More Information Isn't Always Better: The Case of Voluntary Provision of Environmental Quality

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Abstract

We use a new U.S. survey on pro-environment behaviors, attitudes, and knowledge and find that individuals engage more frequently in pro-environment behaviors that are most closely related to activities they believe are more effective in reducing carbon emissions, regardless of whether or not these beliefs are accurate. We find that low provision of the public good is greater among people who believe they cannot do much for the environment and do not consider themselves environmentalists. A policy implication of the results is that more accurate information that effectively changes people's beliefs has an ambiguous effect on the provision of the public good.

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Abstract

We use a new U.S. survey on pro-environment behaviors, attitudes, and knowledge and find that individuals engage more frequently in pro-environment behaviors that are most closely related to activities they believe are more effective in reducing carbon emissions, regardless of whether or not these beliefs are accurate. We find that low provision of the public good is greater among people who believe they cannot do much for the environment and do not consider themselves environmentalists. A policy implication of the results is that more accurate information that effectively changes people's beliefs has an ambiguous effect on the provision of the public good.

1 Introduction

Policymakers and activists have dedicated a great amount of effort to inform the public about the causes and consequences of climate change and ways households can curb their emissions of greenhouse gases.[1] Solutions that rely on voluntary efforts need to overcome incentives to free-ride and informational problems: while individuals may engage in multiple pro-environment behaviors, each activity entails different levels of monetary and time commitment as well as different impacts on the environment. Thus, whether or not households make choices that lead to sustainable consumption depends on both the level and the nature of their contributions.

In this paper we use data from a new representative national survey of U.S. households to examine empirically how households allocate efforts to various pro-environment behaviors when there are several contribution mechanisms they can choose from and there is variability in how individuals regard the impact of their efforts. In particular, we estimate the relationship between the perceived impacts of various activities on carbon emissions and the frequency of pro-environment behaviors closely related to those activities. We find that, on average, individuals overestimate the effectiveness of their efforts on emissions of carbon dioxide and that a belief that an activity has higher impact is associated with greater frequency of engaging in the behavior most closely related to that activity.

The empirical evidence that we present can have important implications for public policy. Although it is tempting to conclude that more education about the value of individual efforts to increase environmental quality would result in greater provision of this public good, our results imply that the effect of more education is ambiguous. As individuals develop a better

[1] A popular example is the public campaign associated with Al Gore's film *An Inconvenient Truth* and the accompanying web site.

understanding of the effectiveness of various activities and adjust their beliefs accordingly, the quantity of the public good that they voluntarily provide could either increase or decrease, depending in part on whether they initially underestimate or overestimate the relative impact of their efforts.

In order to understand a household's motivation to provide for the public good of environmental quality, we first propose a stylized model in which there are multiple contribution mechanisms and then we use a representative survey of U.S. households to test the implications of the model. To motivate our empirical analysis, we draw from Andreoni (1990), Brekke, Kverndokk, and Nyborg (2003), and Duncan (2004). To explain the fact that voluntary contributions to public goods are larger than would be expected if individuals were purely self-interested, Andreoni (1989, 1990) has developed a private consumption model in which it is the act of giving that generates utility (or "warm glow"). An implication of this model is that individuals would not account for the impact of their contributions on the supply of the public good. Alternatively, Duncan (2004) proposes a public consumption model in which individuals gain utility from the increase in the public good caused by their own efforts (what Duncan calls "impact philanthropy"). Our work bridges these two approaches to altruism. We assume that individuals receive a warm glow from contributions and, also, that more effective efforts generate more utility. In addition, unlike Duncan (2004), we allow for individuals to have inaccurate information about the effectiveness of their contributions. We find evidence for a modified warm glow: individuals are more likely to engage in behaviors they perceive have higher impacts on increasing the public good.

We also draw from the work by Brekke, Kverndokk, and Nyborg (2003). Their model considers individuals who contribute in order to be socially responsible and accounts for the

effectiveness of efforts and changes in information. The authors present statistics that are consistent with the predictions of their model but do not explore whether individuals hold different beliefs about the effectiveness of pro-environment behaviors and how those beliefs correlate with efforts. In contrast, in our empirical analysis we identify substantial variability in beliefs about the impact of several activities that reduce emissions of carbon dioxide and use this variation to explain the frequency of related pro-environment behaviors, after controlling for socio-economic variables and attitudes.

Finally, our work relates to the literature examining personal values and sustainable consumption.[2] This area of research usually focuses on the categorization of values (for example, universalism versus individualism) and analyzes the influence of values on attitudes, intentions, and behaviors. Although we do control for values in our analysis, our main hypotheses relate to the effects of perceived effectiveness of efforts on the type and intensity of pro-environment behaviors.

The paper proceeds as follows. In Section 2 we present a simple theoretical model to guide hypothesis testing. Section 3 presents the empirical methods and main hypotheses. Section 4 describes the survey design and the original data set used for our empirical analysis. Section 5 discusses the main results and robustness checks and section 6 concludes.

2 Theoretical Framework

In this section, we present a stylized model to guide our empirical analysis. We consider individuals who can contribute to the public good of environmental quality, *G*, through *J* distinct behaviors. The utility of individual *i* is equal to:

[2] The literature examining values and sustainable consumption is large. See, among many others, Thogersen and Olander (2002), and Dietz, Gergory, and Guagnana (1998).

$$U_i = u(x_i, G, g_1(e_{i1}), \ldots g_J(e_{iJ})) \quad (1)$$

where x_i represents consumption of the private good, G represents environmental quality, e_{ij} represents the effort that individual i makes in performing behavior j, (j=1 to J), and $g_j(e_{ij})$ represents individual i's contribution to environmental quality through behavior j. We assume utility is increasing and concave in all arguments. In our empirical model, the dependent variable for effort measures the frequency with which individuals engage in several behaviors. Thus, we assume that time is spent either producing the private good or supplying efforts e_{ij} to particular behaviors. We assume that an individual's contributions to environmental quality through behavior j increases with efforts at a decreasing rate and allow for $g_j(e_{ij})$ to vary across individuals.[3] The specification in Equation 1 is general enough to allow each $g_j(e_{ij})$ to contribute to the warm glow in potentially a different way. This allows for individuals to obtain different amounts of utility from the same amount of carbon reduction, possibly because some of these activities may be associated with different levels of comfort or convenience. Time spent in the private sector is directly converted into the private good so that individuals face the following time constraint:[4]

$$x_i + \sum_j e_{ij} = T \quad (2)$$

Environmental quality is a linear function of the impact of the individual efforts:

$$G = G(g(e)) = b\sum_i \sum_j g_j(e_{ij}) \quad (3)$$

[3] This assumption of decreasing returns is reasonable if individuals first undertake activities that are the easiest in contributing to the public good. Abatement might increase with effort at an increasing rate if there were learning-by-doing.

