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RISK, INEQUALITY AND TIME IN THE WELFARE ECONOMICS OF CLIMATE CHANGE: IS THE WORKHORSE MODEL UNDERSPECIFIED?

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Risk, inequality and time in the welfare economics of climate change: is the workhorse model underspecified?

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Abstract

In the workhorse model of welfare economics, the elasticity of marginal utility, often denoted as η, serves simultaneously to represent aversion to risk, aversion to spatial inequality, and preferences for intertemporal substitution. While Kreps-Porteus-Selden and Epstein-Zin preferences enable risk to be separated from intertemporal substitution, no model enables all three concepts to be disentangled. This theoretical lacuna is important, particularly for the economics of climate change, which is a global, long-run, uncertain externality. Much debate, for instance in the wake of the Stern Review (Stern, 2007a) has focused on the appropriate value for η. This paper tests the suitability of the workhorse model for climate change economics, by surveying the attitudes of over 3000 people to risk, time, and income inequality. The results show that individual attitudes to the three are only weakly correlated. This suggests that because the three concepts are captured by a single parameter, the model is underspecified and a richer model should be considered.

JEL classification: D01, D63, C90, Q51,
Keywords: climate change, discounting, cost-benefit analysis, risk aversion, intertemporal substitution, inequality aversion, intergenerational equity

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1. Introduction

Although rarely explicitly acknowledged, the standard welfare-economic model assigns a fairly restrictive structure to preferences for risk, inequality and intertemporal substitution. This has been highlighted recently with its application to the analysis of climate-change costs and benefits, where a single parameter must capture the aggregate social value of large disparities in impacts across time, space and states of the world. The aim of this study is to test whether public attitudes to climate-change policy conform to the restrictive structure of the standard welfare-economic model. This is done through the *Climate Ethics Survey* – a stated-preference survey delivered online to over 3000 respondents.

In applied welfare economics, the standard approach is to employ a model that consists of a Utilitarian social welfare function and an isoelastic utility function. The Utilitarian social welfare function defines social welfare as the sum of individual utilities, hence treating individuals symmetrically across time, space and states of the world. The isoelastic utility function implies that the elasticity of the marginal utility of consumption is constant. The simplicity of this specification is its chief advantage. However, this simplicity has its costs, one of which is that three distinct features of preferences are intertwined. Risk aversion, preferences for intertemporal substitution and aversion to spatial inequality (i.e. between individuals within any given time period) are all determined by a single parameter, namely the elasticity of marginal utility of consumption, η, which thus becomes very influential.

The rationale for why these three attributes of preferences should be equal rests on some rather restrictive assumptions. Harsanyi (1955, 1976) argued that if people were to choose between different income distributions from behind a 'veil of ignorance', inequality aversion would be married to risk aversion. However, such a veil of ignorance never exists in reality. Furthermore, moral judgements do not obviously derive from individual welfare-maximising choices. The most in-depth theoretical discussion is given by Broome (1991) who discovers formal theorems showing that if certain conditions are fulfilled, consistency may require that risk aversion, inequality aversion and aversion to intertemporal substitution must all be equal. Yet, he does not claim that the conditions are fulfilled for the distribution of consumption in the three dimensions, and various evidence from hypothetical choice experiments and subjective measures of well-being suggest that they are systematically violated.[1]

[1] The critical condition is what Broome refers to as *separability*. It requires that what happens in one location of a dimension can be evaluated independently of what happens in other locations in the same dimension. The dimensions in question are time, people, and states of the world. Evidence suggests that this does not hold for evaluations of income across the dimensions of time and people, as we compare our current income with our previous income, and with that of our peers (see e.g. Di Tella and McCulloch, 2006; Layard, 2005). The Allais paradox (1953) describes systematic violations of separability across states of the world.

The parsimonious structure of the workhorse model has been clearly exposed in its application to the analysis of climate-change impacts. The physical nature of these impacts means that an unprecedented load is placed on η, because the value of this parameter determines the approach taken to three of the defining characteristics of climate change as a policy problem:

1. Risk: uncertainties about the impacts of climate change are large and may in part be irresolvable (as emphasised by e.g. Stern, 2007a). Furthermore, the worst-case scenarios imply very large damages on a global scale (e.g. Weitzman, 2007).
2. Time: the marginal impact of a tonne of greenhouse gas persists long after it has been emitted (several centuries in the case of carbon dioxide – Yohe, 2003).
3. Inequality: there are large spatial disparities in the relative impacts of climate change worldwide, with tropical and sub-tropical low-income regions widely expected to experience the greatest relative damages (IPCC, 2007).

Our analysis is based on information garnered by direct questions about hypothetical consumption choices under each of the three defining characteristics of climate change, described above. In comparison with revealed preference approaches, the use of direct questioning to elicit dynamic preference over consumption has the advantage of simplicity and avoids strong assumptions on the constraints faced by individuals.

In the results of the survey, the correlations between attitudes to risk, inequality and intertemporal substitution are very weak. This suggests that the standard workhorse model is not well-suited for incorporating the attitudes of the public into the analysis of climate change, and provides a rationale for disentangling the three concepts when climate change is the topic.

The next section investigates the theory and practice of economic modelling of risk, time and inequality, and shows that the approach taken to the three issues has a very strong influence on the economic analysis of climate change. Section three describes the methodology used in the empirical research. Our findings are presented in section four and discussed in section five. Section six concludes.

2. Risk, time and inequality in the analysis of climate change

2.1 The workhorse model

To see how the elasticity of marginal utility of consumption, $\eta = \frac{-u' \cdot c}{u''}$, comes to play three different roles, we start by observing that most economic analyses make the simplifying assumption that the utility of individual *i* at time *t* (u_{it}) is a function only of that individual's consumption in the same time period c_{it}:

$$u_{it} = u(c_{it}) \tag{1}$$

Consumption is defined in the broadest sense, encompassing everything from which a person may derive utility. Hence it can include non-market goods such as an unspoilt environment and good

health, for which willingness-to-pay is estimated using various techniques. In the workhorse model, the function takes the specific iso-elastic form:

$$u_{it} = \frac{c_{it}^{1-\eta}}{1-\eta} \tag{2}$$

The Expected Utility (EU) model introduced by von-Neumann and Morgenstern (1944) provides the standard framework for analysing choice under uncertainty. It assumes that the preference function over lotteries takes the following form:

$$V = \sum_{j=1}^{n} p_j u_j \tag{3}$$

where p_j is the probability of outcome j occurring. This implies that the value of an uncertain prospect is equal to the expected level of utility associated with this prospect. When outcomes are specified in terms of consumption levels, the assumption of diminishing marginal utility implies aversion to risk. In the EU model, risk preferences can be summarised by the coefficient of relative risk aversion, which, for the isoelastic utility function, it is constant and equal to η. It follows that risk preferences are completely determined by the value for η. The assumption of constant relative risk aversion implies that people at different levels of consumption would pay the same fraction of their consumption to avoid a risk of losing a given fraction of their consumption.

Many policy questions require aggregating the utility of multiple individuals to find the total welfare of the group. A standard form of aggregation is the Utilitarian social welfare function, which defines social welfare at time t as the unweighted sum of individual utilities:

$$W_t = \sum_{i=0}^{n} u_{it} \tag{4}$$

With this specification, η becomes the coefficient of social aversion to inequality in consumption. It is defined in analogous way to the coefficient of relative risk aversion. It follows that social preferences for the distribution of consumption are determined completely by η, which can also be interpreted as the elasticity of marginal social welfare with respect to consumption.

In an intertemporal setting, the Discounted Utility model presented by Samuelson (1937) provides the standard tool. It assumes that individuals maximise the weighted sum of utility in each period, with the weights determined by the utility discount rate δ. Total utility over time (U_i) is then given by:

$$U_i = \sum_{t=1}^{T} u_{it} (1+\delta)^{-t} \tag{5}$$

Ramsey (1928) showed that an individual whose utility is given by an isoelastic function and who maximises lifetime utility will have an optimal consumption discount rate of:

$$s_t = \delta + \eta g_t \tag{6}$$

where g_t is the expected growth rate of consumption at time *t.* This tends also to be the recommended approach for social discounting (usually citing Lind 1982). The extrapolation from individual discounting to social discounting implies that future generations are treated as if they were later stages in the lives of the current generation. In this model, η becomes the measure of the aversion to intertemporal substitution. Often the term elasticity of intertemporal substitution is used to describe preferences for consumption paths over time. This is simply the inverse of the aversion to intertemporal substitution, in this case $1/\eta$.

2.2 Debate over the value of η

Due to the triple role that η plays, there are three distinct sources of data that have been used for calibration. Moreover, there are at least two fundamentally different approaches to the study of each of the three elements of η. The revealed-preference approach traditionally favoured by economists attempts to infer preferences from observed behaviour in markets, or alternatively from the observed egalitarianism of the tax system. This is in contrast to the stated-preference approach, which asks respondents about their preferences in hypothetical choice situations. The large array of different data sources and research methods has given rise to a wide range of values for η. Stern (1977) comes up with estimates ranging all the way from 0 to 10 based on revealed preference studies of all three of the dimensions of η. However, the validity of the higher estimates has been questioned by Pearce (2003). A more recent meta-study by Cowell and Gardiner (1999) concludes that a reasonable range seems to be from 0.5 to 4.

The value of η has recently been the to the subject of a great deal of attention by climate change economists. One reason for this is that in the context of climate change, there is a strong ethical element to the choice of η. Another reason is that the outcome of the numerical economic modelling of climate change is very sensitive to this parameter. It is standard practice to set the value of η to unity (Stern, 2007a; Nordhaus and Boyer, 2000; Tol, 1997; Fankhauser *et al.,* 1997; HM Treasury 2003) which gives the particularly tractable case of equation (2) where utility is the natural logarithm of consumption. However, other economists, including Dasgupta (2006), Weitzman (2007) and Gollier (2006) have suggested this value is too low. Like the numerical estimates in the literature, these arguments are typically based on evidence or introspection relating to only one of the three dimensions of η, and it is not clear that they are equally valid to all three. It therefore appears that disentangling the three may reduce the domain for disagreement (Stern, 2007b; Beckerman and Hepburn, 2007; Dietz *et al.,* 2008).

