More information isn't always better: the case of voluntary provision of environmental quality

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Abstract

This paper adds to the literature on the voluntary provision of public goods by showing that the warm glow that individuals gain depends on the perceived relative effectiveness of contributions. We use a new survey on pro-environment behaviors, attitudes, and knowledge and find that individuals act in accordance with their beliefs, regardless of whether or not these beliefs are accurate, and engage more frequently in activities that have a higher perceived impact on environmental quality. 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.

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Abstract

This paper adds to the literature on the voluntary provision of public goods by showing that the warm glow that individuals gain depends on the perceived relative effectiveness of contributions. We use a new survey on pro-environment behaviors, attitudes, and knowledge and find that individuals act in accordance with their beliefs, regardless of whether or not these beliefs are accurate, and engage more frequently in activities that have a higher perceived impact on environmental quality. 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.

1 Introduction

The literature on the voluntary provision of public goods shows that contributions are larger than would be expected if individuals were purely self-interested. In Andreoni's theory of impure altruism, contributing creates a warm glow. According to this theory, it is the act of giving that generates utility (Andreoni, 1989, 1990). Duncan (2004) proposes an alternative motivation, "impact philanthropy," where the increase in the public good caused by the individual's efforts creates utility, while Brekke, Kverndokk and Nyborg (2003) develop a model in which individuals gain utility when they act in accordance with their self-image as socially-responsible people. Our paper extends this literature by developing a model in which the perceived effectiveness of effort generates utility but individuals might have inaccurate and differing information about the impact of specific efforts. We then present evidence from a new nationally representative household survey that supports the key assumptions and conclusions of the model. In particular, in the case of the public good of environmental quality, we show that most individuals hold incorrect beliefs about the impact of their pro-environment efforts, but efforts correlate consistently with perceived impacts. These results suggest that it is necessary to consider the lack of accurate information in explaining individual contributions to public goods.

Examining the relationship between the perceived impact of contributions and actual contributions has important implications for public policy. First, although it is tempting to conclude that more education about the value of individual efforts to increase the public good would result in greater provision, our model and empirical results imply that the effect of more education is ambiguous. As individuals develop a better understanding of the effectiveness of various activities, 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 what follows, we discuss the circumstances under which education may lead to a more efficient allocation of contributions and the conditions under which education may actually lead to less of the public good. A second policy conclusion, independent of whether individuals are fully informed or not, is that government regulation would not be a perfect substitute for voluntary pro-environment actions. This result parallels the conclusion in Andreoni (1989).

While our model can be applied to different public goods, we examine empirically one of today's foremost public policy challenges: reduction of greenhouse gases or, more generally, resource conservation. A great amount of information and advocacy efforts are being dedicated to these issues but it is unclear whether these campaigns are successful and whether individuals are willing to make sustainable consumption choices voluntarily.[1] We use data from a new representative national survey and estimate the relationship between the perceived impacts of several activities on emissions of carbon dioxide and actual frequency of pro-environment behaviors. We find that, on average, individuals overestimate the effectiveness of their efforts on emissions of carbon dioxide but people act according to their perceptions and engage more frequently in activities that have higher perceived impacts. Thus, we present evidence for a modified warm glow, a warm glow based on the perceived impact of contributions rather than the contribution itself.

This paper relates to several research areas. First, it adds to the literature analyzing the role that information plays in public goods contributions. Kremer and Miguel (2007) investigate the determinants of individual actions to prevent the spread of infectious disease in Kenya and find that school health education programs had no effect on individual behavior. Using

[1] A popular example is the public campaign associated with the film *An Inconvenient Truth*. In fact, we use information on this film's web site, www.climatecrisis.com as the basis for some of the examples we provide in our survey.

experimental data, Andreoni (1995) examines whether public goods contributions can be attributed to "kindness or confusion" and finds evidence for both. Houser and Kurzban (2002) present corroborating evidence. In these papers, the confusion is specific to the experimental design. In our empirical work, we find that individuals hold inaccurate beliefs about the impact of activities in which they regularly engage, but the level of their contributions is still consistent with those beliefs.

