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Quantifying Loss Aversion: Evidence from a UK Population Survey

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Abstract

We estimate loss aversion using on an online survey of a representative sample of over 4,000 UK residents. The average aversion to a loss of £500 relative to a gain of the same amount is 2.41, but loss aversion varies significantly with characteristics such as gender, age, education, financial knowledge, social class, employment status, management responsibility, income, savings and home ownership. Other influencing factors include marital status, number of children, ease of savings, rainy day fund, personality type, emotional state, newspaper and political party. However, once we condition on all the profiling characteristics of the respondents, some factors, in particular gender, cease to be significant, suggesting that gender differences in risk and loss attitudes might be due to other factors, such as income differences.

Keywords: Behavioural finance, loss aversion, expected utility, survey data

JEL: C83, C90, G40

1. Introduction

The simplest canonical models in economics assume that agents have identical preferences and that they maximise expected utility. In this paper, we contribute to the literature on more sophisticated models of human behaviour by using survey data to estimate differences in preferences where we allow agents to have a more general objective function. In particular, we estimate a simple parametric representation of Kahneman and Tversky's (1979) model of loss aversion for 4,016 respondents who form a representative sample of individuals in the United Kingdom. We show that responses are consistent with loss aversion, but that attitudes to risk in both the gain and loss domains are significantly correlated with reported characteristics of the respondents. The importance of our contribution is that we provide evidence on a much larger and more representative sample than has been considered hitherto.

For at least fifty years, economists have been aware that the expected utility (EU) model might not fully capture consumer behaviour under risk (Allais (1953), Samuelson (1963), Rabin and Thaler (2001)) and this has led to a range of more general models being proposed. Simply put, the EU model assumes that the objective function depends on two components: first, the value (or utility, loosely defined) of a state depends upon the consumption or wealth in that state without regard to how it was reached; second, when considering more than one possible outcome, the different states of the world are weighted by the subjective probability of each state occurring. In the specific example of the EU model, the objective function is

$$\sum_i p_i u(c_i) \qquad (1)$$

where $u(c_i)$ is a standard increasing and concave utility function depending upon consumption (or wealth) in each state i and p_i is the associated probability of that state occurring.

Kahneman and Tversky (1979) suggested changing both of these components so that the objective function becomes

$$\sum_i w(p_i) v(x_i) \qquad (2)$$

replacing the standard utility function with a more general value function and weighting the outcomes not by the probabilities but by a function of the probabilities. In this paper, we focus on a particular (iso-elastic) form of the value function which depends upon gains and losses, x, relative to the initial position:

$$v(x)=\begin{cases} v^{+}(x)=x^{\alpha} & \text{if } x\geq 0 \\ v^{-}(x)=-\lambda(-x)^{\beta} & \text{if } x<0 \end{cases} \tag{3}$$

where λ measures "direct" loss aversion, defined as the value of a loss of one unit of currency, i.e., $x=-1$. The parameter α measures risk attitudes in the domain of gains. There is risk aversion in the domain of gains if $\alpha<1$ and this increases as α falls; there is risk seeking in the domain of gains if $\alpha>1$ and this increases as α rises. The parameter β measures risk attitudes in the domain of losses. There is risk seeking in the domain of losses if $\beta<1$ and this increases as β falls; there is risk aversion in the domain of losses if $\beta>1$ and this increases as β rises. There is risk neutrality in the relevant domain when these parameters take a value of unity.

We do not attempt to model the more sophisticated treatment of probabilities embodied in Equation (2), i.e., to estimate the weighting function $w(p_i)$. There are two reasons for this.

First, existing studies show that the effect of the weighting function is most important when probabilities are close to either zero or unity. All our prospects involve probabilities of 0.5 (i.e., 50:50 outcomes) where the weighting issue appears to be least important. For example, Abdellaoui et al (2008) find $w(0.5)=0.46$ in the gain domain and $w(0.5)=0.45$ in the loss domain, suggesting we can assume $w(p_i)\approx p_i$ without a serious reduction in accuracy.