2.3 The relationship between η and climate change damage cost estimates

In the current model it cannot be predicted *a priori* what effect changing the value of η has on climate change damage costs estimates. This is because, as long as the three components of η are not disentangled, increasing the value of η will have opposing effects on the damage estimates. Higher aversion to intertemporal substitution has the effect of lowering damage estimates, because it increases the discount rate as long as expected future growth rates are positive. Higher risk aversion, on the other hand, increases the damage estimates, as more weight is placed on the most severe outcomes. This is reinforced by higher aversion to intra-temporal inequality because relative impacts are on the whole higher in countries with lower incomes.

The net effect depends on a range of assumptions about the relationship between the climate and the economy. Dietz *et al.* (2007) performed a sensitivity analysis of the PAGE2002 model used by Stern (2007a), which shows that increasing the value of η from unity to two reduces the total discounted cost of business-as-usual climate change by approximately 69 per cent. However, Dietz (2007) also shows that if the assumed sensitivity of temperatures to greenhouse gas concentrations is increased, the relationship between η and damage cost estimates becomes U-shaped, as risk aversion starts to dominate for higher values of η. It is also important to keep in mind that since this particular model does not formally incorporate aversion to intra-temporal income inequality, this effect is not included in the sensitivity analysis.

This analysis shows that the relationship between the preference attributes embodied in η and the outcome of cost-benefit analyses is complex and opaque in the workhorse model.

2.4 Alternative models

A handful of theoretical models exist that can disentangle risk aversion from intertemporal substitution. The first were developed simultaneously but independently by Kreps and Porteus (1978) and Selden (1978). The two can be shown to be equivalent (Gollier 2001), and represent generalizations of the specific EU model, which emerges as one particular case. While theoretically innovative, these models have limited potential for practical application because they can only consider two time periods. However, they have been extended into multiperiod models by Epstein and Zin (1989) and Weil (1990). These are the richest models to date, and they contain the Kreps-Porteus-Selden model as a specific subclass. They have preserved the EU model's desirable feature of dynamic consistency. Kreps-Porteus preferences have been used in an analytical model of climate change impacts by Ha-Duong and Treich (2004), but to our knowledge none of these preference structures have been incorporated into a numerical analysis of climate change.

Using a non-utilitarian social welfare function would disentangle risk aversion from inequality aversion and intertemporal substitution. Such functions have been applied to climate change damages by Fankhauser *et al.* (1997), but only in an atemporal setting. An important theoretical lacuna exists because no model to date enables all three concepts to be disentangled simultaneously.

3. Methodology

3.1 Relevant existing studies

In the context of climate change and many other policy questions, η is essentially an ethical parameter. This makes it problematic to use observed behaviour in markets to estimate its value, as explained by Beckerman and Hepburn (2007) and Dietz *et al.* (2008). The relevance of the inequality aversion implied by the tax system is also questionable, since this is an outcome of a complex political process rather than an optimization problem (Stern, 2007b). Hence, revealed-preference methods are insufficient for the question at hand. Theoretical and philosophical arguments have a bearing, given the ethical nature of the parameter, however, in a functioning democracy it would be undesirable to leave the question entirely in the hands of academics. This study therefore takes an intermediate approach, by conducting a stated-preference survey of the general public.

Our research is most closely related to Carlsson *et al.* (2005), who investigate stated preferences for risk and inequality among 324 undergraduate students from Karlstad University in Sweden. Respondents are asked to make choices on behalf of their imaginary grandchild. One experiment measures risk aversion with the level of inequality fixed, while another experiment measures inequality aversion in a setting with no risk. The results suggest that relative risk aversion is between 2 and 3 and that relative inequality aversion is between 1 and 2. The results indicate a relatively strong correlation between the two parameters with a coefficient of 0.46. Another study by the same authors (Johansson-Stenman *et al.,* 2002) contains a similar experiment on risk, except that inequality is not fixed. Consequently, the results can be interpreted as measures of either risk aversion or inequality aversion, the median of which is between 2 and 3.

Barsky *et al.* (1997) conduct an experiment designed to elicit information about risk aversion and time preferences regarding personal income. This is delivered to a subsample of the large Health and Retirement Survey in the USA. Two-thirds of respondents display a coefficient of relative risk aversion greater than 3.76, while 72 per cent of respondents display aversion to intertemporal substitution greater than 3.45. A correlation analysis yields no significant relationship between individual responses to the risk experiment and the inequality experiment. This is striking, since the workhorse model implicitly assumes a perfect correlation. But the test had limited statistical power because the number of useful observations was only 116.

The Climate Ethics Survey builds on these previous studies. The original contribution is two-fold. Firstly, all three elements of η are incorporated into the same questionnaire, allowing within-sample and within-subject comparisons, and permits an analysis of the correlation of individual attitudes across the three domains. Secondly, the survey explores the justification for disentangling η specifically in the analysis of climate change. The most important practical implications are that respondents are asked to make choices that affect the whole society, not just themselves, and that the time scale is lengthened relative to existing studies.

3.2 Challenges in stated-preference studies

To infer preferences or ethical values from people's choices in hypothetical situations is no trivial exercise. To start with, there is the inverse-optimum problem, which applies to empirical estimation of economic preferences in general, whether based on revealed or stated choices. The problem is that several different structures of preferences can be consistent with the same observed choices. The parameter values obtained from the choices consequently depend on what underlying model structure is assumed. If the structure of respondents' preferences do not conform with the assumptions we make in the next section, the estimates for the aversion parameters will not have a clear theoretical interpretation. An illustration of the pervasiveness of this problem in the domain of risk aversion is the great difficulty of squaring the expected-utility model with observed returns in financial markets (for a review see Mehra and Prescott 2003). Stated approaches reduce the problem relative to revealed approaches because they can define the choice situation more precisely, but do not avoid it completely. Because of this issue, we emphasize the results of the correlation analyses more than the estimates of the absolute values of the three dimensions of η. The former does not rely on specific assumptions about the structure of respondents' preferences, while the latter do. These assumptions are described in the next section and discussed in section 5.3.

In addition there are potential problems related particularly to stated-preference studies. There is a large literature discussing both the nature of the problems and the appropriate methodological responses (see e.g. Diamond and Hausmann, 1994 and Carson *et al.*, 2001). A basic question is whether and to what extent the hypothetical nature of the choice situation leads to a discrepancy between expressed and true preferences. Again, the correlations are not the most sensitive to this concern. Even if some hypothetical bias leads to a systematic overstatement of one parameter and a systematic understatement of another the correlations would be unaffected as long as the bias does not affect the relative ranking of respondents for the individual parameters. Potential bias to the estimated parameter values is addressed in the discussion.

3.3 The experiments

The survey consisted of five parts: 1) questions on general attitudes; 2) the inequality aversion experiment; 3) the risk aversion experiment, 4) the intertemporal substitution experiment; and 5) demographic questions. It was created in six different versions in order to accommodate different currencies and different levels of purchasing power. Individual versions were targeted at the UK, the US, Canada, Australia and Mexico; while respondents from other countries were offered a general version, with figures in US dollars. These are all available in *Appendix III* (p. 119) at http://www.economics.ox.ac.uk/members/cameron.hepburn/Helgeson(2007).pdf.

Graphs were used to help illustrate the questions on inequality and intertemporal substitution. This is in line with recent research on stated preference surveys, which suggests that visual illustrations may increase the 'evaluability' of numeric questions (Bateman *et al.* 2006). Each of the three experiments contained a short introduction, which explained the questions in simple terms and listed some assumptions that respondents needed to make. Not all the assumptions are reproduced here, but they can be found in the online survey. To reduce problems with learning and order effects, respondents were made aware that they could go back and change responses in previous sections if they so wished.

The survey was distributed through a number of different e-mail lists, which are given in Appendix I. It was also advertised on the social networking website *Facebook*. The resulting sample is purely a convenience sample. Sample biases will be discussed in section 5.2.

3.2.1 Risk aversion

Our risk experiment has two characteristics that distinguish it from other studies in economics and psychology: the stakes are large and the risks apply to the whole national economy[2]. This makes the results particularly relevant for the analysis of climate change. The structure of the questions borrows heavily from Barsky *et al.* (1997) but the framing is modified to measure aversion to societal rather than individual risk.

The experiment uses a triple-bounded dichotomous choice format. This means that respondents are grouped into eight categories based on their answers to three questions each. In the first question, respondents are asked whether they would be willing to have their government adopt a policy that

[2] The survey also contained an experiment on risks to individuals but this will not be used in this paper.

gives a 50% chance of doubling the national average income and a 50% chance of cutting it by one-third. Those who answered 'Yes' ('No') are presented with a second question which is identical, except that the amount by which income is cut is now 50% (15%). Similarly, those answering 'Yes' ('No') to the second question are given a third question in which the policy is more (less) risky.