This paper also adds to the literature on the motives for altruism. As mentioned earlier, Duncan (2004) develops a model in which individuals gain utility from the increase in the public good caused by their efforts. Our model takes into account Duncan's impact philanthropy yet also includes Andreoni's original warm glow motive because individuals gain utility from the perceived impact of the effort, not from the actual consumption of the public good.[2] More importantly, we allow for individuals to have inaccurate information about the effectiveness of their contributions, an extension that has both empirical and policy relevance.

Also related to our work is the research by Brekke, Kverndokk, and Nyborg (2003) examining whether a desire to be socially responsible motivates recycling efforts and community work. As we do, they consider the effectiveness of efforts in their model. However, they focus on how effort relates to self-image and do not consider the possibility that individuals may have different levels of accuracy of information.[3] An important implication of Brekke, Kverndokk, and Nyborg (2003) is that public policy might decrease the private provision of the public good if mandated behavior makes it more difficult for individuals to fulfill their ideal actions.[4] Our

[2] In other words, in our model, individuals gain utility from the efforts even when they believe that their action has no appreciable effect on the total quantity of the public good.
[3] In their model, allowing individuals to have different perceptions about the effectiveness of effort would pose additional complications unnecessary for their main point. In particular, it would then be necessary to propose a mechanism through which individuals would define and learn the amount of effort a socially responsible person ought to exert.
[4] See also Bruvoll and Nyborg (2004) and Nyborg and Rege (2003).

research also suggests public policy might have unexpected consequences, although in our case this conclusion is due in part to the possibility that information about the impacts of different pro-environment behaviors could make individuals revise downwards the perceived effectiveness of their actions and provide less of the public good.

Finally, our work relates to the literature examining values and sustainable consumption.[5] This area of research usually focuses on the categorization of values (for example, universalism versus individualism) and their influence 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 such efforts.

The paper proceeds as follows. We present the theoretical framework in Section 2. 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

2.1 Utility Maximization

We model individuals who can contribute to a public good through J distinct activities. The utility of individual i is equal to:

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

where x_i represents consumption of the private good, G represents the total amount of the public good, e_{ij} represents the effort that individual i makes in performing activity j, (j=1 to J), and $g_j(e_{ij})$ represents individual i's contribution to the public good through activity j. We assume utility is increasing and concave in all arguments, so that $u'(\cdot) > 0, u''(\cdot) < 0$. Time is spent either

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

producing the private good or supplying efforts e_{ij} to a particular activity. We assume that an individual's contributions to the public good through activity j increases with efforts at a decreasing rate and allow for $g_j(e_{ij})$ to vary across individuals with $g_j(0) = 0, g_j'(\cdot) > 0, g_j''(\cdot) < 0$ for all j.[6] Time spent in the private sector is directly converted into the private good so that individuals face the following time constraint:

$$x_i + \sum_j e_{ij} = T \tag{2}$$

The total amount of the public good is a linear function of the impact of the individual efforts:

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

where b>0 is a constant.

Substituting equations (2) and (3) into equation (1) gives:

$$U_i = u\left[T - \sum_j e_{ij}, b\sum_i \sum_j g_j(e_{ij}), g_1(e_{i1}),..g_J(e_{iJ}) \right] \tag{4}$$

First, we solve for the social optimum, taking into account the warm glow motive of individuals. The social optimum is achieved by maximizing

$$\sum_i u\left[T - \sum_j e_{ij}, b\sum_i \sum_j g_j(e_{ij}), g_1(e_{i1}),..g_J(e_{iJ}) \right] \tag{5}$$

The first order conditions are:

$$\frac{\partial U_i}{\partial x_i} = \left(\frac{\partial g_j}{\partial e_{ij}} b \right) \sum_i \frac{\partial U_i}{\partial G} + \frac{\partial g_j}{\partial e_{ij}} \frac{\partial U_i}{\partial g_j} \quad \forall i, j \tag{6}$$

[6] 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.