[4] It might be more natural to think of comfort or convenience factors as a cost along with time, rather than suggesting that discomfort or inconvenience simply reduces the utility from a particular activity as we have above. However, because it is difficult to conceptualize a constraint for these costs (there is no uniform upper limit for them like there is for hours in a day), we make the simplifying assumption that the optimization is done only with a time constraint and the disutility of some activities enters via the utility function.

where b>0 is a constant. Individual *i* chooses effort levels $e_{i1,} \ldots e_{iJ}$ to maximize equation (1). The first order conditions are:

$$\frac{\partial U_i}{\partial x_i} = \frac{\partial g_j}{\partial e_{ij}}\left[b\frac{\partial U_i}{\partial G} + \frac{\partial U_i}{\partial g_j} \right] \quad \forall i, j \tag{4}$$

In our empirical model we examine how perceptions about the effectiveness of specific activities that reduce emissions of carbon dioxide correlate with the frequency with which individuals undertake related behaviors. In the theoretical framework, we let $\hat{g}_{ij}(.)$ denote the belief of individual *i* about the effectiveness of behavior *j* in reducing carbon emissions and $\hat{b}_i$ denote the belief of individual *i* about the technology that transforms carbon reduction into environmental quality. Misperceptions can occur when either $\hat{b}_i \neq b$ or $\hat{g}_{ij}(\cdot) \neq g_j(\cdot)$. An individual with imperfect information chooses the optimal levels of effort given $\hat{g}_{ij}(\cdot)$ and $\hat{b}_i$, rather than the actual technology. Thus, the first order conditions are:

$$\frac{\partial U_i}{\partial x_i} = \frac{\partial \hat{g}_{ij}}{\partial e_{ij}}\left[\hat{b}_i \frac{\partial U_i}{\partial G_i} + \frac{\partial U_i}{\partial \hat{g}_{ij}} \right] \forall\ i, j \tag{5}$$

We are interested in how changes in $\hat{g}_{ij}(\cdot)$ and $\hat{b}_i$ influence the optimal level of efforts. In other words, letting $\hat{g}_e = \frac{\partial \hat{g}_{ij}}{\partial e_{ij}}$ what is the sign of $\frac{\partial e_{ij}}{\partial \hat{g}_e}$ and $\frac{\partial e_{ij}}{\partial \hat{b}_i}$? Of course, e_{ij} is implicitly defined by Equation (5) and applying the implicit function theorem, we find

$$\frac{\partial e}{\partial \hat{g}_e} = -\frac{\left[\hat{b}U_G + U_{\hat{g}}\right]}{U_{xe} - \left(\hat{g}_{ee}\left[\hat{b}U_G + U_{\hat{g}}\right] + \hat{g}_e\left[U_{\hat{g}e} + U_{Ge}\right]\right)} \tag{6}$$

where, to make our notation more compact, we represent the variable that is changing in the derivative as a subscript. For example, $U_G = \frac{\partial U}{\partial G}$; $U_{xe} = \frac{\partial^2 U}{\partial x \partial e}$; $\hat{g}_{ee} = \frac{\partial^2 \hat{g}}{\partial e \partial e}$, etc.

Without making further restrictive assumptions, we see that it is not possible to determine if Equation 6 is positive or negative. Technically, the reason is that it is not possible to sign $U_{\hat{g}e}$ or U_{Ge}. In understanding why this is so, it is important to understand that, given the time constraint, any increase in effort for one activity must be offset by decreases in efforts to other activities and/or the private good. U_{Ge} could be positive or negative because, as a result of efforts in one activity increasing, efforts in other activities could decrease. Because individuals are acting based on their beliefs of the effectiveness of their efforts and not based on the true effectiveness, we are unable to determine if *G* increases or decreases and therefore what happens to the marginal utility of *G*. Similarly, $U_{\hat{g}e}$ is undetermined without further assumptions because we have allowed $g_j(e_{ij})$ to enter the utility function both directly as a warm glow and indirectly via its ability to produce *G*. Without making additional assumptions about the relative marginal utilities of the carbon reduction that results from different kinds of activities we cannot determine if $U_{\hat{g}e}$ is positive or negative. As a result of these uncertainties, the sign of Equation 6 is ambiguous.[5] Although we do not present the detailed derivation here, we reach the same conclusion about the sign of $\frac{\partial e_{ij}}{\partial \hat{b}_i}$ for similar reasons. Because we do not have theoretical grounds to impose assumptions that will allow us to reach a more definitive conclusion regarding the effects of changes in beliefs about the effectiveness of activities, we leave this as an open empirical question for which finding the answer is the focus of this paper.

In what follows, we examine this question by using a cross-section of households and we exploit the variability in beliefs about the impacts of several activities on carbon reduction to

[5] If we assume that 1) the warm glow effect for $g_j(e_{ij})$ is identical across all activities, 2) that people get utility from their belief about *G* rather than the actual *G*, and 3) the belief about *G* is related to their own efforts, then we can determine that Equation 6 is positive and that efforts increase for an activity when people believe its marginal effect is higher.

explain frequency of related pro-environment behaviors. In drawing out the policy conclusions regarding the effects of more accurate information, we implicitly assume that more accurate information would lead to beliefs that are closer to the true impact on carbon emissions of various activities. Section 4 presents the data and provides more specifics on the variables we use. In Section 5 we discuss results that indicate individuals are more likely to engage in pro-environment behaviors the higher the perceived effects of specific activities on carbon emissions.

3 Methods and Hypotheses

Our dependent variables measure the frequency over the past 12 months with which individuals undertake each of the following behaviors out of concern for the environment: recycling, reducing energy consumption at home, buying environmentally friendly products, and altering food consumption. We do not observe the actual amount of effort individuals dedicated to each behavior. Rather, we observe responses on a 1 to 4 scale with 1 corresponding to "never," 2 corresponding to "occasionally," 3 corresponding to "frequently," and 4 corresponding to "nearly all the time." Thus, our dependent variables are ordinal. Because these variables violate the assumption of the linear regression model of equal distance between categories, we present results from ordered probit models.[6]

For a given behavior and individual, the actual level of effort e^* is unobserved. In our empirical model, e^* depends on socio-economic characteristics, general attitudes, and values that we denote with the vector of controls X. We also assume that the level of efforts depends on the perceived effectiveness of specific activities on carbon abatement that we denote with the vector W. Then, the structural model for individual i is: $e_i^* = X_i\beta + W_i\gamma + \varepsilon_i$. We observe e =1 if

[6] We also estimate ordered logit models, multinomial logit and probit models, and OLS models. We find the results are robust to the estimation method. We discuss these issues in more detail in Section 5.

$-\infty \le e^* < \delta_1$, e = 2 if $\delta_1 \le e^* < \delta_2$, e = 3 if $\delta_2 \le e^* < \delta_3$, and e = 4 if $\delta_3 \le e^* < \infty$, where e can be our ordinal measure of the frequency of behaviors: recycling, energy conservation, use of environmentally friendly products, or altering food consumption. The δ parameters are thresholds such that the observed response changes as the unobserved level of effort e^* crosses the cut-off points. For given values of the independent variables, the probability of outcome m (m = 1 to 4) is: $\Pr(e = m \mid X, W) = F(\delta_m - X\beta - W\gamma) - F(\delta_{m-1} - X\beta - W\gamma)$, where we assume F is the normal cumulative density function with Var(ε) = 1.[7]

Equation 5 provides the first order conditions to the individual's problem determining e^*. As we describe in more detail below, we proxy for $\partial \hat{g}_{ij} / \partial e_{ij}$, $\partial G_i / \partial \hat{g}_{ij}$, $\partial U_i / \partial \hat{g}_{ij}$ and $\partial U_i / \partial G_i$ with responses to questions from a nationally representative U.S. household survey. In the next section, we describe this survey in more detail and discuss how we proxy these concepts.