In the standard economic framework, the responses to these questions can be used to derive a measure of aversion to risk to society. An expected-utility maximiser whose income changes proportionally to national average income will accept a policy which gives a 50% chance that income doubles and a 50% chance that it will fall by a fraction of θ, if and only if

$$\left[\frac{1}{2}U(2y)+\frac{1}{2}U(1-\theta)y\right]\geq U(y) \tag{7}$$

where *y* denotes national average income. Assuming an isoelastic utility function, this becomes

$$\left[\frac{\frac{1}{2}(2y)^{1-\eta^r}}{1-\eta^r}+\frac{\frac{1}{2}((1-\theta)y)^{1-\eta^r}}{1-\eta^r}\right]\geq\frac{y^{1-\eta^r}}{1-\eta^r} \tag{8}$$

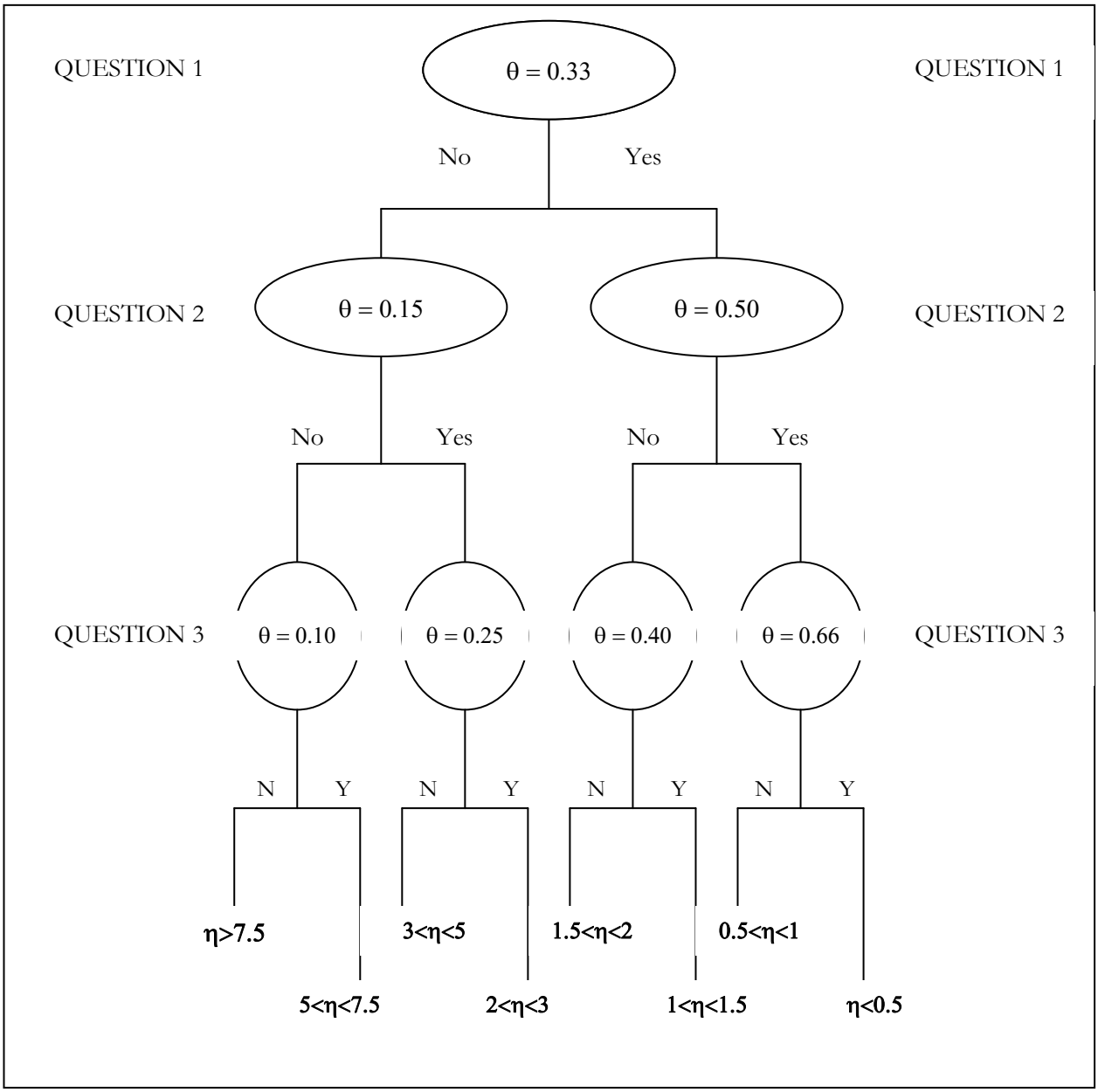
which simplifies to[3]

$$\left[\frac{\frac{1}{2}(2)^{1-\eta^r}}{1-\eta^r}+\frac{\frac{1}{2}(1-\theta)^{1-\eta^r}}{1-\eta^r}\right]\geq\frac{1}{1-\eta^r} \tag{9}$$

where η^r is the coefficient of relative risk aversion. These equations can be used to find intervals for η^r corresponding to each of the eight combinations of answers. Diagram 3.1 illustrates the structure of the questions in this section. It gives the ϑ values in each question, and shows what questions respondents will be asked based on their previous answer. Furthermore, it lists intervals for η^r into which respondents are categorised.

[3] For η^r=1, the equation is: $\left[\frac{1}{2}\ln(2)+\frac{1}{2}\ln(1-\theta)\right]\geq 0$

Figure 3.1: Triple-bounded dichotomous choice format of risk aversion experiment



3.2.2 Inequality aversion

To investigate people's aversion to income inequality, respondents are presented with a pair of hypothetical income distributions and asked to choose the one they find preferable. The options are described in terms of maximum (y_{max}), average, and minimum income (y_{min}). Option A offers the highest total income, while Option B provides a more equal distribution. A graphic presentation is reproduced in figure 3.2. Each respondent is asked three such questions. Option A stays the same, but the income levels in Option B are different for each of the three questions. This makes it possible to see how much total income the respondent is willing to trade off for a more equal distribution.

The income figures in Option A were chosen to reflect the 90th percentile and the 10th percentile of the world distribution of real income as reported by Dikhanov (2005)[4].

Figure 3.2: Graphic illustration of income distributions



	Min. Income	Average Income	Max. Income
Option A	£25	£413	£800
Option B	£103	£258	£413

Under the assumptions of the workhorse model, this information can be used to estimate the coefficient of relative inequality aversion. The mathematical structure of the questions in this section is based on that of Carlsson *et al.* (2005) and Johansson-Stenman *et al.* (2002), but the question framing is different.

Respondents are told that people are distributed uniformly between the two income extremes, since this distribution is particularly easy to interpret. With this distribution the social welfare arising from each income distribution is given by:

$$W = \int_{y_{\min}}^{y_{\max}} \left(\frac{y^{1-\eta^I}}{1-\eta^I} \right) \left(\frac{1}{y_{\max} - y_{\min}} \right) dy = \left(\frac{1}{(1-\eta^I)(2-\eta^I)} \right) \left(\frac{y_{\max}^{2-\eta^I} - y_{\min}^{2-\eta^I}}{y_{\max} - y_{\min}} \right) \qquad (10)$$

where η^I refers to relative aversion to intra-temporal income inequality[5]. If a respondent is indifferent between distributions A and B, we have *W(A)=W(B)* and hence from equation (10) we have:

[4] The survey also contained an experiment on the distribution of income within a country not reported in this paper. Future work may try to differentiate between aversion to inequality on a global scale and aversion to inequality on a national scale.

[5] For the special case of $\eta_I=1$ we have: $W = \left(\frac{y_{\max} \ln y_{\max} - y_{\min} \ln y_{\min}}{y_{\max} - y_{\min}} \right) - 1$

$$\left(\frac{y_{\max,A}^{2-\eta^I} - y_{\min,A}^{2-\eta^I}}{y_{\max,A} - y_{\min,A}}\right) = \left(\frac{y_{\max,B}^{2-\eta^I} - y_{\min,B}^{2-\eta^I}}{y_{\max,B} - y_{\min,B}}\right) \quad (11)$$

Solving this equation for η^I gives the minimum inequality aversion for someone choosing Option B, or the maximum value for someone choosing Option A. The same triple-bounded format as for risk is used again. A respondent that chooses Option A (B) in the first question is given a second question where the income levels in Option B are increased (reduced) relative to Option B in the first question. For consistency, the same interval boundaries for η are used as for risk.

Respondents are presented with a few technical assumptions in the question directions to ensure that the questions are interpreted in the intended manner. Specifically, they are told that prices are consistent across the two options, that there is no welfare state, and that economic growth rates would not be affected by the choice. Respondents are furthermore told to assume that their own position in the income distribution would be approximately the same as in reality. If respondents were choosing from behind a 'veil of ignorance', choices would be influenced by risk aversion, as stressed by Rawls (1971), and Harsanyi (1955). To keep risk aversion and inequality aversion separate, uncertainty about the respondent's personal position needs to be eliminated. Finally, to avoid the finding of Cowell and Gardiner (1999) that individuals tend to be more extreme in the rate of transfers depending on the social classes of those considered, we tell respondents that the very richest and the very poorest live outside the stated income range and will not be affected by their choices.

3.2.3 Intertemporal substitution

The questions in this section were inspired by the survey by Barsky *et al.* (1997), who asked respondents to choose between different options for allocating consumption before and after retirement. We applied their structure to national borrowing and saving and lengthened the timeframe to 200 years – a timeframe typically modeled in integrated assessment models – to make the choice situation similar to climate change policy decisions.

Respondents are given the following information:

> *Some of the policies adopted by governments affect how the standard of living will change in the future. Many of these policies can be thought of in a way similar to your own decisions on how much to spend and how much to save.*

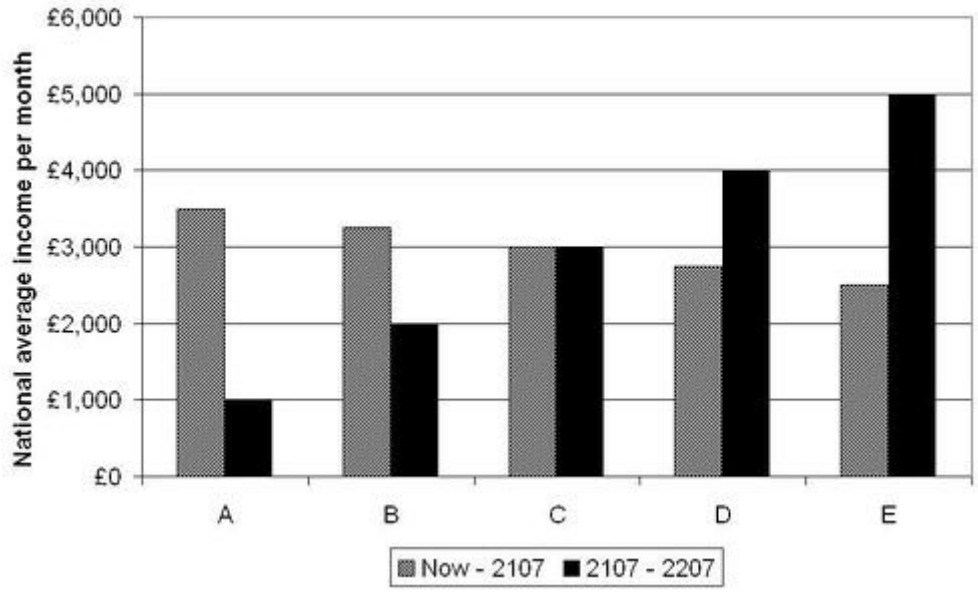
They are then asked to choose between different government plans for spending and saving, each with different implications for the living standards in two different periods; 2007-2107 and 2107-2207. The measure of the living standard used is national average real income.