For each individual, there are *J* first order conditions that correspond to the *J* possible activities that contribute to the public good. Each FOC states that the marginal utility of the private good is set equal to the sum of two terms. The first term is the marginal product of effort expended through activity *j* times the marginal product of the individual's contribution in increasing the public good times the sum of the individual marginal utilities of the public good. The second term is the marginal product of effort times the marginal utility of the individual's contribution to the public good. This second term represents the modified warm glow effect, a warm glow that depends on the impact of effort and not exclusively on the amount of effort.

2.2 Voluntary Provision

Now we derive the conditions for voluntary provision of the public good. Individual *i* chooses effort levels $e_{i1}, \ldots e_{iJ}$ to maximize equation (4). The first order conditions are:

$$\frac{\partial U_i}{\partial x_i} = \frac{\partial g_j}{\partial e_{ij}}\left[b\frac{\partial U_i}{\partial G} + \frac{\partial U_i}{\partial g_j} \right] \quad \forall i, j \qquad (7)$$

Notice the difference between the FOC's in equation (6) and the FOC's in equation (7). To achieve the social optimum, the first term on the right hand side in equation (6) includes the sum of each individual's marginal utility of the public good. Private provision of the public good will yield FOC's where the first term on the right hand side includes only that individual's marginal utility of the public good. Thus, we obtain the standard result that too little of the public good is produced relative to the social optimum.

2.3 Perceptions and Behavior

In our empirical models we examine how perceptions about the effectiveness of specific activities that reduce emissions of carbon dioxide correlate with the frequency with which individuals undertake pro-environment behaviors. Thus, we can interpret $g_j(\cdot)$ as the technology

that transforms effort into carbon abatement and $G(\cdot)$ as the technology for transforming carbon reductions into environmental quality.

Although there is an actual technology $g_j(\cdot)$ for each activity *j*, individuals might not accurately assess the effectiveness of their efforts. As we describe in the next section, we find that in a nationally representative sample, individuals differ in their beliefs about how several activities reduce emissions of carbon dioxide and that typical respondents misperceive the impact of their efforts. It is also the case that individuals hold different beliefs about technology that creates the public good (in our model this is Equation 3). For example, in our sample, only 22 percent of the respondents say it is definitely true that using coal, oil, or gasoline contributes to climate change.

Let $\hat{g}_{ij}(.)$ be the belief of individual *i* about the effectiveness of activity *j* in reducing carbon emissions and let $\hat{b}_i$ be the belief of individual *i* about the technology that transforms carbon reduction into environmental quality. Misperceptions can occur when $\hat{b}_i \neq b$ and $\hat{g}_{ij}(\cdot) \neq g_j(\cdot)$. An individual without perfect information chooses the optimal level of efforts given $\hat{g}_{ij}(\cdot)$ rather than the actual technology. Thus, the first order condition is:

$$\frac{\partial U_i}{\partial x_i} = \frac{\partial \hat{g}_{ij}}{\partial e_{ij}}\left[\hat{b}\frac{\partial U_i}{\partial \hat{G}_i} + \frac{\partial U_i}{\partial \hat{g}_{ij}}\right] \forall\, i, j \qquad (8)$$

An examination of Equation 8 reveals that without making further restrictive assumptions, the effect of more accurate information is ambiguous. The reason for this is that changes in the perceived effectiveness of efforts have both an output effect and a substitution effect. For example, as individuals who initially underestimate the impact of their efforts become better informed, the output effect decreases the optimal level of effort because

individuals are able to contribute more to the public good with less effort. On the other hand, the substitution effect increases effort because individuals allocate more time to activities with relatively higher impacts. If the output effect dominates, then when individuals learn that activity *j* has a higher impact than originally perceived, they will decrease the time they spend in that activity. If the substitution effect dominates, however, individuals will put more effort into that activity. The analogous conclusions hold when individuals overestimate the impact of their efforts—they may increase or decrease their efforts when they learn the truth.

