9.16 \).

The positive net utility points shown on the graphs above were calculated under the
following assumptions: $U(0) = U(x_\alpha) = 5 - x_\alpha + \frac{(4+\sqrt{x_\alpha})^{1-r}}{1-r}$ and $U(0) = U(x_\beta) = 5 - x_\beta + \frac{(4+5\sqrt{x_\alpha})^{1+r}}{1+r}$. This implies that any point on the interval $(0, x_\alpha)$ or $(0, x_\beta)$, respectively, will result in a net utility gain, while exceeding the maxima will yield a lower utility than the starting point. These conditions hold true for all three tasks.

For the $\beta$ utility function, I assume that a one point reduction in $\beta$ is equivalent to at least a two point increase in $\alpha$, as implied by the unadjusted expected value function, so I multiplied the $\sqrt{c}$ term by $.5$. I also reversed the sign on the risk aversion coefficients under the assumption that risk averse individuals would gain more utility from reductions in $\beta$ than risk loving individuals. These estimates may be slightly low, but under the assumptions of expected utility risk-neutral and risk-loving individuals should be indifferent to all values of $\beta$, thereby avoiding investing in it.

**Animations and Programming**

The sliders and PDF graphics were built using D3.js [8] which is a Javascript Library designed specifically to embed interactive animations in webpages. Qualtric is able to embed custom Javascript and CSS files, which allowed the animations to function inside of the survey and also helped capture and consolidate subject response data. Since the equations defined above for $\alpha$ and $\beta$ are injective, we only needed to record participants’ ”c” values to identify their individual shifted distributions. For Task 3 where the parameters were jointly adjusted, we simply recorded the unique point $(c_\beta, c_\alpha)$ inside of the plane constraining the domain of the responses.
Table 1: Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A_Both</td>
<td>1.84</td>
<td>1.95</td>
<td>1.58</td>
<td>55</td>
</tr>
<tr>
<td>A_Only</td>
<td>2.64</td>
<td>2.53</td>
<td>1.44</td>
<td>55</td>
</tr>
<tr>
<td>Max_A</td>
<td>1.69</td>
<td>1.07</td>
<td>1.55</td>
<td>55</td>
</tr>
<tr>
<td>B_Both</td>
<td>1.63</td>
<td>1.49</td>
<td>1.46</td>
<td>55</td>
</tr>
<tr>
<td>B_Only</td>
<td>1.88</td>
<td>2.07</td>
<td>1.46</td>
<td>55</td>
</tr>
<tr>
<td>Max_B</td>
<td>0.59</td>
<td>1.07</td>
<td>0.23</td>
<td>55</td>
</tr>
<tr>
<td>Number of Safe Choices</td>
<td>4.13</td>
<td>4</td>
<td>1.71</td>
<td>55</td>
</tr>
<tr>
<td>Number of Present Choices</td>
<td>2.25</td>
<td>2</td>
<td>2.02</td>
<td>55</td>
</tr>
</tbody>
</table>

Results

We found that overall, participants spent significantly more than predicted by their risk and time preferences. Table 1 presents the summary statistics for the key measured variables, and two predicted variables, $A_{Max}$ and $B_{Max}$. $A_{Max}$ and $B_{Max}$ were calculated by finding the point $x_m$ such that $U(0) \leq U(x_m) \forall k \in (0, x_m)$ for each level of risk aversion. That is, any input higher than $A_{Max}$ or $B_{Max}$, respectively, will yield an expected utility lower than the expected utility of not investing at all.

This pattern of outspending the maximum predictions was statistically significant on Task 1 ($t=3.25$, $p<.005$) and Task 2 ($t=5.19$, $p<.0001$). The pattern was observed for $\beta$ ($t=4.15$, $p<.001$) but not $\alpha$ on Task 3. This could be due to the fact that $\alpha$ and $\beta$ are substitutes in Task 3 (corr=-.52, $p<.0001$) with participants exhibiting a stronger preference for $\beta$.

The average level of relative risk aversion suggests risk neutrality ($-.17 < r < .13$), whereas the average coefficient is usually measured in the moderately risk averse range ($.39 < r < .66$) [7]. This could be due to the population measured, since younger people tend to be less risk averse [11]. Figure 9 shows a frequency distribution for the number of safe choices made on
Figure 9: Counts for each level of Risk and Time Preferences

The measured time preferences are inconsistent with the literature [1]. The average discount factor under the assumption of risk-neutrality is .84, which is very low for a three-week time horizon. When risk preferences are accounted for, the discount factor coefficient decreases (t=-1.9, p<.1). The literature suggests that the discount factor should increase when individual utility is accounted for, but this assumption only holds when 0<r, which is generally not the case in this study. The correlation between risk preferences and the discount factor based on risk preferences is positive and significant (t=3.7, p<.0005), which is consistent with other findings. Time preferences are almost never measured for a time horizon shorter than six months, and the lack of findings here might explain why.