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and for η_I=2 we have : $$W = \left(\frac{\ln y_{\max} - \ln y_{\min}}{y_{\max} - y_{\min}}\right)$$

The first question contains only three options, and serves as a warm-up for respondents to familiarize themselves with the format. They are then presented with three further questions, each with five choice options. In each question, the present discounted value of each option is the same for a given interest rate. This interest rate is zero in the warm-up question and the next one, then in subsequent questions it is changed to 1.39% (illustrated in figure 3.3) and -1.39%.

Figure 3.3: Graphic illustration of income paths



If preferences conform to the discounted utility model, the optimal consumption path satisfies the condition that:

$$r = \delta + \eta^t g \tag{12}$$

where η^t is the aversion to intertemporal substitution. This is Ramsey's formula again, the only difference from equation (6) is that the optimum discount rate is replaced by the market interest rate (r). In each question, we observe the respondent's choice of g for a given r. Comparing choices in two questions makes it possible to solve for η^t and δ. However, since each question offers only five choices of g, it is likely that the respondent's most preferred g lies somewhere in between two choices. Their preferences can therefore only be estimated within a range. The last question makes it possible to narrow this range.

4. Results

4.1 Sample size and demographics

In total, the survey received 3645 responses. Of those, 505 responses were considered anomalous due to reasons that will be described in section 4.4. These were discarded altogether, leaving 3140 responses in total. Since all the questions were optional, the total number of respondents varies

slightly from question to question. The demographics of the sample are summarised in Tables 4.1 and 4.2.

Table 4.1: Sample demographics

Region of residence	Mean Age	Median Household Income Bracket	Percent Female	Members of Env. Groups	Sample Frequency
Canada	27.5	£40000-£50000	55.9 %	19.1 %	**31.1 %**
UK	30.2	£40000-£50000	44.4 %	30.8 %	**29.1 %**
USA	32.3	£50000-£60000	40.8 %	41.4 %	**12.3 %**
Oceania	31.4	£50000-£60000	49.5 %	30.4 %	**6.0 %**
Scandinavia	29.1	£30000-£40000	45.4 %	23.7 %	**4.8 %**
Rest of Europe	31.2	£30000-£40000	44.3 %	40.3 %	**5.3 %**
Rest of World	30.2	£30000-£40000	42.2 %	31.3 %	**11.4 %**
Sample	**29.7**	**£40000-£50000**	**47.2 %**	**27.8 %**	**100.0 %**

n=3140

Table 4.2: Highest level of educational attainment

		Education			
		Some High School or Less	High School Graduate	Undergraduate Degree	Post-Graduate Degree
Region	Canada	10.9%	28.8%	49.6%	10.7%
	UK	2.9%	16.2%	48.3%	32.6%
	USA	6.8%	16.2%	32.1%	44.9%
	Oceania	1.6%	17.2%	50.5%	30.6%
	Scandinavia	3.3%	19.1%	38.8%	38.8%
	Rest of Europe	1.2%	6.0%	26.2%	66.7%
	Rest of World	1.7%	14.6%	38.6%	45.1%
Sample		**5.5%**	**19.5%**	**44.1%**	**30.9%**

n=3140

4.2 Risk aversion

The results from the questions on risk aversion are reported in Table 4.3. The median estimated η^r is in the interval 3-5, and this is also the modal group. People in this group rejected a policy that gives equal chances of doubling national income and of reducing it by one quarter, while accepting a policy where the reduction amounts to 15%.

These results are comparable to results of surveys that have estimated aversion to personal risk. Carlsson *et al.* (2005) obtain a median between 2 and 3, while in Barsky *et al.*'s (1997) study the median respondent displays a relative risk aversion greater than 3.76. The median range also overlaps with what is typically found in revealed-preference studies of risk aversion. Gollier (2006) for example, implicitly condones the range 2-4 based on studies of insurance markets. Taken together, this suggests that the logarithmic utility function underestimates people's actual aversion to risk.

Table 4.3: Frequency distribution for Relative Risk Aversion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<0.5	80	2.5	2.9	2.9
	0.5-1.0	114	3.6	4.1	7.0
	1.0-1.5	114	3.6	4.1	11.2
	1.5-2.0	467	14.9	17.0	28.2
	2.0-3.0	136	4.3	4.9	33.1
	3.0-5.0	890	28.3	32.3	65.4
	5.0-7.5	387	12.3	14.1	79.5
	>7.5	565	18.0	20.5	100.0
Missing		387	12.3		
Total		3140	100.0		

4.3 Inequality aversion

Table 4.4 presents the results from the experiment on inequality aversion. The median value is one category below that for risk, between 2 and 3, but the modal group is the upper extreme. There is also a higher frequency in the lowest category than there is for risk. Possible reasons for this polarisation are discussed in section 5.1.

The median estimate is the same as that of Johansson-Stenman *et al.* (2002) while higher than that of Carlsson *et al.* (2005). The latter observation seems like a logical consequence of a difference in the framing of the question. In Carlsson *et al.*'s (2005) study, respondents are asked to evaluate different distributions from the perspective of someone who is guaranteed to receive the median income of whichever distribution is chosen. Alternatively, in our survey respondents they are asked to choose the income distribution that is most desirable overall given their current position in society. In the questions there is always a trade-off between equality and the median income. Given the different instructions, it is not surprising that the respondents in Carlsson *et al.'s* (2005) study put less weight on equality.

Table 4.4: Frequency distribution for Relative Aversion To Inequality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<0.5	397	12.6	14.3	14.3
	0.5-1.0	151	4.8	5.4	19.7
	1.0-1.5	168	5.4	6.0	25.8
	1.5-2.0	197	6.3	7.1	32.9
	2.0-3.0	509	16.2	18.3	51.2
	3.0-5.0	343	10.9	12.3	63.5
	5.0-7.5	162	5.2	5.8	69.3
	>7.5	852	27.1	30.7	100.0
Missing		361	11.5		
Total		3140	100.0		

4.4 Time

Most respondents displayed very high aversion to inter-temporal substitution. Because of the large number of answer combinations possible, the respondents cannot be grouped into a few non-overlapping groups. For each valid response, we calculated the range of values for the elasticity of inter-temporal substitution ($1/\eta^t$) consistent with the choices made. For the median respondent, the midpoint of this range is .11, which corresponds to a value for η^t as high as 8.8. This seems to be broadly in line with the results of Barsky *et al.* (1997). They do not report the preferences of the median respondent but instead the modal response, which gives a midpoint corresponding to η = 8.7.

These low elasticities arise because respondents changed their preferred consumption path very little in response to changes in the implicit market interest rate. The most common response (24%) was to always choose a flat path. The second most common response (20%) was to always prefer a moderately upward sloping path. This tendency was also found by Barsky *et al.* (1997). In their experiment, over 70% of respondents chose one of these two paths. In a follow-up study to Barsky *et al.* (1997), Kapteyn and Teppa (2003) find that in three out of four consecutive consumption pattern choice questions the most frequent response is a flat consumption path. Only in the first question in the series is the slightly upward-sloping consumption path more frequently chosen; and, this can potentially be attributed to learning effects.

While not the main focus of this paper, the question on time also provides information about δ, which can be found using equation (13). The results indicate that on average respondents have a negative δ. This tendency is often found in psychological experiments (see e.g. Loewenstein and Prelec 1993), but is not evident in market behavior (see e.g. Nordhaus 2007). For a discussion on why market behavior may not reveal people's true utility discount rate see Dietz *et al.* (2008).

The time-preference experiment contained a check on the rationality of respondents. The first two questions were identical, except that the second contained two additional options. Out of the total of 3645 respondents, 141 (4%) answered these questions in an inconsistent manner. In addition, a further 363 (10%) reacted perversely to changes in the market interest rate (r), implying a negative η^t, which is unlikely to represent their true preferences. The rate of anomalous responses is lower than in Barsky *et al.*'s (1997) experiment, where 29% were dropped due to the same inconsistencies. Failure in the rationality check could be interpreted as an indicator of lack of attention. As a precautionary measure, these respondents were therefore dropped from the analysis of the other sections as well. However, there were no large differences in the frequency distributions for risk and inequality between this subsample and the rest of the sample. This decision is hence rather inconsequential.

4.5 Correlations

To investigate whether attitudes towards the three concepts are linked, the correlations between responses to the three different experiments were measured. The data are categorical so Kendall's tau-b is used instead of the ordinary Pearson's r.

As Table 4.2 shows, the correlation between each pair of variables is significant but weak. All the correlation coefficients are around 0.1. For the analyses involving intertemporal substitution, the

weak correlations arise because a relatively large number of respondents display high aversion to intertemporal substitution but low aversion to risk and/or inequality. The correlation between risk aversion and inequality aversion is weakened by respondents displaying high risk aversion coupled with low inequality aversion. Low risk aversion coupled with high inequality aversion is less common.

By intertwining the three concepts, the standard model implies a perfect correlation of 1. Our results suggest that this underspecifies the structure of public attitudes. These results corroborate Barsky *et al.*'s (1997) finding that risk and time preferences are essentially uncorrelated, indicating that their failure to detect a relationship between the two was not only due to limited statistical power. Together the two studies suggest that the low correlation is robust to differences in the question format, since Barsky *et al.* (1997) looked at preferences for personal income changes, which could be different from attitudes to how society should allocate income over a much longer timeframe.

It is notable that the correlation between risk aversion and inequality aversion is substantially weaker than Carlsson *et al.* (2005) found. The fact that their sample consisted entirely of students cannot explain much of the difference, as the correlation coefficient among students in our sample is only slightly higher than for the whole sample, at 0.149. A more important difference may be that the two surveys are not measuring exactly the same parameters. While our survey pertains to global income distributions and risks to the entire economy, Carlsson *et al.* (2005) looked at national income distributions and risks to individuals. Another difference arises in the framing of the questions. In Carlsson *et al.*'s (2005) survey the two questions look graphically exactly the same. This is not the case in our survey, although the structure of the two are very similar. What format is best suited to elicit true preferences is not easy to determine.