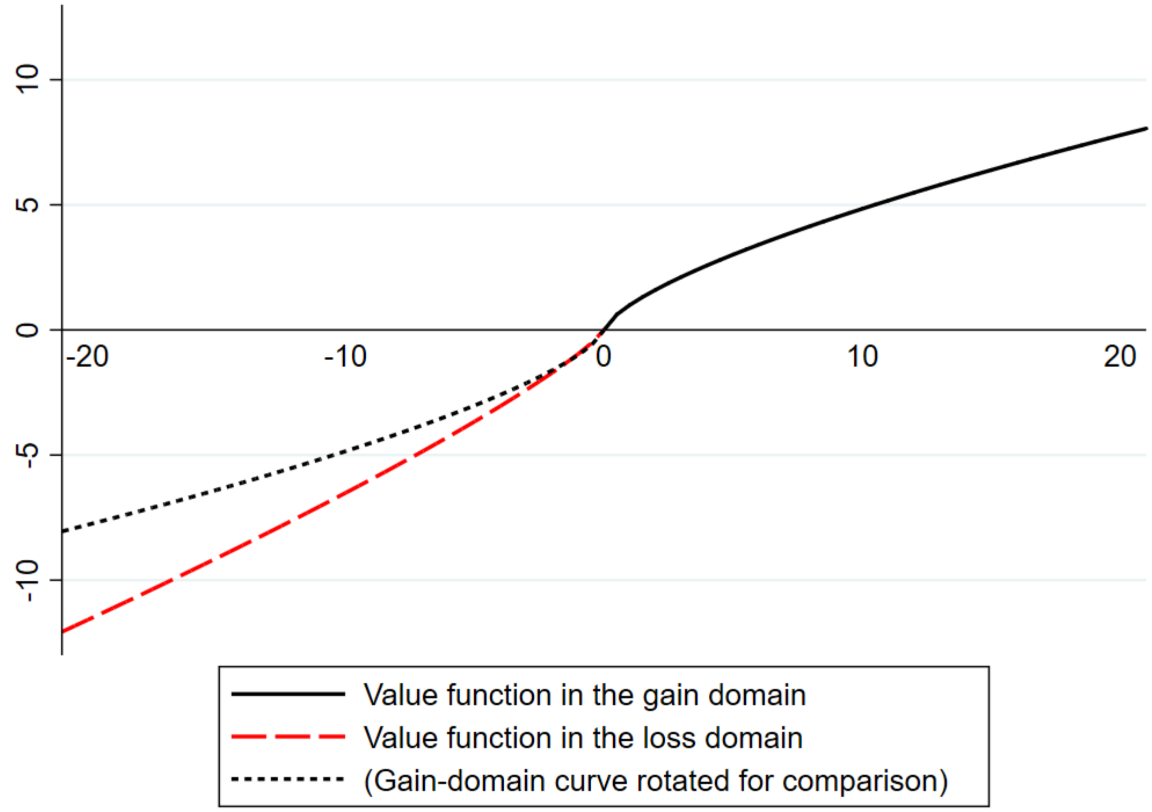
Second, there are significant trade-offs that need to be made when calibrating a utility or value function using real world data. Studies of behaviour under risk are usually based on questionnaires of a relatively small number of homogeneous individuals who are typically students of the authors of those studies. For example, Harrison and Swarthout (2016, Table 2) list papers testing or estimating models of loss aversion and the last ten of these references analyse a total of twelve data sets, nine of which are based on students with a sample size ranging from thirty to 177 respondents. The three exceptions are Scholten and Read's (2014) Yale University data set of 569 online respondents (many of whom may also have been students), Abdellaoui et al's (2013) analysis of 65 couples and von Gaudecker et al's (2011) survey of a representative sample of 1,422 individuals from the Netherlands.

The advantage of a data set of students is that the respondents are usually willing (indeed required) to answer a large number of questions – often about a hundred – which is sufficient to identify relatively complicated functional forms of both the value function and the weighting function; furthermore, the financial cost of recruiting students is relatively low. The corresponding disadvantage is that the study only reveals information on student-aged individuals selected for university education and whose understanding of risk may be conditioned by what they have already been taught (since they are often Economics, Finance or MBA students). Since estimated utility and value functions might be used to analyse the savings behaviour of poorly educated individuals or the decumulation behaviour of pensioners, estimates of risk or loss aversion from such studies may be inappropriate.