None of the demographic characteristics came through as significant. This is likely due to the small sample size and the homogeneity of subjects.
Discussion

The inconsistencies in the results do not add up. Risk neutrality implies increased utility from increased expected value, and indifference to the level of variability. Instead we see the opposite, and none of the other variables provide insight. There are three main explanations outside of the dataset.

The first is that participants did not understand the tasks. This would help explain the large standard deviations associated with the variables, but the small sample size must also be considered. The response rate was also very low. Over 200 invitations went out, and only 56 people participated in the study. There was no attrition once subjects began the survey, meaning that two thirds of the subject pool did not attempt to access the survey.

The second possibility has to do with the influence of the framing effect. Participants were primed to think about reducing temperature, which is more consistent with the thought of decreasing variability than it is with increasing expected value. This would explain spending patterns on Tasks 2 and 3, but not Task 1 where participants on average spent an irrationally large amount of money on $\alpha$.

Finally, it’s possible that the appearance of Task 3 biased participants. The range of possible expected values is [4, 6.24], while variance ranges from [1.78, 9.16]. The cost of reducing $\beta$ by 1 unit is twice the cost of increasing $\alpha$ by one unit, but a change in $\beta$ has a larger absolute effect on variance than the same change in $\alpha$ has on expected value. Reducing $\beta$ also changes the appearance of the distribution more dramatically than increasing $\alpha$, so it’s likely that participants fallaciously believe that they’re getting more benefit from reducing the variance, when in reality they’re acting against their own self-interests.
Conclusions

In the context of Pindyck’s (2014) theories, our results suggest that people are willing to pay significantly more than their utility-maximizing amount to reduce the drift and volatility of temperature increase. However, several factors need to be addressed for that assertion to have any real weight.

The small sample size caused fundamental statistical issues. Certain trends, like time preferences, were likely washed out due to the high standard errors associated with each coefficient. Along those lines, the sample also has very little statistical power with such a small sample size. The sample used was also not at all representative of the general population, which probably caused a significant amount of bias.

The next potential issue is a lack of understanding of the experimental tasks. A discrete choice set would be more consistent with the rest of the survey and likely easier for subjects to understand. This approach would also cut down on potential bias caused by false comparisons made during the simultaneous task.

However, the sliders were novel and could have a wide variety of uses in experimental measurements so long as participants have an explicit understanding of their task.
Appendix A: Global Warming Survey

Do you think global warming is happening?
- Yes
- No
- Not Sure

How much of a threat do you think global warming poses?

<table>
<thead>
<tr>
<th>No Threat</th>
<th>Severe Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Assuming global warming is happening, how many years do you think it will take for us to see its effects?

Note: Units are given in years. Answering 0 years indicates that the effects of global warming are already apparent.

Overall, how concerned are you about global warming?

<table>
<thead>
<tr>
<th>Not at all concerned</th>
<th>Extremely concerned</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Overall, how active are you in spreading global warming awareness?

<table>
<thead>
<tr>
<th>Not at all active</th>
<th>Extremely active</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Appendix B: Global Warming Game Explanation

You can think of the next section as a global warming game. Pretend you’re going to receive a check for $10,000 tomorrow, and another check in 10 years. However, the amount of the check in 10 years is uncertain, and depends on how much the global temperature increases in that period. That is, if the temperature increases significantly over the next 10 years, you will likely receive less money.

Now pretend that you can invest some of your $10,000 tomorrow to help reduce temperature increase over the next 10 years. Future income would still be uncertain, but the likelihood of “bad outcomes” (less money) is reduced. How much would you spend, if any? We aim to answer this question in the final part of the study. You will be playing the global warming game, but with less money and a shorter time horizon. The instructions follow in the next section.

Appendix C: Payout Explanation

Remember the global warming game. You receive income today and future income is uncertain on account of global warming.

You have earned $5 credit for your previous responses; think of this as “current income”. Your “future income” (in three weeks) is expected to be less and is uncertain on account of global warming.

Now we are going to give you three tasks where you can trade off some of your $5 credit to improve the likelihood of future income. In each task you can give up between $0 and $5 of your current income and change the distribution of future income. You will provide responses for all three tasks but only one will count. The task that counts will be randomly selected after you have completed the survey.

You will be paid during the week of 4/6/15. You will receive $5 less what you invest, plus money from a random draw.

This random draw will come from one of the three distributions. The exact amount of this payout will be unknown—however, some summary statistics are provided to give you an idea of possible and likely payouts. All tasks are independent and equally likely to be selected for your future payout, so please choose carefully on each.
Bibliography