Table 4.3: Correlations

		Relative Risk Aversion	Elasticity of Intertemporal Substitution (Midpoint)
Relative Inequality Aversion	Correlation Coefficient	,133(**)	-,123(**)
	Sig. (1-tailed)	,000	,000
	N	2546	2269
Relative Risk Aversion	Correlation Coefficient		-,069(**)
	Sig. (1-tailed)		,000
	N		2249

** Correlation is significant at the 0.01 level (1-tailed).

4.6 Regressions and selection bias

Recruiting the sample through electronic media has both benefits and drawbacks. We obtained a large and heterogeneous sample from around the world. This provides a good opportunity to investigate how attitudes differ based on the respondents' characteristics. On the other hand, the sample was not drawn randomly and this limits our ability to draw inferences about the target population. This leads to the question of what the target population is. To determine the optimal policy from a global perspective – as CBAs of climate change often aim to do – it is arguably the entire current and future global population. More realistically, a political decision-maker may want to ensure that the national policy is in line with the attitudes of the voters of the country she

represents. We chose to compare the sample characteristics with the population of the UK, in order to give an illustration of sample biases.

To investigate what characteristics influence responses, and hence which sampling biases might have influenced the results three regressions were carried out – one for each of the three experiments. The explanatory variables are the responses given to the demographic and attitudinal questions. Because of the categorical nature of the data on η, an Ordered Probit model is employed. This model makes it possible to estimate what effect a change in an explanatory variable has on the probability of an individual being in each of the eight categories for η[6]. We calculated such marginal effects for the top and the bottom category for each dimension of η. An explanatory variable which has a positive marginal effect on the top category and a negative marginal effect on the bottom group can be assumed to have a positive effect on the dependent variable. Only variables that have significant marginal effects on both extreme categories are reported. The marginal effects are reported in Appendix II.

There appear to be surprisingly small regional differences in the responses when other differences are controlled for. The only significant effects are that respondents from Africa are less averse to inequality while those from the US are more so, compared with the reference group which is set as UK.

Gender is the only variable that has a significant effect on all the different regressions.Women have larger values for all the dimensions of η. Higher risk aversion among women is consistent with the findings of Carlsson *et al.* (2005), Barsky *et al.* (1997), Hartog *et al.* (2002) and Jianakoplos and Bernasek (1998). Carlsson *et al.* (2005) also report the same result for inequality aversion. Fortunately, the number of men and the number of women in the sample were almost equal, accounting for 52% and 48% respectively, so the problem of gender bias is minimal.

The regressions show that education is positively linked with inequality aversion but has no significant relationship with the results in the other two experiments. Because the sample was recruited largely through academic channels, highly educated people are overrepresentated. To investigate whether this bias affects the main results, the sample was weighted according to the guidelines of De Vaus (2002). This does not change the result that responses to the three different experiments are only weakly correlated. As can be seen in Table 4.4, all the correlation coefficients are reduced to an even lower level. The weighted distribution for inequality aversion is displayed in Figure 5.1. The weighted frequency distribution for inequality aversion is displayed in Table 4.4. The main change is that there is an increased frequency in the lowest category accompanied by a reduced frequency in the highest category. As expected, there is little change in the distributions of responses to the other two experiments.

[6] For the purpose of the regression, the responses to the time question were grouped into the same categories as those used for risk and intra-temporal inequality based on the midpoint of the estimated range for the elasticity of intertemporal substitution.

Table 4.4: Weighted correlations

		Relative Risk Aversion	Elasticity of Intertemporal Substitution (Midpoint)
Relative Inequality Aversion	Correlation Coefficient	,093(**)	-,106(**)
	Sig. (1-tailed)	,000	,000
	N	1981	1715
Relative Risk Aversion	Correlation Coefficient		-,040(*)
	Sig. (1-tailed)		,019
	N		1641

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

Table 5.1: Weighted distribution of responses to inequality experiment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<0.5	524	16,9	20,1	20,1
	0.5-1.0	193	6,2	7,4	27,5
	1.0-1.5	202	6,5	7,8	35,2
	1.5-2.0	212	6,8	8,1	43,3
	2.0-3.0	501	16,2	19,2	62,5
	3.0-5.0	285	9,2	10,9	73,5
	5.0-7.5	142	4,6	5,4	78,9
	>7.5	550	17,8	21,1	100,0
Missing		483	15,6		
Total		3093	100,0		

Our analysis shows that people with high income display somewhat lower aversion to inequality. This is as expected, given that respondents were told to assume that their position in the hypothetical income distribution would be the same as in reality. Aversion to intertemporal substitution also appears to be weakly associated with income, with respondents in the bottom income group displaying higher values. The sample median household income is in the range of £40,000-£50,000, which is substantially higher than the median for the UK population of just over £20,000 (ONS, 2007). This suggests that a sample with a more representative income distribution would actually have produced larger estimates for these two parameters. For inequality aversion the same applies to age. According to our results, age has a small but significant positive effect on inequality aversion and no significant effect on the other two parameters. Young people are also overrepresented in the sample, as seen by comparing the sample median of 27 years with the median in the UK population of 39 (Office of National Statistics 2005).

Self-selection is likely to have lead to an overrepresentation of people who take a particular interest in climate change, since the term 'climate' was used in the presentation of the survey. In addition, some of the networks through which the survey was distributed had an environmental theme. One indicator of bias in terms of interest in climate change is that 28% of respondents were members of environmental organisations or conservation groups. The regressions show that members of such

groups are more averse to income inequality. This indicates that the large proportion of members in our sample may have lead to higher estimates for inequality aversion than that for the general population. However, the effect is not very large. The biggest implication is that members are 7% more likely to be in the top category than non-members. There is no significant effect of this characteristic on attitudes towards risk and inter-temporal substitution.

5. Discussion

The results from the correlations support the proposition that the three components of η should be disentangled when analysing the costs of climate change. The result that risk aversion, inequality aversion and preferences for intertemporal substitution are not tightly linked in the sample suggests that the workhorse model is not well-suited to incorporate the structure of public attitudes on these issues. If one wishes to base climate policy for example on high risk aversion but low aversion to intertemporal substitution, the model has little to offer.

The responses also show two other interesting patterns. The first is that in each of the three experiments there is a high proportion of responses indicating very large values for η. The second is that attitudes on income distribution are highly polarised, with a high score for both the extreme categories. This section will discuss whether these findings are reflections of people's true attitudes or artefacts of the survey, and to what extent it affects the core result that attitudes are only weakly correlated across the three domains.

5.1 Hypothetical bias

The validity of the results, including the correlations, rests upon the assumption that respondents answered the questions in a truthful and accurate way. This is not a trivial assumption in any survey-based research. Miller (1992 pp.557) warns of the "danger of picking up 'Sunday-best' beliefs, that is, the views that people think they ought to hold according to some imbibed theory as opposed to the operational beliefs that would guide them in a practical situation." Kahneman and Knetsch (1992) refer to this effect as the 'purchase of moral satisfaction'. This may have lead to an inflated number of responses in the high categories to the extent that such attitudes are seen as more responsible or ethical, but it is worth noting that online distribution likely reduces this bias relative to personal interviews.

Another possibility is that the responses of people who are not used to thinking systematically about questions of this type will be ill thought out and therefore not reflect their true attitudes. A general concern about stated-preference studies is whether they give respondents sufficient incentive to undertake the mental effort to answer in a way that accurately reflects their preferences (Freeman, 1979). Some respondents may have found the experiments cognitively quite demanding, and therefore relied on simplifying heuristics to aid their choices. One such heuristic would be to rank the options solely with reference to one of the attributes, for example total income or minimum income. For the risk and inequality experiments, such a strategy would place the respondent in one of the extreme categories. In the time experiment it appears that many respondents made their choices only with reference to the sign of the slope of the consumption path, sticking to the same option even when this meant giving up a large amount of total income. Such respondents would display a very high aversion to intertemporal substitution. To find out whether lack of comprehension and/or

effort has produced a bias, it would be desirable to test whether a survey environment better suited to foster comprehension leads to a significantly different result.

5.2 Alternative mental models

As explained in section 3, the parameter values reported are based on a simple model of how people make the choices in question. This section discusses more sophisticated theories of choice, which are better at explaining the response given. It shows that it is plausible that the results reflect true attitudes reasonably well, but that people were applying a rationality that our model does not fully capture. Since the correlation analysis does not presuppose a specific structure of preferences, this means that the low correlations are plausible even though some of the responses give rise to unconventional parameter values when one tries to square them with the preference structure described in section 3.

5.3.1 Risk

It is a well-established result that the EU model performs poorly at explaining actual choices under uncertainty. According to a review by Starmer (2000), the cumulative Prospect Theory of Kahneman and Tversky (1992) is the theory that best predicts the empirical data. Its key insight is that people give more weight to losses than gains of equal size, even when these changes are so small that they should not command a risk premium according to the EU theory. People are in a sense attached to the status quo. This theory can support the claim that the relatively high levels of risk aversion observed in this study are a good reflection of respondents' true risk preferences.

5.3.2 Time

A robust finding from the literature on subjective measures of well-being is that the level of life satisfaction derived from a given level of consumption depends negatively on the level one is accustomed to (for a review see Di Tella and MaCoulloch, 2006 or Layard, 2006). This could help explain the strong focus on the slope of the consumption path that we observed. It implies that people would be unlikely to accept a downward sloping consumption path even if this could give them a large increase in total consumption. This is supported by empirical research (Loewenstein and Prelec, 1993).

5.3.3 Inequality

One interesting finding from the inequality experiment was the high degree of polarisation, with high scores for both the top and the bottom category. Under the assumptions of the workhorse model, this is hard to explain, since one would not expect the valuations of the elasticity of marginal utility to vary between people to such a large extent. But the reality is that views on income inequality depend on much more than how quickly one thinks marginal utility falls. Miller (1992) shows that there is a complex interplay between the two different criteria of needs and deserts in how people judge different distributions.

Those who focus on needs are quite likely to display very high aversion to inequality. A good case can be made for putting more weight on the utility of the most miserable society, hence rejecting the Utilitarian social welfare function. The maxi-min strategy advocated by Rawls (1971) would imply that η^{I} is infinity. From this perspective it does not seem so strange that many respondents displayed values above 7.5. In addition, inequality may give rise to externalities like more crime, another reason inequality aversion may exceed the elasticity of marginal utility.