Our data set is for a representative sample of the UK adult population and contains a large number of variables describing the economic, social, political and personal characteristics of the respondents. The tradeoff from having access to such a rich data set is that we were unable to ask a large number of questions because the agency conducting the survey was concerned that if the experiment was too onerous it might put off respondents from completing it. We were able to ask sufficient questions to identify the value function but not the weighting function.

To give a flavour of the issues that we consider, we summarise some of our findings in Figures 1 and 2. Figure 1 illustrates our estimate of the value function for our whole sample, ignoring the heterogeneity of respondents: this figure is based entirely on our estimates of α, β and λ in Equation (3). These estimated values provide evidence for three stylised facts: first, the S-shaped value function posited by Kahneman and Tversky (1979) which is concave in both gains and losses; second, the older insight (which can be traced back to Samuelson, 1963) that the disutility of losses is greater than the utility of gains, commonly known as "loss aversion"; and third, that the value function is less concave in losses than it is in gains, i.e., $\beta > \alpha$, implying that the marginal disutility of losses exceeds the marginal utility of gains.

Figure 1: The estimated value function for the full sample of respondents



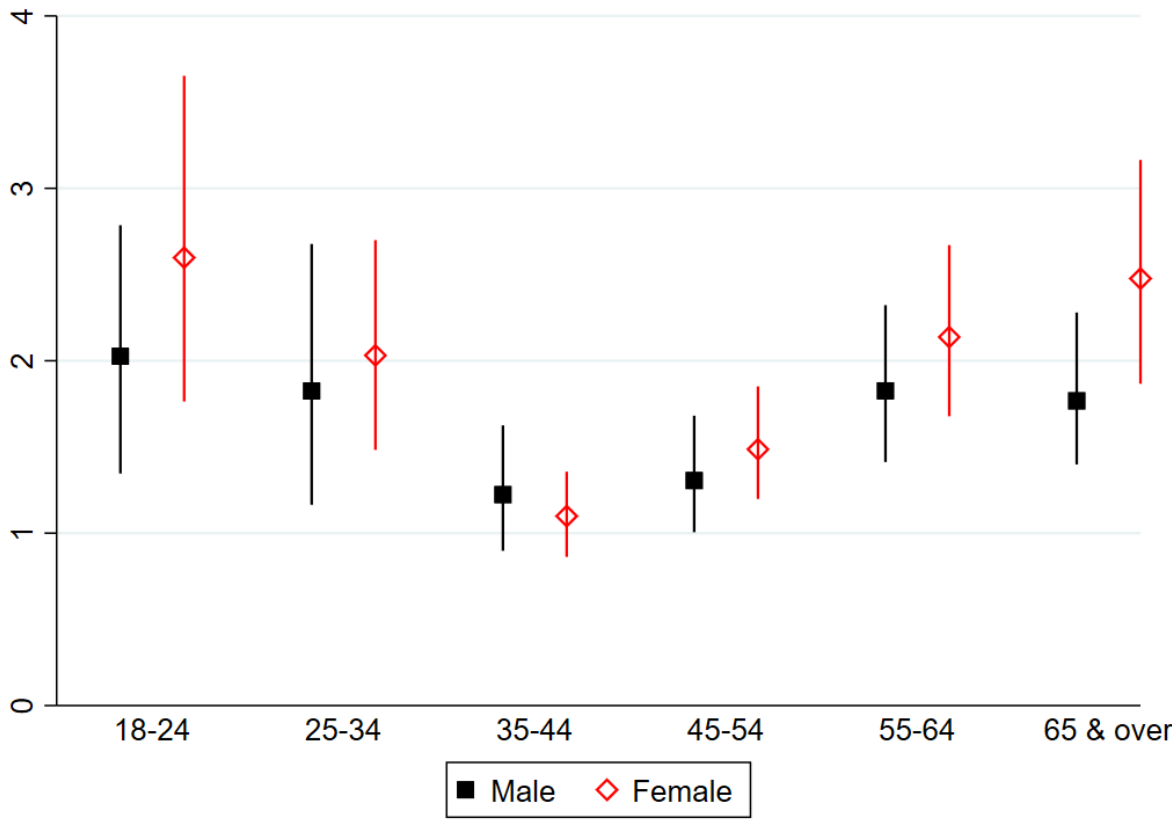
We show that these three qualitative findings hold not only for the whole sample but for any sub-sample of the data: for example, they are true for both men and women, at any age, for any level of income, for any level of education, etc. However, quantitatively the value functions vary considerably by gender, age, income, education, and so on. We summarise these differences using a measure of "relative loss aversion" which we define as