4 Survey Design and Data

We use data for approximately 1,700 respondents from a new nationally representative U.S. household survey conducted in September and October of 2007. The respondents to the survey were part of the Knowledge Networks Internet panel and were recruited via random digit dialing. Knowledge Networks uses a unique sample design for Internet panels, providing households Internet access to avoid the biased sample that results from requiring participants to obtain Internet access on their own.[8,9] Knowledge Networks does not accept volunteer panelists.

[7] We replicate all models assuming F is logistic. We draw the same main inferences but the standard errors under the assumption of normal errors are systematically smaller in our data.

[8] Internet surveys have several advantages. They allow for more complex questions than can be asked in a telephone survey and are less likely to be subject to interviewer bias (trying to please the interviewer by responding the "right way") than telephone or face-to-face surveys are. See Krosnick and Chang (2001) for a comparison of random digit dialing telephone interviews, the Knowledge Networks Internet panel, and other Internet panels.

[9] The response rate among Knowledge Networks panelists for our survey was 66%. Berrens et al. (2004) also present results using a survey implemented by Knowledge Networks (KN) on willingness to pay for climate change

The survey instrument contained fifty questions.[10] The first set of questions is about general attitudes toward the natural environment. The second group elicited how frequently individuals engage in pro-environment behaviors out of concern for the environment. Third, the survey evaluated the respondents' general knowledge of environmental problems and beliefs about the effectiveness of specific activities on emissions of carbon dioxide. Finally, the survey asked questions about time preferences, risk aversion, and attitudes towards free riding. We augment the survey with respondent demographics and an array of individual characteristics that Knowledge Networks collects as part of their "public affairs profile," a series of questions that are asked periodically of all members of the panel.

To measure contributions to the public good of environmental protection we use four questions that elicit how frequently individuals engage in pro-environment behaviors out of concern for the environment. In particular, we ask the following questions: "These are some things some people do to help the environment. In the last 12 months, *out of concern for the environment*, how often have you done the following?" We then list a number of different behaviors, including the following four that we focus on: recycling (RECYCLE), reducing energy consumption at home (ENERGY), buying environmentally friendly products (PRODUCT), and altering food consumption (FOOD). The survey gave some specific examples for the behaviors such as: washing clothes in cold water instead of hot as a way to reduce energy consumption, using energy-saving light bulbs as an example of buying environmentally friendly products, and eating less meat as a way to alter food consumption for environmental reasons.[11]

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mitigation and Cameron and DeShazo (2001, 2004) show that their KN sample is comparable to data from the 2000 Census.

[10] The entire survey as well as more detailed information about the survey methodology can be obtained from http://www.hamilton.edu/levitt/Sustainability/Environmental_survey_2008.html.

[11] See the Appendix for the text of the complete questions.

Surveys such as the World Values Survey ask similar questions but code responses simply as yes or no. We gather data on the frequency of pro-environmental behaviors and find that beliefs affect not only whether individuals engage in certain activities, but also the degree to which people engage in them, indicating that collapsing responses into a binary variable is inappropriate.

In addition, we are also able to validate the data by matching up the survey responses with other data sources. Specifically, we use 2006 data reported by states to an on-line form designed by the journal BioCycle (in collaboration with Columbia University's Earth Engineering Center) on the reported percent of municipal solid waste recycled. We calculate average recycling rates in the BioCycle data by Census region and compare it to the percent of respondents who claim to recycle "Nearly all the time" or "Frequently" in our survey. We observe a clear overlap. Actual recycling rates are the highest in the Pacific (excluding Alaska), Middle Atlantic, and New England. In our survey, stated recycling efforts are the highest in these same three regions. A clear correspondence also exists between recycling rates and survey responses for the Mountain, West South Central, and East South Central regions, where recycling rates and efforts are the lowest of the nine regions.[12]

As we discussed earlier, we are interested in examining how pro-environment efforts correlate with the perceived effectiveness of activities that reduce carbon emissions. A unique aspect of our survey is a series of questions that assess the respondents' beliefs about the effectiveness of specific activities on emissions of carbon dioxide. First, the survey noted that "scientists think that average global temperatures are rising and global climate is changing because carbon dioxide from burning coal and oil and other greenhouse gases are released into

[12] We use 2002 data for Georgia and exclude Alaska to calculate the average for the Pacific region as Alaska reports an unusually low recycling rate. There are not comparable data available on energy savings, purchases of environment-friendly products and food products.

the atmosphere."[13] Then, as a baseline comparison, the survey stated that adjusting the thermostat in a typical household up two degrees in the summer and down two degrees in the winter is associated with a 2,000 pound reduction of carbon emissions per year. Subsequent questions asked the respondent to rate the impact of different activities in terms of the amount of carbon reduction: recycling half of household garbage (RECYCLE_BELIEF), using cold water instead of hot to wash one's clothes (COLD_BELIEF), replacing five regular light bulbs with compact fluorescent light bulbs (LIGHT_BELIEF), and eliminating all animal products from one's diet (VEGAN_BELIEF). Respondents were asked to make their "best guess" as to how much these behaviors reduced carbon emissions per year: significantly less than adjusting your thermostat (less than 1,500 pounds), about the same as adjusting your thermostat (1,500 up to 2,500 pounds), and significantly more than adjusting your thermostat (more than 2,500 pounds). We code these responses in two indicator variables for each behavior (where the omitted category is less than 1,500 pounds). We also create an index from these four questions by giving each respondent one point for each correct answer, SCORE.

In the estimation of pro-environment behaviors, we also control for general knowledge about environmental problems as well as attitudes and values related to the environment, as these correlate with behaviors and perceptions of the effectiveness of specific activities. The survey asked individuals whether or not they considered themselves to be an environmentalist. From the responses to this question, we constructed two indicator variables, GREEN_SOME and GREEN_DEF, indicating those who responded "yes, somewhat" and "yes, definitely,"

[13] This information was provided *after* respondents answered questions eliciting general knowledge about causes of climate change.

respectively.[14] Our respondents were asked the same question approximately six months before they completed our survey, as part of Knowledge Networks' public affairs profile. We repeated the question to explore whether individuals might want to appear to have the "right" attitudes in our survey. We find a high degree of correlation between the responses: only seven people who said they were definitely not an environmentalist six months earlier claim to definitely be an environmentalist in our survey. This consistency across time and in different contexts adds confidence to our data.

We include three variables that measure basic knowledge about climate change by using the extent to which people believe it is true that "Every time we use coal, oil, or gas, we contribute to climate change." Those who said this statement was definitely true are indicated by the indicator variable, COAL_DEF, those who said it was probably true are indicated by COAL_PROB, and those who said it was probably not true are indicated by COAL_NOT.[15]

To control for the degree to which individuals believe their actions influence overall environmental quality, we include the variable FATALIST that equals one if the individual strongly agrees or agrees that it is "difficult for somebody like me to do much about the environment." Individuals might also contribute to the public good if the level of the public good itself generates utility. On a scale of one to four, PERSONAL indicates the extent to which people believe that climate change will affect them personally and LIVSTAND indicates the extent to which people believe that environmental damage will cause a reduction in living standards in the next 50 years.