Because we do not have theoretical grounds on which to impose assumptions to determine unambiguously the optimal response on efforts, how individuals respond to perceived impact of their actions becomes an empirical question which we take up in the remainder of the paper. The next section describes our empirical approach for providing evidence on this issue. In particular, we empirically estimate the effect of beliefs about impact of efforts on the amount and type of effort that individuals exert. Section 4 presents the data and provides more specifics on the variables used in the analysis. Section 5 provides results that indicate individuals are in fact more likely to engage in pro-environment behaviors the higher the perceived effects of specific activities on carbon emissions.

3 Methods and Hypotheses

To gather evidence on the role that perceived impacts have on pro-environment behaviors, we examine the factors affecting four different pro-environment behaviors. Specifically, our dependent variables measure the frequency over the past 12 months with which individuals undertake each of four 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

activity. 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.[7]

For a given activity and individual, the actual level of effort y^* is unobserved. In our empirical model, y^* depends on socio-economic characteristics, general attitudes, values, and knowledge, and perceived effectiveness of specific behaviors on carbon abatement. Letting the vector X represent these controls, the structural model for individual i is given by: $y_i^* = X_i\beta + \varepsilon_i$. We observe $y = 1$ if $-\infty \le y^* < \delta_1$, $y = 2$ if $\delta_1 \le y^* < \delta_2$, $y = 3$ if $\delta_2 \le y^* < \delta_3$, and $y = 4$ if $\delta_3 \le y^* < \infty$, where y can be our ordinal measure of the frequency of 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 y^* crosses the cut-off points. For given values of the independent variables, the probability of outcome m (m = 1 to 4) is: $\Pr(y = m \mid X) = F(\delta_m - X\beta) - F(\delta_{m-1} - X\beta)$, where we assume F is the normal cumulative density function with Var(ε) = 1.[8]

Equation 8 provides the first order conditions to the individual's problem and we use that equation to guide our empirical work. As we describe in more detail below, we are able to proxy for $\partial\hat{g}_{ij}/\partial e_{ij}$, $\partial\hat{G}_i/\partial\hat{g}_{ij}$, $\partial U_i/\partial\hat{g}_{ij}$ and $\partial U_i/\partial\hat{G}_i$ with responses to questions from a nationally representative household survey. In the next section, we describe this survey in more detail and discuss how the data is used to proxy these concepts.

[7] 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.

[8] 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.

4 Survey Design and Data

To test the hypotheses of the model we use data for approximately 1,700 respondents from a new nationally representative household survey conducted in September and October of 2007. The respondents to the survey were part of the Knowledge Networks Internet panel who 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.[9,10] Volunteer panelists are not accepted by Knowledge Networks.

The survey instrument contained fifty questions.[11] The first set of questions asked 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

[9] 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.

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

[11] 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.

concern for the environment. 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.

A main result of the model is that efforts to reduce one's carbon footprint through various activities should correlate with the perceived effectiveness of the activities. A unique aspect of our survey is a series of questions that assess the respondents' beliefs about the effectiveness of specific behaviors on improving environmental quality. 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 the atmosphere."[12] 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. Four 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

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

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," respectively.[13] 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

[13] 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.

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.[14]

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.

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."[15] The sum of these responses becomes an index of civic responsibility, CIVIC, which ranges from 4 to 40.[16] 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."

[14] The survey included other general knowledge questions but this one has the strongest predictive power.
[15] These questions and scales of responses are similar to ones that appear in the World Values Survey.
[16] 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."

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 for geographical factors that can influence the opportunity cost of engaging in the behaviors with indicator variables for region (Northeast, Midwest, South, and West).[17] 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.[18]

[17] 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.

[18] 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

"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 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 individuals 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 important concepts in the first order conditions of the optimization problem that appear in Equation 8. Specifically, we control for the perceived effect of various activities on reducing individual carbon emissions, $\partial \hat{g}_{ij} / \partial e_{ij}$, with the specific belief questions: RECYCLE_BELIEF,

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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.