At the other extreme we may have people who emphasise the criterion of deserts. There is plenty of evidence that many people reject equalising transfers even if they come at no cost to the total size of the pie (Bukszar and Knetsch, 1997 and Miller, 1992). They may believe that, as a matter of justice, people deserve unequal rewards, or that income inequality is needed to provide incentives to work hard.

Highly polarised attitudes toward global income inequality translate into divergent values for the inequality-adjusted welfare cost of climate change. This shows the fallibility of trying to come up with a single numerical estimate of climate change. If the population really is split between high and low inequality aversion, using the average pleases no-one and masks important debate over the ethical inputs into the economic model.

6. Conclusions

Our survey of over 3000 people shows that the correlations between their attitudes toward risk, inequality and intertemporal substitution are weak in the context of climate change. This suggests that the workhorse model of welfare economics – which determines all three through the choice of one single parameter – is underspecified. For example, it is not uncommon that an individual is highly averse to risk but cares little about income inequality. Such a structure of preferences cannot be accommodated in the current model.

The survey also reveals large heterogeneity of preferences within each of the three dimensions of η, particularly for inequality aversion. This means that using a single value for each would conceal important ethical disagreement. However, it does not mean that formal economic modelling of climate change is futile. On the contrary, Dietz *et al.* (2007) have argued that these models are useful precisely for exploring the roles of attitudes toward risk, inequality and intertemporal substitution in modeling the costs of climate change. Because these are issues over which reasonable minds may disagree, modellers should present policy-makers with a range of damage cost estimates corresponding to different degrees of risk aversion, inequality aversion and aversion to intertemporal substitution. However, the current specification of the model puts constraints on this type of sensitivity analysis, because one cannot for example change the degree of risk aversion without simultaneously changing the aversion to intertemporal substitution , and these two changes have opposing effects on the damage cost estimates. Therefore, the heterogeneity observed reinforces the need to disentangle η.

Any model must make a number of simplifying assumptions, but the one in question warrants particular attention because the results of formal economic modelling of climate change are driven largely by risk and ethics. For such models to be legitimate to the public and useful for policymakers, they should be transparent about how different judgements in these domains lead to different damage cost estimates. This transparency is currently lacking because three important concepts are conflated into one parameter – concepts that this survey suggests people view as distinct.

The conclusion is that employing a model that can disentangle attitudes to risk, inequality and time would have important advantages when analysing the costs of climate change impacts. The next step should therefore be to incorporate Epstein-Zin preferences into an integrated assessment model. This would make it possible to investigate separately the role of risk aversion and aversion to

intertemporal substitution. Disentangling all three dimensions requires more work, both in developing a new welfare economic model, and improving the spatial resolution of the integrated assessment models.

In addition, there is a need for further empirical work, with the aim of understanding how people arrive at the choices made in this survey. In particular, the bi-modal results for inequality aversion need explaining. The principles underlying the attitudes in question can be fairly complex, therefore it would be desirable to complement large scale surveys like this one with more in-depth studies such as focus groups. Such studies could also provide a check on respondents' comprehension of the questionnaire.

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Appendix II: E-mail lists through which the survey was distributed

Environment & Ethics List, University of Oxford

Green College students & staff, University of Oxford

Linacre College students & staff, University of Oxford

Physics Department, University of Oxford.

MSc Environmental Change and Management Alumni List, University of Oxford

Fulbright Academy of Science & Technology, July 2007 On-Line Newsletter

US National Institute of Standards and Technology, Office of Applied Economics

SPIRE, Norwegian University of Life Sciences

RESECON (Land & Resource Economics Network)

EARTHNOTES, Brandeis University

Parent Heart Watch, USA

Climate Change Information Mailing List, IISD

Appendix II: Regressions

Table A.1: Explanation of variables. For categorical variables, the reference catecory are indicated. For regions, the reference category is UK.

Demographic Indicator/Dummy Variable	Response Code	Meaning
Gender		
female	F	Female
reference	*M*	*Male*
genderMiss		Failure to respond
Income Band		
Income0	0	<£10000
Income1	1	£10000-£19999
Income2	2	£20000-£29999
Income3	3	£30000-£39999
reference	*4*	*£40000-£49999*
Income5	5	£50000-£59999
Income6	6	£60000-£69999
Income7	7	£70000-£79999
Income8	8	£80000-£139999
Income9	9	>£140000
IncomeMiss		Failure to respond
Level of Education		
ed0	0	Some High School or Less
ed1	1	High School Graduate
reference	*2*	*College/University Undergraduate Degree*
ed3	3	Post-Graduate Degrees (Master or PhD)
ed4	4	Medical (doctor) Degree
ed5	5	Law Degree
edMiss		Failure to respond
"It is the role of the government to reduce differences in income between those with high incomes and those with low incomes."		
pol0	0	Strongly agree

pol1	1	Agree
reference	*2*	*Neither Agree nor Disagree*
pol3	3	Disagree
pol4	4	Strongly Disagree
polMiss		Failure to respond
"The effects of climate change will pose serious risks to you and your family during the remainder of your lifetime"		
CCYou0	0	Strongly Disagree
CCYou1	1	Disagree
reference	*2*	*Neither Agree nor Disagree*
CCYou3	3	Agree
CCYou4	4	Strongly Agree
CCYouMiss		
"The effects of climate change will pose serious risks to global society during the remainder of your lifetime"		
CCWorld0	0	Strongly Disagree
CCWorld1	1	Disagree
reference	*2*	*Neither Agree nor Disagree*
CCWorld3	3	Agree
CCWorld4	4	Strongly Agree
CCWorldMiss		Failure to respond
Conservation Group		
reference	*N*	*Does NOT belong to an environmental or conservation group*
conserve	Y	Does belong to an environmental or conservation group
conserveMiss		Failure to respond

In the calculation of marginal effects, all dummy variables are set at zero. Age is set at the sample mean value.

Table A.2: Marginal effects on the probability of being in the category η<0.5 for Risk Aversion.

Marginal effects after oprobit
y = Pr(SocialRisk==0) (predict, p outcome(0))
= .03764957

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	-.0002417	.00977	-0.02	0.980	-.019384	.018901	0
Pacific*	.005005	.00786	0.64	0.524	-.010397	.020407	0
LatinAm*	.0475103	.02031	2.34	0.019	.007709	.087312	0
WestEur*	-.0018509	.00861	-0.22	0.830	-.018724	.015022	0
SouthEur*	.050153	.03106	1.61	0.106	-.010731	.111037	0
USA*	.0062323	.00627	0.99	0.320	-.006053	.018517	0
Canada*	.0017283	.00448	0.39	0.700	-.007055	.010512	0
EastAsia*	.0061283	.01743	0.35	0.725	-.028035	.040292	0
Scan*	-.0037116	.00762	-0.49	0.626	-.018642	.011219	0
MidEast*	.0292504	.0263	1.11	0.266	-.022306	.080807	0
EastEur*	.0281026	.0472	0.60	0.552	-.064414	.120619	0
pol0*	-.0145184	.00568	-2.56	0.011	-.025648	-.003389	0
pol1*	-.0074833	.00463	-1.62	0.106	-.016555	.001588	0
pol3*	-.0032434	.00498	-0.65	0.515	-.01301	.006523	0
pol4*	.0030945	.00717	0.43	0.666	-.010954	.017143	0
polMiss*	.0038015	.02003	0.19	0.849	-.035453	.043056	0
CCYou0*	.006478	.01434	0.45	0.652	-.021633	.034589	0
CCYou1*	-.0039296	.00677	-0.58	0.562	-.017204	.009345	0
CCYou3*	-.006271	.0056	-1.12	0.262	-.017237	.004695	0
CCYou4*	-.0097563	.00612	-1.59	0.111	-.021756	.002244	0
CCYouM~s*	-.0321632	.01135	-2.83	0.005	-.054407	-.009919	0
CCWorld0*	.0086113	.01783	0.48	0.629	-.026333	.043555	0
CCWorld1*	.0151561	.01237	1.22	0.221	-.009097	.039409	0
CCWorld3*	.0148275	.00836	1.77	0.076	-.001556	.031211	0
CCWorld4*	.0167848	.00938	1.79	0.074	-.0016	.03517	0
female*	-.0182247	.00503	-3.62	0.000	-.028088	-.008362	0
gender~s*	-.0276862	.01104	-2.51	0.012	-.049318	-.006054	0
age	-.0003237	.00017	-1.87	0.062	-.000664	.000016	29.67
Income0*	-.0138174	.00715	-1.93	0.053	-.02783	.000195	0
Income1*	-.0096477	.00678	-1.42	0.155	-.022938	.003642	0
Income2*	-.0096993	.00646	-1.50	0.133	-.022359	.00296	0
Income3*	-.0069501	.00655	-1.06	0.289	-.019796	.005895	0
Income5*	-.0052049	.00719	-0.72	0.469	-.01929	.00888	0
Income6*	-.0127321	.00729	-1.75	0.081	-.027024	.00156	0
Income7*	.0010442	.00805	0.13	0.897	-.014725	.016813	0
Income8*	.0079699	.00769	1.04	0.300	-.007098	.023038	0
Income9*	-.0040395	.00755	-0.54	0.592	-.018828	.010749	0
Income~s*	-.0145924	.00819	-1.78	0.075	-.030643	.001459	0
ed0*	-.0069349	.00725	-0.96	0.339	-.021142	.007272	0
ed1*	-.0060227	.00438	-1.37	0.169	-.014609	.002564	0
ed3*	.0011096	.00439	0.25	0.801	-.007499	.009718	0
ed4*	-.0175732	.01116	-1.58	0.115	-.039441	.004295	0
ed5*	.0315405	.01958	1.61	0.107	-.006837	.069918	0
edMiss*	-.003523	.01697	-0.21	0.836	-.036785	.029739	0
conserve*	.0021383	.00419	0.51	0.610	-.006076	.010353	0
conser~s*	.0231644	.01954	1.19	0.236	-.015124	.061453	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table A.3: Marginal effects on the probability of being in the category η>7.5 for risk.