[14] We also experimented in our models with commonly used environmental attitudes and found those variables are statistically insignificant after controlling for self-reported environmentalism. Those results suggest that our measure of environmentalism summarizes well a person's overall attitudes toward the environment.

[15] The survey included other general knowledge questions but this one has the strongest predictive power.

We include two variables related to an individual's overall propensity to contribute to public goods: a proxy for social responsibility and a proxy for optimism. We measure social responsibility by summing the responses to questions about the justifiability of cheating on taxes, riding public transportation without paying the fare, downloading copyrighted music or movies without permission, and buying stolen goods. Respondents state on a scale of one to ten where a ten indicates that the behavior can "never be justified" while a one indicates that the behavior is "always justifiable."[16] The sum of these responses becomes an index of civic responsibility, CIVIC, which ranges from 4 to 40.[17] We also control for an individual's overall level of optimism by including the response to a question that elicits, on a scale of one to four, how strongly individuals agree with the statement that "the U.S. economy will improve in the next five years."

Demographic controls include dichotomous variables for married respondents, homeowners, African-Americans, Hispanics, and two variables indicating if the individual is a high school or a college graduate. We also include age and age squared, self-reported health status, the log of household income (at the census block level), and the fraction of the population in the respondent's zip code that is classified as being in an urban area. These demographic variables control for the opportunity costs of engaging in pro-environment activities. For example, more educated individuals may be more sensitive to environmental issues or respondents with higher income may find it easier to incur costs associated with pro-environment actions such as buying more environmentally-friendly products. Recycling could be more convenient for those who live in urban areas or who own their own homes. Finally, we account

[16] These questions and scales of responses are similar to ones that appear in the World Values Survey.
[17] This treatment parallels that in Knack and Keefer (1997) who use a similar set of questions from the World Values Survey to measure civic responsibility at the country level. Only about one third of our sample indicated that all of these behaviors are "never justifiable."

for geographic factors that can influence the opportunity cost of engaging in the behaviors with indicator variables for region (Northeast, Midwest, South, and West).[18] In Section 5.3, we discuss additional results when we include state-level variables, in particular, average retail prices of electricity, proportion of a state's population with access to curbside programs, and average prices received by beef cattle farmers.

Descriptive statistics and definitions for these variables appear in Table 1. Compared to the U.S. Census Bureau demographic statistics, both our unweighted and weighted data are representative of the U.S. population. The 2000 Census estimates that the U.S. population is 51 percent female, 12 percent African-American, and 11 percent Hispanic, all within a 95 percent confidence interval for the means in our data. Nonetheless, we use weighted data for Table 1 and all models.[19]

"Nearly all the time" is the modal response for RECYCLE at approximately 45 percent of the sample. "Frequently" is the modal response for ENERGY and PRODUCT (39 and 38 percent, respectively) while "Occasionally" is the most frequent response for FOOD (39 percent of the sample). There are 173 unique response patterns to these questions and the frequency of patterns is very evenly distributed. Overall, there is a substantial amount of variability in the frequency with which individuals engage in these four behaviors. Regarding how people perceive the effectiveness of several activities, we find that most people do not have an accurate sense of the impact of their actions. The source of error is that, on average, respondents overstate the effectiveness of some activities. This can explain why fatalists do slightly better on

[18] We have also estimated the models considering nine, rather than four, geographical regions. The results for the variables of interest are very similar and we present the results of the more parsimonious model.

[19] Demographic and geographic distributions from the Current Population Survey as well as information from the entire Knowledge Networks panel re Internet access are used as benchmarks in the construction of the weights. See http://www.hamilton.edu/levitt/Sustainability/Environmental_survey_2008.html for more detail on the calculation of the weights. Our main conclusions are unaffected by the use of sampling weights. Results for estimations without weights and any others discussed but not reported in detail are available from the authors upon request.

the total score for this four question "quiz." It is interesting to compare other statistics between those who believe that they cannot do much about the environment (fatalists) and those who think they can. As Table 1 shows, non-fatalists are more likely to engage in all types of behavior, to describe themselves as environmentalists, and rate the individual activities (recycling, using cold water, using compact fluorescent light bulbs, becoming a vegan) as having a high impact. On the other hand, fatalists and non-fatalists seem to be equally civic-minded as indicated by the averages for the index of civic behavior, CIVIC. If this variable is related to an individual's ability to receive a pure warm glow (a benefit from effort, regardless of the impact), this similarity could explain why the fatalists still contribute.

Prior to presenting our results, we relate the variables discussed above to the optimization problem in Section 2. We control for the perceived impact of various activities on reducing carbon emissions with RECYCLE_BELIEF, COLD_BELIEF, LIGHT_BELIEF, and VEGAN_BELIEF. We note that the dependent variables measure efforts out of concern for the environment while these belief questions measure perceived effectiveness of several activities on carbon emissions. If individuals undertake pro-environment efforts because of multiple impacts on environmental quality in addition to carbon emissions reductions, then it would be more difficult to find statistically significant effects for the belief questions. We expect the coefficient estimate on these variables to be positive if, as we discuss in Section 2, the effect of an increase in the belief about effectiveness of an activity makes an individual increase the effort in that activity. We measure $\partial G/\partial \hat{g}_{ij}$ with FATALIST. Holding everything else constant, we expect the coefficient on FATALIST to be negative as lower values of $\partial G/\partial \hat{g}_{ij}$ should be associated with less effort in providing the public good and greater consumption of the private good. We proxy for the marginal effect of contribution on utility, $\partial U_i/\partial \hat{g}_{ij}$, with GREEN_SOME

("somewhat of an environmentalist") and GREEN_DEF ("definitely an environmentalist"). We hypothesize that the coefficients on these two variables are positive as environmentalists should derive more utility from contributing to the public good of resource conservation. In addition, CIVIC might measure overall incentives to contribute to public goods. We control for the marginal effect of the public good on utility, $\partial U_i / \partial G_i$, with PERSONAL and LIVSTAND. We expect the coefficient on these variables to be positive as utility should increase with private benefits. The model indicates that an individual's optimal provision of the public good depends on the interaction of fatalism, warm glow, and perceived effectiveness. Because we use binary variables to measure all these effects and the models are fairly complex, rather than adding interaction terms we estimate models for strong and weak environmentalists as well as fatalists and non-fatalists separately.

5 Results

In this section, we first discuss the effects of socio-economic and attitudinal variables and show that attitudes correlate with frequency of behaviors as expected. Second, we estimate the relationship between perceived effectiveness of several activities and frequency of behaviors closely related to those activities. We find robust evidence that only the belief about the impact of a specific activity correlates positively with the corresponding behavior. Then, we examine the issue of reverse causality and present evidence suggesting that it is *not* the case that individuals simply assign a higher impact to the activities related to the behaviors they undertake more often. Finally, we discuss robustness checks.

5.1 Base Models

Table 2 presents coefficients from an ordered probit estimation when we include all variables except the perceived effectiveness of specific activities in reducing carbon emissions.