COLD_BELIEF, LIGHT_BELIEF, and VEGAN_BELIEF. Recall that our model predicts that the larger the impact an individual attributes to an activity, the more likely it is that the individual undertakes that activity more often. This implies positive coefficient estimates for these variables. After controlling for belief about the impact of specific activities on carbon abatement, we measure the perceived marginal effect of carbon abatement on the public good, $\partial \hat{G}_i / \partial \hat{g}_{ij}$, with FATALIST. Holding everything else constant, we expect the coefficient on FATALIST to be negative, lower values of $\partial \hat{G}_i / \partial \hat{g}_{ij}$ 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, $\partial U_i / \partial \hat{G}_i$, 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 present the results of base specifications, discuss how perceived effectiveness of specific activities influences efforts, and then check for the robustness of our results.

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).[19] 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

[19] We obtain qualitatively similar results when we enter three indicator variables for PERSONAL and LIVSTAND.

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.[20]

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 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.[21]

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

[20] This result corroborates the findings of Owen and Videras (2006) who find a similar effect using data from the World Values Survey.

[21] 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).

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, this result is consistent with a modified warm glow: a higher score implies 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 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.[22]

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 behaviors 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

[22] 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.

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).[23]

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

[23] 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.

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 very little significance for the "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.[24] Overall, these results provide evidence that it is the individual's belief about the impact of specific activities, correct or incorrect, that drives 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,

[24] 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.

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, individuals assign greater effectiveness to the activities they engage in more often. In that event, the responses to the impact questions would simply be another measure of 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.[25] 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

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

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 consistent with a person's overall view of the severity and importance of environmental problems.

Comparing fatalists and non-fatalists might also shed light on whether perceived effectiveness influences pro-environment behaviors or if it is the case that people who do certain behavior simply assign a greater effectiveness to that 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 (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 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.[26] In fact, the marginal effect of being at least a weak environmentalist appears to be stronger for fatalists than for non-fatalists. These 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.[27] 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.

[26] This result is consistent with findings by Kahn (2007).
[27] 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).

Finally, we note that our model assumes individuals engage in pro-environment behavior in order to receive a warm glow and 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 expenses, rather than to receive the warm glow. To validate that our results are robust to the inclusion of variables related to individual 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.[28] 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.

[28] 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.

6 Summary and Conclusions

This paper contributes to the research on the voluntary provision of public goods by examining how the perceived effectiveness of contributions influences actual contributions. We develop a model in which warm glow depends on the impact of efforts and individuals hold different beliefs about the effectiveness of their efforts. We use a new national survey to test the implications of the model. A unique aspect of our work is that we can test how beliefs about the extent to which different activities reduce carbon emissions correlates with the frequency of pro-environmental behaviors.

Our empirical results show that individuals' actions are consistent with their beliefs, regardless of whether or not these beliefs are accurate. Individuals who believe that a given activity significantly reduces carbon emissions are more likely to engage in behaviors related to that activity than to other activities that they believe have less impact. In addition, it is the perceived effect of the activity most closely associated with each behavior that matters and not the perceived effects of other activities. Importantly, we find evidence that individuals are not simply assessing a higher impact to the behaviors they undertake more often. Rather, 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. Although in our theoretical model the correlation between perceived effectiveness of an activity and effort is theoretically ambiguous, these results suggest that the substitution effect dominates the output effect.

These 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. On the other hand, 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 perceived impact, 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.

Finally, as is the case with Andreoni's (1989) warm glow model, our model also implies that government intervention does not completely crowd out individual efforts. Andreoni shows that the warm glow motive implies crowding out of charitable donations is incomplete. Because individuals care about giving per se, a tax that pays for increases in the public good does not completely substitute for private giving. In the context of pro-environment behaviors, it is appropriate to consider government mandated behavior such as fuel efficiency standards,

mandated recycling, required phasing out of incandescent light bulbs, etc. In our model, government mandates would not be perfect substitutes for voluntary pro-environment actions, independent of whether individuals are fully informed.

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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.