Marginal effects after oprobit
y = Pr(SocialRisk==7) (predict, p outcome(7))
= .15539378

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	.0007061	.02863	0.02	0.980	-.055417	.05683	0
Pacific*	-.0134281	.01983	-0.68	0.498	-.052286	.02543	0
LatinAm*	-.07774	.02126	-3.66	0.000	-.119406	-.036074	0
WestEur*	.0055618	.02652	0.21	0.834	-.046424	.057547	0
SouthEur*	-.080148	.02933	-2.73	0.006	-.137628	-.022668	0
USA*	-.0164098	.01544	-1.06	0.288	-.046667	.013847	0
Canada*	-.0048857	.01264	-0.39	0.699	-.029668	.019897	0
EastAsia*	-.0161614	.04208	-0.38	0.701	-.09863	.066308	0
Scan*	.0115336	.02475	0.47	0.641	-.036972	.060039	0
MidEast*	-.0573752	.03617	-1.59	0.113	-.128262	.013512	0
EastEur*	-.055825	.06427	-0.87	0.385	-.181795	.070145	0
pol0*	.0566886	.0197	2.88	0.004	.018077	.095301	0
pol1*	.0250033	.01423	1.76	0.079	-.002887	.052893	0
pol3*	.0099926	.01507	0.66	0.507	-.019538	.039523	0
pol4*	-.008556	.01952	-0.44	0.661	-.046808	.029696	0
polMiss*	-.0103931	.05165	-0.20	0.841	-.111616	.09083	0
CCYou0*	-.0169934	.03467	-0.49	0.624	-.084943	.050956	0
CCYou1*	.0122601	.02142	0.57	0.567	-.029718	.054238	0
CCYou3*	.0204551	.01806	1.13	0.257	-.014942	.055852	0
CCYou4*	.034169	.02177	1.57	0.116	-.008492	.07683	0
CCYouM~s*	.2464237	.16799	1.47	0.142	-.082824	.575671	0
CCWorld0*	-.0218868	.04079	-0.54	0.592	-.101837	.058063	0
CCWorld1*	-.0351905	.02598	-1.35	0.176	-.086116	.015735	0
CCWorld3*	-.0345769	.02035	-1.70	0.089	-.074457	.005303	0
CCWorld4*	-.0381563	.02119	-1.80	0.072	-.07968	.003368	0
female*	.0783924	.01406	5.58	0.000	.050844	.10594	0
gender~s*	.1657568	.11319	1.46	0.143	-.056089	.387603	0
age	.0009419	.0005	1.87	0.062	-.000048	.001931	29.67
Income0*	.0530421	.02636	2.01	0.044	.001385	.104699	0
Income1*	.0337104	.02249	1.50	0.134	-.010378	.077799	0
Income2*	.0339278	.02124	1.60	0.110	-.0077	.075556	0
Income3*	.0229756	.02093	1.10	0.272	-.018044	.063995	0
Income5*	.0166322	.0229	0.73	0.468	-.028257	.061521	0
Income6*	.0476407	.02726	1.75	0.080	-.005782	.101063	0
Income7*	-.0029855	.02294	-0.13	0.896	-.047942	.041971	0
Income8*	-.0204475	.01967	-1.04	0.298	-.058992	.018097	0
Income9*	.0126286	.02367	0.53	0.594	-.03377	.059027	0
Income~s*	.0570812	.0343	1.66	0.096	-.010154	.124316	0
ed0*	.0229183	.02626	0.87	0.383	-.028545	.074382	0
ed1*	.0195504	.01438	1.36	0.174	-.008627	.047728	0
ed3*	-.0031691	.01244	-0.25	0.799	-.027547	.021209	0
ed4*	.0742455	.06308	1.18	0.239	-.049391	.197882	0
ed5*	-.0603565	.02539	-2.38	0.017	-.110116	-.010597	0
edMiss*	.0109097	.05595	0.19	0.845	-.098754	.120574	0
conserve*	-.0060043	.01138	-0.53	0.598	-.028316	.016307	0
conser~s*	-.0486867	.02973	-1.64	0.102	-.106965	.009592	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table A.4: Marginal effects on the probability of being in the category η<0.5 for inequality.

Marginal effects after oprobit
y = Pr(G_Inequal==0) (predict, p outcome(0))
= .12310937

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	.0746822	.03463	2.16	0.031	.006815	.142549	0
Pacific*	.0226456	.02067	1.10	0.273	-.017876	.063168	0
LatinAm*	.0376078	.03044	1.24	0.217	-.022052	.097268	0
WestEur*	.0121726	.02391	0.51	0.611	-.034681	.059027	0
SouthEur*	.0393239	.04763	0.83	0.409	-.054022	.13267	0
USA*	.0394935	.01742	2.27	0.023	.005355	.073632	0
Canada*	.0182532	.01194	1.53	0.126	-.005151	.041657	0
EastAsia*	.0572173	.05088	1.12	0.261	-.042512	.156946	0
Scan*	-.0073228	.0197	-0.37	0.710	-.045938	.031293	0
MidEast*	.08927	.05822	1.53	0.125	-.02484	.20338	0
EastEur*	-.0056151	.07606	-0.07	0.941	-.154692	.143462	0
pol0*	-.0696778	.01533	-4.55	0.000	-.099719	-.039636	0
pol1*	-.0262346	.01154	-2.27	0.023	-.048859	-.00361	0
pol3*	.0425472	.01501	2.83	0.005	.013123	.071971	0
pol4*	.2033551	.0324	6.28	0.000	.139857	.266854	0
polMiss*	.0070472	.04301	0.16	0.870	-.077259	.091354	0
CCYou0*	.0186373	.03617	0.52	0.606	-.052258	.089532	0
CCYou1*	.0278945	.01977	1.41	0.158	-.010849	.066638	0
CCYou3*	-.0130437	.01414	-0.92	0.356	-.040764	.014676	0
CCYou4*	-.0256739	.01544	-1.66	0.096	-.055927	.004579	0
CCYouM~s*	.0387575	.08468	0.46	0.647	-.127207	.204722	0
CCWorld0*	.0680829	.05231	1.30	0.193	-.034446	.170612	0
CCWorld1*	.0579709	.03136	1.85	0.065	-.003492	.119434	0
CCWorld3*	.0070662	.01794	0.39	0.694	-.028089	.042222	0
CCWorld4*	-.0202825	.01805	-1.12	0.261	-.055662	.015097	0
female*	-.0411717	.00976	-4.22	0.000	-.06031	-.022033	0
gender~s*	-.0704703	.03983	-1.77	0.077	-.148529	.007588	0
age	-.0008147	.00047	-1.75	0.080	-.001728	.000099	29.67
Income0*	.0077186	.02078	0.37	0.710	-.033019	.048456	0
Income1*	-.01322	.01772	-0.75	0.456	-.047953	.021513	0
Income2*	-.0014212	.01722	-0.08	0.934	-.035181	.032339	0
Income3*	.0178945	.0185	0.97	0.333	-.018365	.054154	0
Income5*	.028301	.02135	1.33	0.185	-.013543	.070145	0
Income6*	-.0254469	.01966	-1.29	0.195	-.063976	.013082	0
Income7*	.040258	.02381	1.69	0.091	-.006406	.086922	0
Income8*	.0822749	.02272	3.62	0.000	.037747	.126803	0
Income9*	.0330524	.02284	1.45	0.148	-.011722	.077826	0
Income~s*	.0033156	.0252	0.13	0.895	-.046077	.052708	0
ed0*	.1373407	.03459	3.97	0.000	.069549	.205132	0
ed1*	.0078979	.01206	0.65	0.513	-.015737	.031533	0
ed3*	.0000401	.01102	0.00	0.997	-.021568	.021648	0
ed4*	.0255133	.05116	0.50	0.618	-.074758	.125785	0
ed5*	.0053987	.03178	0.17	0.865	-.05689	.067688	0
edMiss*	.0301019	.05068	0.59	0.553	-.069223	.129427	0
conserve*	-.0361506	.00986	-3.66	0.000	-.055483	-.016818	0
conser~s*	-.0144795	.02895	-0.50	0.617	-.071228	.042269	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table A.5: Marginal effects on the probability of being in the category η>7.5 for inequality.

Marginal effects after oprobit
y = Pr(G_Inequal==7) (predict, p outcome(7))
= .26511036

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	-.0909152	.03357	-2.71	0.007	-.156707	-.025123	0
Pacific*	-.0331594	.02818	-1.18	0.239	-.088393	.022074	0
LatinAm*	-.0520179	.03663	-1.42	0.156	-.123807	.019771	0
WestEur*	-.018592	.03499	-0.53	0.595	-.087179	.049995	0
SouthEur*	-.0540493	.05624	-0.96	0.337	-.164287	.056189	0
USA*	-.0542488	.02147	-2.53	0.012	-.096328	-.01217	0
Canada*	-.0271981	.01755	-1.55	0.121	-.061603	.007206	0
EastAsia*	-.0738145	.05384	-1.37	0.170	-.179341	.031712	0
Scan*	.0121715	.03351	0.36	0.716	-.053502	.077845	0
MidEast*	-.1037933	.05058	-2.05	0.040	-.202929	-.004657	0
EastEur*	.0092609	.12859	0.07	0.943	-.242777	.261299	0
pol0*	.1655091	.02783	5.95	0.000	.11097	.220049	0
pol1*	.047776	.01961	2.44	0.015	.009333	.086219	0
pol3*	-.0577973	.02017	-2.87	0.004	-.097324	-.018271	0
pol4*	-.1745896	.02672	-6.53	0.000	-.226954	-.122225	0
polMiss*	-.0109968	.06531	-0.17	0.866	-.139006	.117012	0
CCYou0*	-.0277277	.05056	-0.55	0.583	-.126819	.071364	0
CCYou1*	-.0400202	.02717	-1.47	0.141	-.093278	.013238	0
CCYou3*	.0222636	.02415	0.92	0.357	-.025076	.069604	0
CCYou4*	.0466211	.0286	1.63	0.103	-.00943	.102673	0
CCYouM~s*	-.0533818	.10125	-0.53	0.598	-.251832	.145069	0
CCWorld0*	-.0846839	.05314	-1.59	0.111	-.188839	.019471	0
CCWorld1*	-.0745942	.03632	-2.05	0.040	-.145781	-.003408	0
CCWorld3*	-.0110256	.02826	-0.39	0.696	-.066405	.044354	0
CCWorld4*	.0358484	.03129	1.15	0.252	-.025474	.097171	0
female*	.0812754	.01574	5.16	0.000	.050426	.112125	0
gender~s*	.1683915	.13737	1.23	0.220	-.100842	.437625	0
age	.0013106	.00073	1.78	0.075	-.00013	.002751	29.67
Income0*	-.0120102	.03214	-0.37	0.709	-.075008	.050987	0
Income1*	.0225833	.03007	0.75	0.453	-.03635	.081517	0
Income2*	.0023005	.02786	0.08	0.934	-.052309	.05691	0
Income3*	-.026702	.02768	-0.96	0.335	-.08096	.027556	0
Income5*	-.0405401	.02999	-1.35	0.176	-.099318	.018237	0
Income6*	.0461556	.03639	1.27	0.205	-.025159	.117471	0
Income7*	-.0551445	.03124	-1.77	0.077	-.116364	.006075	0
Income8*	-.0977653	.02705	-3.61	0.000	-.150787	-.044744	0
Income9*	-.0464995	.03109	-1.50	0.135	-.107435	.014436	0
Income~s*	-.0052569	.03968	-0.13	0.895	-.083026	.072512	0
ed0*	-.1390665	.02597	-5.36	0.000	-.189961	-.088172	0
ed1*	-.01228	.01842	-0.67	0.505	-.048384	.023824	0
ed3*	-.0000644	.01773	-0.00	0.997	-.034813	.034684	0
ed4*	-.0369422	.06704	-0.55	0.582	-.168331	.094447	0
ed5*	-.0084836	.04883	-0.17	0.862	-.104194	.087227	0
edMiss*	-.042824	.06356	-0.67	0.500	-.167397	.081749	0
conserve*	.0693868	.01871	3.71	0.000	.032722	.106052	0
conser~s*	.0248829	.053	0.47	0.639	-.079002	.128768	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table A.6: Marginal effects on the probability of being in the category η<0.5 for intertemporal substitution