Some demographic controls consistently explain the frequency of pro-environment behaviors. Women are more likely to say that they conserve energy, buy environmentally friendly products, and alter their food consumption out of concern for the environment than men are. We calculate that women are 6 percent more likely to say they conserve energy at home almost all the time than men are. African-Americans are 14 percent less likely to recycle and 10 percent less likely to conserve energy at home at least frequently than individuals of any other race or ethnicity, everything else equal. Those who live in more urban areas are more likely to recycle (perhaps because recycling programs are more widely available to urban residents) but they are less likely to report conserving energy or buying environmentally friendly products.

The more strongly individuals agree with the statement that environmental degradation will cause living standards to decline, the more likely it is that they conserve energy at home (about 5 percent more likely to do this activity nearly all the time) and alter food consumption (about 7 percent more likely to do this activity at least frequently).[20] Individuals who strongly agree with the statement that climate change may affect them personally are more likely to buy environmentally friendly products and alter food consumption (the coefficient in the energy model is significant at the 10 percent level). The marginal effects are approximately of the same magnitude as the effects for LIVSTAND. We also find the expected sign for CIVIC, suggesting that those who are more civic-minded are more likely to engage in all of these behaviors, independent of their values and beliefs about the environment.[21]

As expected, self-proclaimed environmentalists are more likely to engage in all behaviors. The more definite individuals are about their environmentalism, the larger the effect is. Strong environmentalists are almost 29 percent more likely to conserve energy at home

[20] We obtain qualitatively similar results when we enter three indicator variables for PERSONAL and LIVSTAND.
[21] This result corroborates the findings of Owen and Videras (2006) who find a similar effect using data from the World Values Survey.

nearly all the time than non-environmentalists, 42 percent more likely to recycle nearly all the time than non-environmentalists, 36 percent more likely to purchase environment-friendly products, and 26 percent more likely to alter their food consumption. The marginal effects for the weak environmentalists (relative to non-environmentalists) are approximately half of the effects for the strong environmentalists. Meanwhile, individuals who do not believe that they can have an impact on the environment are less likely to engage in all behaviors. Everything else equal, fatalists are about 10 percent less likely to recycle and buy environment-friendly products nearly all the time than non-fatalists. Fatalists are approximately 8 percent less likely to conserve energy and alter food consumption as often as non-fatalists. [22]

Knowledge that using coal, oil, or gas contributes to climate change affects recycling behavior and energy conservation only. It might be that it is more difficult for individuals to relate the use of environmentally friendly products or food consumption to carbon emissions than it is to understand the relationship between recycling or energy conservation and carbon emissions. Finally, these models include SCORE, the score that individuals received on the four question quiz about the impact of specific behaviors on carbon abatement. We find that better knowledge about the effect of specific behaviors is negatively and significantly related to energy conservation at the 5 percent level and buying environmentally friendly products at the 10 percent. Since individuals tend to overestimate the effectiveness of specific activities, a higher score implies that the individual is less likely to overestimate the impact of the activities and therefore is less likely to engage in these behaviors, all else constant.

In the models in Table 2, the estimates of the cut-off points are all statistically different from zero. We also have evidence to reject the null hypothesis that the difference between

[22] A number of studies in economics and other fields show fatalism to be a strong predictor of behavior such as disaster preparedness (McClure, Allen and Walkey, 2001), voting behavior (Goodwin and Allen, 2000), and saving (Wu, 2005).

consecutive thresholds is zero. Thus, the responses ("Almost all the time," "Frequently," Occasionally," and "Never") reflect distinct meaningful thresholds approximating the intensity of the behavior. This suggests it is not appropriate to collapse responses into a binary indicator. Although many surveys such as the World Values Survey use dichotomous choice questions, we find interesting results regarding both the type of behavior and the intensity of the behavior.[23]

5.2 The Effects of Perceived Effectiveness of Specific Activities

In Table 3 we drop the variable SCORE and add the perceived impacts of specific activities individually. We remind the reader that we gave the baseline example that adjusting the thermostat up or down two degrees reduces carbon emissions by approximately 2,000 pounds per year and then asked people to provide their best guess for the annual reduction in carbon emissions (less than 1,500 pounds, 1,500 to 2,500 pounds, or more than 2,500 pounds) for each activity: recycling half of the household's waste (RECYCLE_BELIEF), replacing five regular light bulbs with five compact fluorescent light bulbs (LIGHT_BELIEF), eliminating all other animal products from diet (VEGAN_BELIEF), and using cold water instead of warm or hot water to wash clothes (COLD_BELIEF). Thus, we interpret the coefficients as the effect of believing a given activity reduces carbon emissions by 1,500 to 2,500 pounds or more than 2,500 pounds relative to the omitted category (the activity reduces carbon emissions by less than 1,500 pounds per year).[24]

[23] We also estimate a multinomial logit model and perform a likelihood-ratio test that strongly rejects the null hypothesis that any pair of categories can be collapsed.

[24] When answering these questions, individuals might have focused on the relative comparison with energy conservation since the baseline uses adjusting the thermostat as an example. If this were the case, we should not find that a perceived high impact of using cold water correlates with overall energy conservation. However, we do find positive and strongly significant effects of this belief on energy conservation. In addition, we do not find that perceived high impacts of other activities have a negative and significant effect on energy conservation. These results suggest that individuals evaluate the effectiveness of the activities relative to the baseline of 2,000 pounds per year and not relative to the activity of energy conservation as a whole.

In the first column of Table 3 we include indicator variables for individuals who believe that recycling has a medium impact on reducing carbon emissions and a indicator variable for those who think the impact is high (the correct answer is medium impact). The positive and significant coefficient on the high impact belief (RECYCLE_BELIEF_HI) indicates that people who believe that recycling half of one's household garbage reduces carbon emissions by more than 2,500 pound of carbon emissions per year are more likely to recycle more often. Columns two through four present similar findings for ENERGY, PRODUCT, and FOOD. Those who believe that a specific activity has a higher impact than the baseline are more likely to engage in the behavior most closely related to that activity with greater frequency. Because it might be possible that people who believe that all activities are high impact are more likely to engage in each behavior, we include indicator variables for the perceived effectiveness of all activities simultaneously in each model (columns 5 through 8 of Table 3). We find that it is the perceived effect of the activity most closely associated with each behavior that enters significantly and not the perceived effects of any of the other three activities.

Table 4 presents the marginal effects from the coefficient estimates in Table 3, columns 1 through 4. For example, the second column of Table 4 shows the marginal effect of believing that recycling half of a household's garbage reduces carbon emissions by more than 2,500 pounds per year. This perception reduces the probability that people never recycle by 2.5 percent, the probability that people "occasionally" recycle by 4.7 percent, and the probability that people "frequently" recycle by about 1 percent (conversely, it increases the probability that people report recycling "nearly all the time" by 8.1 percent). Similar findings are evident with the remaining beliefs and behaviors. The stronger the perceived effectiveness of a specific

activity is, the higher the probabilities of engaging in the four pro-environment behaviors with greater frequencies.

To strengthen our confidence in these results, we perform additional analyses on the responses to the questions about perceived impacts. First, it is possible that there is collinearity between the perceived impacts of various activities. In that case, it might be hard to determine whether beliefs about specific activities are correlated with behaviors. To examine this issue we estimate models that include each individual knowledge question separately for each of the behaviors. We find little evidence of "cross-effects". For example, the only specific knowledge question that is statistically significant in the recycling behavior regression is the one related to the impact of recycling.[25] Overall, these results provide evidence that it is the individual's belief about the impact of specific activities that influences that particular behavior.

Second, we note that the questions about the perceived effectiveness of different activities can be difficult to answer. In that case, people may choose a "neutral" answer. We examined the response patterns to those four questions and found that the most common pattern, about 10 percent of the sample, is to say each activity has medium impact. This is a potential focal point. To asses if this affects our results, we created an indicator variable that equals 1 if the respondent chooses the most common pattern. This variable does not significantly predict any of the four dependent variables and the estimates of the perceived effect questions and other controls are almost identical.

Third, it might be possible that the perceived effectiveness of different activities does not influence people's efforts and that, when asked to guess how effective a given activity is,

[25] There are a few exceptions: people who believe recycling has a large impact on reducing carbon emissions are also more likely to report buying environmentally friendly products and altering food consumption, and people who believe that using cold water instead of hot has a large impact are also more likely to report altering food consumption.

individuals assign greater effectiveness to the activities related to behaviors they engage in more often. In that event, the responses to the impact questions would simply be another measure of actual efforts. To determine if this is a cause for concern, we examine whether the responses to the questions about the effectiveness of specific activities are systematically related to the responses to other questions in the survey, responses that we would not expect to be a consequence of a person's pro-environment behaviors. In particular, we estimate how people answer questions about the likelihood that climate change will affect them personally and their opinion on whether we worry too much about environmental problems and not enough about prices and jobs. We estimate models that include both perceived impacts and the frequency of pro-environment behaviors.[26] We find that the higher the impact on carbon emissions that individuals assign to a given activity the more likely it is that individuals believe climate change will affect them and the more likely it is that they disagree that we worry too much about the environment. For example, after controlling for actual recycling efforts, we find that individuals who incorrectly believe recycling half of a household's waste reduces carbon emissions by more than 2,500 pounds are more likely to strongly disagree we worry too much about the environment (coefficient significant at the 1 percent level). Similarly, after controlling for efforts to purchase environment-friendly products, individuals who believe using compact fluorescent light bulbs has a high impact are more likely to believe climate change will impact them personally (also significant at the 1 percent level). Because these estimations also include the actual pro-environment behaviors, these results suggest that the beliefs about impacts have additional explanatory power and that people's responses to the questions about perceived effectiveness are not simply another measure of behavior. Rather, these responses seem

[26] We estimate ordered probit models that also include income, education, gender, race, age, region, and whether the respondents consider themselves environmentalists.

consistent with a person's overall views, whether correct or not, of the severity and importance of environmental problems.

Comparing fatalists and non-fatalists also sheds light on whether perceived effectiveness influences pro-environment behaviors or if it is the case that people who do certain activities simply assign a greater effectiveness to the most closely related behavior. Fatalists think their individual contributions do not help to improve environmental quality. Thus, their beliefs about the effects of several activities on carbon emissions should not be a significant factor in their decision to contribute (but we would expect that altruism and environmental attitudes could affect their efforts). On the other hand, if beliefs about impacts merely reflect efforts, then we should still observe the same correlations between perceived impacts and efforts for this group of individuals as well. Table 5 presents the results when we split our sample into fatalists and non-fatalists. As expected, beliefs about the effectiveness of different activities do not correlate with the frequency of pro-environment behaviors among fatalists, with six of the eight coefficients in the fatalists regressions entering insignificantly. The exceptions are the belief that using cold water has a high impact and, marginally at the 10 percent level, the belief that using compact fluorescent light bulbs has medium impact. In contrast, all eight coefficients for the non-fatalists enter significantly with the expected signs. The fact that the positive correlation between perceived impacts and efforts does not generally hold for fatalists suggests that it is not the case that individuals simply give a higher impact to activities related to the behaviors they undertake more often.

What then are the factors that explain efforts by fatalists? We find that a person's level of civic-mindedness correlates with ENERGY and PRODUCT (marginally with FOOD) among fatalists. In addition, self-proclaimed environmentalists who are also fatalists are still more

likely to engage in pro-environment behaviors with greater frequency than those individuals who do not consider themselves environmentalists.[27] In fact, the marginal effect of being at least a weak environmentalist appears to be stronger for fatalists than for non-fatalists. These results provide two interesting insights. First, Andreoni's private consumption model seems to explain well the behavior of fatalists who only derive a warm glow from their contributions but who do not take into account the impact of their contributions. Second, the results suggest that it is the combination of being a fatalist and not an environmentalist that has large negative effects on the provision of the public good.

5.3 Robustness Checks

While our discussion has focused on the results of ordered probit models, we also estimate ordered logit models and find similar conclusions. A limitation of ordered models is the assumption of parallel regression.[28] When we estimate multinomial probit models that relax the assumption of parallel regression we find that we can draw the same inferences about the hypotheses of interest. We also estimate OLS models treating the behaviors as numerical variables and find that the models explain between 23 and 26 percent of the variability in the dependent variables. Given that we use individual level data, the goodness-of-fit of the models is quite good. Qualitatively and in terms of statistical significance the results are almost identical. Overall, the main results are very robust to different estimation methods.

Finally, we note that the survey questions prompt respondents to report behaviors that are done "out of concern for the environment." Even so, it is possible that individuals may be accurately reporting behavior, but still engaging in some of these behaviors to reduce household

[27] This result is consistent with findings by Kahn (2007).
[28] We perform a Brant test after running the ordered logit models and find violations of the assumption for a few variables in each model. Importantly, for the perceived impact questions, we only reject the assumption of parallel regression for LIGHTKNOW3 in the PRODUCT model (at the 5 percent level).

expenses, rather than to receive the warm glow. To validate that our results are robust to the inclusion of variables related to costs, we exploit variability across states in the opportunity cost of engaging in the behaviors. First, we use a finer regional categorization and estimate the models with eight dummy variables for New England, Mid-Atlantic states, East-North Central states, South-Atlantic, East-South Central, West-South Central, and Mountain states. Second, we use three state-level variables that may be related to individual costs and benefits: the proportion of individuals in the state with access to curbside recycling programs in the empirical model estimating frequency of recycling, retail residential electricity prices (2006 averages) in the empirical models for ENERGY and PRODUCT, and average prices farmers receive for beef cattle at the state level as a possible control in the model predicting FOOD.[29] The coefficient on access to curbside recycling programs is positive and significant at the 5 percent level. The dummy variables for the perceived impact of recycling are still positive and the dummy for high impact is now statistically significant at the 10 percent level. The coefficient estimates on retail prices and price received for cattle are insignificant. Importantly, the indicators for perceived effectiveness maintain their levels of statistical significance, providing support for the claim that costs and benefits that accrue to the individual are not the sole reason for engaging in the behaviors.