Marginal effects after oprobit
y = Pr(category3==0) (predict, p outcome(0))
= .03719233

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	.0069192	.01469	0.47	0.638	-.021867	.035705	0
Pacific*	-.0044357	.00858	-0.52	0.605	-.021243	.012372	0
LatinAm*	-.0187506	.00961	-1.95	0.051	-.037584	.000082	0
WestEur*	-.0027899	.00962	-0.29	0.772	-.021648	.016068	0
SouthEur*	-.0232974	.01162	-2.01	0.045	-.046065	-.000529	0
USA*	.017432	.00968	1.80	0.072	-.001534	.036398	0
Canada*	.002815	.00571	0.49	0.622	-.008374	.014004	0
EastAsia*	-.0149787	.01401	-1.07	0.285	-.04244	.012482	0
Scan*	-.0124184	.00841	-1.48	0.140	-.028895	.004058	0
MidEast*	.0065512	.02287	0.29	0.775	-.038281	.051383	0
EastEur*	-.0228957	.01875	-1.22	0.222	-.059653	.013862	0
pol0*	-.0001215	.00703	-0.02	0.986	-.013904	.013661	0
pol1*	-.0017803	.00559	-0.32	0.750	-.012739	.009178	0
pol3*	-.0061771	.00625	-0.99	0.323	-.018425	.006071	0
pol4*	.0010169	.00908	0.11	0.911	-.01678	.018814	0
polMiss*	-.0270308	.01223	-2.21	0.027	-.050999	-.003062	0
CCYou0*	.0220863	.02359	0.94	0.349	-.024155	.068328	0
CCYou1*	.0285998	.0134	2.13	0.033	.002341	.054859	0
CCYou3*	.0062161	.00785	0.79	0.428	-.00917	.021602	0
CCYou4*	-.0041282	.00783	-0.53	0.598	-.019482	.011226	0
CCYouM~s*	.0092188	.04614	0.20	0.842	-.081216	.099654	0
CCWorld0*	-.0190683	.01306	-1.46	0.144	-.044669	.006532	0
CCWorld1*	-.0141477	.0104	-1.36	0.174	-.034539	.006244	0
CCWorld3*	-.0032981	.00856	-0.39	0.700	-.020066	.01347	0
CCWorld4*	-.0023012	.00911	-0.25	0.801	-.020153	.015551	0
female*	-.0130524	.00518	-2.52	0.012	-.023203	-.002901	0
gender~s*	-.029372	.01378	-2.13	0.033	-.056385	-.002359	0
age	-.0008614	.00043	-2.02	0.043	-.001697	-.000026	29.67
Income0*	.0320044	.01491	2.15	0.032	.002787	.061221	0
Income1*	.0060872	.00992	0.61	0.540	-.013359	.025533	0
Income2*	.0020385	.00892	0.23	0.819	-.01545	.019527	0
Income3*	.0031392	.00918	0.34	0.733	-.014862	.021141	0
Income5*	.0236272	.0131	1.80	0.071	-.002043	.049297	0
Income6*	.018033	.01369	1.32	0.188	-.008797	.044863	0
Income7*	.0164855	.01255	1.31	0.189	-.008106	.041077	0
Income8*	.0192649	.01129	1.71	0.088	-.002862	.041392	0
Income9*	.0227929	.01356	1.68	0.093	-.003781	.049367	0
Income~s*	.0095219	.01459	0.65	0.514	-.019066	.03811	0
ed0*	-.0033736	.00972	-0.35	0.729	-.022423	.015676	0
ed1*	-.0018491	.00575	-0.32	0.748	-.013126	.009427	0
ed3*	.0096537	.00657	1.47	0.141	-.003214	.022522	0
ed4*	-.0158957	.01508	-1.05	0.292	-.045445	.013653	0
ed5*	.0264921	.02139	1.24	0.215	-.015422	.068407	0
edMiss*	-.0264007	.01256	-2.10	0.036	-.051013	-.001788	0
conserve*	.0031439	.00531	0.59	0.554	-.007261	.013548	0
conser~s*	.0047786	.01635	0.29	0.770	-.02726	.036817	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1
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Table A.7: Marginal effects on the probability of being in the category η>7.5 for intertemporal substitution

Marginal effects after oprobit
y = Pr(category3==7) (predict, p outcome(7))
= .70774534

variable	**dy/dx**	Std. Err.	z	P>|z|	[95% C.I.]		X
Africa*	-.0278462	.05644	-0.49	0.622	-.138472	.08278	0
Pacific*	.0194357	.03809	0.51	0.610	-.055219	.094091	0
LatinAm*	.094487	.04753	1.99	0.047	.00133	.187644	0
WestEur*	.0120621	.04214	0.29	0.775	-.070527	.094652	0
SouthEur*	.124433	.06491	1.92	0.055	-.002789	.251656	0
USA*	-.0656186	.03066	-2.14	0.032	-.125701	-.005536	0
Canada*	-.0116611	.02351	-0.50	0.620	-.057734	.034412	0
EastAsia*	.072377	.07345	0.99	0.324	-.071577	.21633	0
Scan*	.0584631	.03898	1.50	0.134	-.017934	.134861	0
MidEast*	-.026432	.08835	-0.30	0.765	-.199596	.146732	0
EastEur*	.1216095	.12198	1.00	0.319	-.117459	.360678	0
pol0*	.0005145	.02978	0.02	0.986	-.057851	.05888	0
pol1*	.0076355	.02381	0.32	0.748	-.039039	.05431	0
pol3*	.027465	.02661	1.03	0.302	-.024689	.079619	0
pol4*	-.0042687	.03801	-0.11	0.911	-.07876	.070223	0
polMiss*	.1528277	.07255	2.11	0.035	.010625	.295031	0
CCYou0*	-.080931	.07568	-1.07	0.285	-.229256	.067394	0
CCYou1*	-.101151	.03911	-2.59	0.010	-.177807	-.024495	0
CCYou3*	-.0251378	.03102	-0.81	0.418	-.085942	.035667	0
CCYou4*	.0180425	.03423	0.53	0.598	-.049041	.085126	0
CCYouM~s*	-.0365327	.17222	-0.21	0.832	-.374086	.30102	0
CCWorld0*	.0964503	.06952	1.39	0.165	-.0398	.2327	0
CCWorld1*	.0677733	.04845	1.40	0.162	-.027186	.162732	0
CCWorld3*	.0143174	.03654	0.39	0.695	-.057293	.085928	0
CCWorld4*	.0099104	.03901	0.25	0.799	-.066539	.086359	0
female*	.0618355	.01798	3.44	0.001	.026599	.097072	0
gender~s*	.1732072	.09466	1.83	0.067	-.012322	.358737	0
age	.0036438	.00096	3.79	0.000	.001758	.005529	29.67
Income0*	-.1112173	.04416	-2.52	0.012	-.197767	-.024668	0
Income1*	-.0246382	.03978	-0.62	0.536	-.102604	.053328	0
Income2*	-.0084927	.03721	-0.23	0.819	-.081426	.06444	0
Income3*	-.0129738	.03794	-0.34	0.732	-.087337	.061389	0
Income5*	-.0858357	.04278	-2.01	0.045	-.16968	-.001992	0
Income6*	-.0676399	.04698	-1.44	0.150	-.159726	.024446	0
Income7*	-.0624077	.04454	-1.40	0.161	-.149714	.024898	0
Income8*	-.0717413	.03937	-1.82	0.068	-.148896	.005414	0
Income9*	-.0831899	.0445	-1.87	0.062	-.17041	.00403	0
Income~s*	-.0376585	.05528	-0.68	0.496	-.145997	.07068	0
ed0*	.014654	.04305	0.34	0.734	-.069724	.099032	0
ed1*	.0079348	.02474	0.32	0.748	-.040556	.056425	0
ed3*	-.0381465	.02345	-1.63	0.104	-.084105	.007812	0
ed4*	.0775626	.08097	0.96	0.338	-.081133	.236259	0
ed5*	-.0947518	.06284	-1.51	0.132	-.217924	.028421	0
edMiss*	.147726	.07836	1.89	0.059	-.00585	.301302	0
conserve*	-.0129927	.02127	-0.61	0.541	-.054685	.028699	0
conser~s*	-.0195194	.06441	-0.30	0.762	-.145754	.106715	0

(*) dy/dx is for discrete change of dummy variable from 0 to 1