6 Summary and Conclusions

In this paper we examine how households provide for the public good of environmental quality when there are several contribution mechanisms they can choose from and there is

[29] For access to curbside programs, we use 2000 data from the 12th annual Biocycle nationwide survey (Biocycle magazine, April 2000). We obtain 2006 average residential retail electricity prices from the Energy Information Administration (http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html). The prices received of beef cattle come from the USDA National Agricultural Statistics Service. The results are available from the authors upon request.

variability in how individuals regard the impact of their efforts. Our empirical results show that beliefs do affect behaviors. Individuals who believe that a given activity significantly reduces carbon emissions are more likely to engage in the behavior most closely related to that activity than in other behaviors. In addition, it is the perceived effect of the activity most closely associated with each behavior that matters, not the perceived effects of other activities. We find that the responses to the questions regarding the impact of specific activities on carbon emissions are consistent with the respondents' overall view of the severity and importance of environmental problems. Moreover, we do not find a correlation between perceived impacts and efforts among fatalists. These results suggest that individuals are not simply assessing a higher impact to the activities related to the behaviors they undertake more often. In addition, these results show that Andreoni's private consumption model explains the behavior of fatalists who only derive a warm glow from their contributions but who do not take into account the impact of their contributions. The results also indicate that it is the combination of being a fatalist and not an environmentalist that has large negative effects on the provision of the public good.

The findings imply that the voluntary provision of the public good might increase or decrease as individuals learn about the actual impact of their activities. The typical respondent in our sample has a poor understanding about the amount of carbon dioxide emissions that can be prevented with different activities. In particular, respondents generally overestimate the impact of their efforts. Because higher perceived impacts correlate with higher frequency of pro-environment behavior, it might then be possible that better informed consumers would choose to provide less effort in creating the public good than poorly informed individuals. Conversely, to the extent that the typical individual underestimates the effectiveness of some activities that have large impacts, education might cause a more efficient allocation of efforts. Individuals in our

sample overestimate the impact of using cold water instead of hot water and the impact of using fluorescent light bulbs while around 80 percent of the respondents underestimate the effect of the high impact behavior of eliminating meat and all other animal products from one's diet.

Although we cannot rule out the possibility of some reverse causality in our results—that behaviors cause beliefs—even this phenomenon would be consistent with a utility function that valued the perceived impact of efforts. As long as it is the case that individuals gain utility from the perceived impacts of efforts, our policy conclusion remains intact. More accurate information may change behavior by either increasing or decreasing pro-environment efforts. However, to the extent that individuals do not respond to new information and exclusively form their beliefs based on their behavior, our policy conclusion about the effects of accurate information would be tempered.

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Table 1: Descriptive Statistics

	Definition	Overall Mean	Mean "fatalists"	Mean "non-fatalists"
RECYCLE	Frequency of recycling (1-4 scale)	2.96	2.70	3.09***
ENERGY	Frequency of energy conservation (1-4)	2.96	2.75	3.06***
PRODUCT	Frequency of using env.-friendly products (1-4)	2.77	2.51	2.90***
FOOD	Frequency of altering food cons. (1-4)	2.35	2.17	2.43***
GREEN_SOME	"Somewhat" of an environmentalist	.485	.423	.516***
GREEN_DEF	"Definitely" an environmentalist	.075	.034	.095***
FATALIST	Difficult to do much about environment	.330	1	0
COAL_DEF	Using coal, oil or gas definitely contributes to climate change	.240	.200	.260**
COAL_PROB	Using coal, oil or gas probably contributes to climate change	.535	.535	.534
COAL_NOT	Using coal, oil or gas probably doesn't cont. to climate change	.180	.201	.170
VEGAN_BELIEF_MED	=1 if medium impact of vegan	.328	.366	.309**
VEGAN_BELIEF_HI^{+}	=1 if high impact of vegan	.171	.154	.178
RECYCLE_BELIEF_MED^{+}	=1 if medium impact for recycle	.442	.504	.412**
RECYCLE_BELIEF_HI	=1 if high impact for recycle	.329	.219	.383***
COLD_BELIEF_MED	=1 if medium impact for using cold water instead of hot	.494	.487	.497
COLD_BELIEF_HI	=1 if high impact for using cold water instead of hot	.264	.225	.283**
LIGHT_BELIEF_MED	=1 if medium impact of using fluorescent light bulbs	.536	.525	.542
LIGHT_BELIEF_HI	=1 if high impact of using fluorescent light bulbs	.151	.115	.168**
SCORE	Overall score on impact rankings	1.15	1.27	1.09***
PERSONAL	Belief that climate change will affect individual personally	2.80	2.61	2.88
OPTIMIST	Economy will improve, 1 to 4 scale	2.40	2.40	2.40
LIVSTAND	Belief that living standards will decline	3.02	2.98	3.04
CIVIC	Index of civic behavior	34.31	33.87	34.53
Married	=1 if married	.561	.549	.566
Homeowner	=1 if own home	.651	.617	.667
Ln(Income)	Ln(household income)	10.48	10.34	10.55***
High School	=1 if high school graduate	.576	.594	.567
College	=1 if college graduate	.283	.188	.329***
Health	Self-reported health status (1-4)	3.37	3.20	3.45***
Female	=1 if female	.521	.469	.546**
Black	=1 if African American	.112	.105	.116
Hispanic	=1 if Hispanic	.127	.124	.128
Age	Age of respondent	46.31	48.00	45.47
Urban	Percent urban in zip code	77.70	77.06	78.01

Statistics calculated using sampling weights.$^{+}$ indicates correct answer, Asterisks indicate that the differences in means significant at the 1% (***), 5%(**) and 10%(*) level.

Table 2: Ordered Probit Models, Base Estimations

	(1)	(2)	(3)	(4)
	RECYCLE	ENERGY	PRODUCT	FOOD
Married	.144* (.085)	-.037 (.076)	-.004 (.076)	.003 (.079)
Homeowner	.281*** (.090)	.144* (.085)	.065 (.087)	-.009 (.092)
Ln(Income)	.053 (.045)	-.047 (.045)	-.043 (.045)	-.006 (.048)
High School	-.013 (.107)	.031 (.105)	.041 (.114)	.011 (.114)
College	.204 (.126)	.077 (.117)	-.015 (.130)	-.115 (.130)
Health	.094** (.038)	.046 (.036)	.088** (.040)	.048 (.040)
Female	.105 (.071)	.173** (.069)	.139** (.069)	.201*** (.072)
Black	-.367*** (.117)	-.311*** (.110)	-.058 (.120)	.007 (.116)
Hispanic	-.117 (.110)	-.008 (.122)	.127 (.129)	.125 (.119)
Age	-.022* (.012)	.018 (.011)	.016 (.011)	.017 (.012)
Age*Age	.000** (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
Urban	.005*** (.001)	-.002* (.001)	-.002** (.001)	-.001 (.001)
OPTIMIST	.054 (.047)	.028 (.044)	.088* (.047)	.052 (.047)
PERSONAL	-.022 (.050)	.080* (.047)	.157*** (.052)	.157*** (.054)
COAL_DEF	.784*** (.219)	.808*** (.225)	.309 (.204)	.268 (.215)
COAL_PROB	.542*** (.186)	.598*** (.203)	.104 (.179)	.099 (.174)
COAL_NOT	.463** (.185)	.650*** (.198)	.141 (.181)	.166 (.169)
LIVSTAND	.090 (.059)	.128*** (.049)	.064 (.050)	.161*** (.055)
CIVIC	.017*** (.006)	.032*** (.005)	.022*** (.005)	.011** (.006)
FATALIST	-.259*** (.072)	-.237*** (.074)	-.355*** (.076)	-.214*** (.080)
GREEN_SOME	.495*** (.075)	.385*** (.073)	.495*** (.076)	.487*** (.081)
GREEN_DEF	1.150*** (.178)	.753*** (.144)	1.011*** (.137)	.983*** (.147)
SCORE	-.030 (.038)	-.092** (.042)	-.070* (.040)	.016 (.040)
Cut-off 1	1.23*** (.61)	.88*** (.57)	.47*** (.59)	1.81*** (.61)
Cut-off 2	2.25*** (.61)	2.13*** (.56)	1.93*** (.59)	3.09*** (.61)
Cut-off 3	2.99*** (.61)	3.28*** (.56)	3.09*** (.60)	4.12*** (.61)
Observations	1671	1670	1671	1671

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%
All estimations use survey weights and include regional indicator variables

Table 3: Ordered Probit Models: The Effects of Beliefs about Specific Impacts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RECYCLE	ENERGY	PRODUCT	FOOD	RECYCLE	ENERGY	PRODUCT	FOOD
RECYCLE_BELIEF_MED	.1444				.1432	.0108	.1268	.1597*
	(.0902)				(.0923)	(.0882)	(.0980)	(.0905)
RECYCLE_BELIEF_HI	.2082**				.2448**	.0250	.1127	.1462
	(.0996)				(.1040)	(.0959)	(.1043)	(.0978)
COLD_BELIEF_MED		.1848**			.0879	.1761**	-.0099	-.0618
		(.0852)			(.0851)	(.0860)	(.0895)	(.0877)
COLD_BELIEF_HI		.4038***			.0204	.4007***	.1332	.0478
		(.0958)			(.1049)	(.0981)	(.1016)	(.1029)
LIGHT_BELIEF_MED			.1937***		-.0813	.0462	.1527**	.0031
			(.0746)		(.0812)	(.0765)	(.0769)	(.0753)
LIGHT_BELIEF_HI			.2269**		-.0638	.0441	.1760	.0436
			(.1150)		(.1094)	(.1197)	(.1223)	(.1247)
VEGAN_BELIEF_MED				.2054***	.0195	-.0148	.0884	.1877**
				(.0768)	(.0788)	(.0779)	(.0789)	(.0788)
VEGAN_BELIEF_HI				.2368**	-.1377	-.0756	-.1150	.2056**
				(.1024)	(.1094)	(.1007)	(.0976)	(.1019)
Observations	1671	1670	1671	1671	1671	1670	1671	1671

Robust Standard errors in parentheses *significant at 10%; ** significant at 5%; *** significant at 1%. Includes all control variables used in estimations in Tables 2 except SCORE. Uses sampling weights.

Table 4: Marginal Effects from Ordered Probit Models (Based on estimations in Table 3)

	(1)	(2)	(3)	(4)
	RECYCLE	RECYCLE	ENERGY	ENERGY
Impact Belief	RECYCLE_BELIEF_MED	RECYCLE_BELIEF_HI	COLD_BELIEF_MED	COLD_BELIEF_HI
Prob (Never)	-.018 (.011)	-.025** (.011)	-.013** (.006)	-.024*** (.006)
Prob (Ocasionally)	-.033* (.020)	-.047 ** (.022)	-.048** (.022)	-.10*** (.024)
Prob (Frequently)	-.005 (.004)	-.009* (.006)	-.001 (.003)	-.017** (.009)
Prob (Nearly All the Time)	.056 (.035)	.081** (.039)	.063** (.029)	.144*** (.035)

	(5)	(6)	(7)	(8)
	PRODUCT	PRODUCT	FOOD	FOOD
Impact Belief	PRODUCT_BELIEF_MED	PRODUCT_BELIEF_HI	VEGAN_BELIEF_MED	VEGAN_BELIEF_HI
Prob (Never)	-.016** (.007)	-.016** (.007)	-048*** (.017)	-.053** (.021)
Prob (Ocasionally)	-.057*** (.022)	-.068** (.034)	-.032** (.013)	-.040** (.020)
Prob (Frequently)	.021** (.009)	.017*** (.006)	.043*** (.016)	.049** (.020)
Prob (Nearly All the Time)	.053*** (.020)	.067** (.036)	.036** (.014)	.044** (.021)

Standard errors in parentheses *significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Ordered Probit Models for Split Sample (Fatalists versus Non-Fatalists)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RECYCLE	RECYCLE	ENERGY	ENERGY	PRODUCT	PRODUCT	FOOD	FOOD
	Fatalists	Non-Fatalists	Fatalists	Non-Fatalists	Fatalists	Non-Fatalists	Fatalists	Non-Fatalists
CIVIC	.011	.022***	.043***	.024***	.037***	.013*	.015*	.012*
	(.009)	(.007)	(.008)	(.007)	(.008)	(.007)	(.008)	(.007)
GREEN_SOME	.556***	.481***	.551***	.292***	.564***	.466***	.580***	.435***
	(.129)	(.094)	(.129)	(.090)	(.133)	(.092)	(.135)	(.096)
GREEN_DEF	1.380***	1.192***	.841***	.771***	1.186***	1.006***	1.105***	.956***
	(.413)	(.196)	(.310)	(.161)	(.273)	(.158)	(.371)	(.155)
RECYCLE_ BELIEF_MED	-.021 (.140)	.261** (.113)						
RECYCLE_ BELIEF_HI	.000 (.171)	.337*** (.122)						
COLD_ BELIEF_MED			.017 (.133)	.298*** (.113)				
COLD_ BELIEF_HI			.385** (.158)	.452*** (.124)				
LIGHT_ BELIEF_MED					.235* (.124)	.169* (.094)		
LIGHT_ BELIEF_HI					.016 (.182)	.338** (.141)		
VEGAN_ BELIEF_MED							-.069 (.133)	.300*** (.094)
VEGAN_ BELIEF_HI							.191 (.188)	.252** (.117)
Observations	513	1158	513	1157	514	1157	514	1157

Robust Standard errors in parentheses; *significant at 10%; ** significant at 5%; *** significant at 1%; Includes all control variables used in estimations in Tables 2 except SCORE and FATALIST; uses sampling weights.

Appendix: Survey questions on frequency of pro-environmental behaviors

Now we want to ask about things for which reducing your own personal impact on the environment is an important motivation. These are some things some people do to help the environment. In the last 12 months, *out of concern for the environment*, how often have you done the following?

Recycle

a. nearly all the time
b. frequently
c. occasionally
d. never

Reduce energy consumption at home (for example, using less hot water, using a clothesline instead of dryer, unplugging appliances not in use, only running the dishwasher with a full load, adjusting the thermostat)

a. nearly all the time
b. frequently
c. occasionally
d. never

Buy environmentally friendly products (for example, using energy saving light bulbs and recycled paper products, avoiding heavily packaged products)

a. nearly all the time
b. frequently
c. occasionally
d. never

Alter your food consumption (for example, consuming locally grown foods, buying fresh instead of frozen, eating less meat)

a. nearly all the time
b. frequently
c. occasionally
d. never