$$\Lambda(x) \equiv \frac{\left|v^{-}(-x)\right|}{v^{+}(x)} = -\lambda \frac{(-x)^{\beta}}{x^{\alpha}} \tag{4}$$

which depends not only on the size of direct loss aversion, λ, but, in general, also on the sizes of α, β and x. Only in the cases of $\alpha = \beta$ or $x = 1$ will $\Lambda(x)$ be independent of x and equal to direct loss aversion, λ.

Figure 2 shows our point estimates and 90% confidence intervals for $\Lambda(50)$, estimated separately for our data broken down by gender and into six age groups. There is a strong U-shaped relationship between loss aversion and age; there is also evidence that women have slightly higher loss aversion than men at most ages. It is notable that loss aversion is highest among individuals in the age range 18-24, precisely the age group most likely to be analysed by studies based on university students.

Figure 2: Relative loss aversion with a gain or loss of 50 ($\Lambda(50)$) across gender and age



Note: The figure shows the expected value of $\Lambda(50)$ and the associated 90% confidence interval.

While the associations are very strong, we do not claim that they imply a causal relationship since we have not controlled for other factors. To address the association of loss aversion with reported characteristics, we now turn to a detailed description of our study. In section 2, we describe the survey design, elicitation method and sample of respondents. Our results are described in section 3 and section 4 concludes.

Our analysis is closest to that of von Gaudecker et al (2011) who also choose to ignore the probability weighting issue. There is, however, an important difference in the value functions between the two studies: whereas our value function is concave for both gains and losses, the one used by von Gaudecker et al (2011) is concave for gains but convex for losses.[1]

2. Survey design

2.1 Survey participants

Our experimental data are taken from a survey conducted online by market research agency YouGov from 9th to 17th January 2017. There were 4,018 respondents, of whom 4,016 successfully completed the questions: the respondents were UK residents over the age of 18. Individuals were classified according to 25 profiling characteristics: gender, age, marital status, number of children, health status, two personality types, emotional state at the time of completing the survey, education, financial knowledge, social class, employment status, management responsibility, employment sector, job security, income, home ownership, savings, ease of short-term saving, rainy day fund, region, newspaper, political party, religion, and religiosity.

[1] von Gaudecker et al (2011)'s value function is (taken from Kreps and Porteus (1978)):

$$v(x) = \begin{cases} v^{+}(x) = -\dfrac{1}{\gamma} e^{-\gamma x} & \text{if } x \geq 0 \\ v^{-}(x) = \dfrac{\lambda - 1}{\lambda} - \dfrac{1}{\gamma} e^{-\gamma x} & \text{if } x < 0 \end{cases}$$

This differs from the functional form in (3) in three respects: the negative exponential form implies constant absolute risk aversion in contrast with constant relative risk aversion implied by the iso-elastic form in (3); the value function is concave in gains and convex in losses, implying that disutility increases in losses; and the risk aversion parameter, γ, is the same in both the gain and loss domain, similar (but not identical) to imposing $\gamma = \alpha = -\beta$ in (3) and implying that the curvature is the same in all outcomes. λ is the loss aversion parameter.

Table 1: Survey sample broken down by key profiling characteristics

Characteristic	Full sample		UK population
	Number	Per cent	Per cent
Gender			
Male	1815	45.2%	49%
Female	2201	54.8%	51%
Age			
18-24	350	8.7%	15%
25-34	438	10.9%	17%
35-44	630	15.7%	16%
45-54	837	20.8%	17%
55-64	939	23.4%	13%
65 & over	822	20.5%	22%
Marital status			
Married/living with partner	2544	63.3%	63%
Single	1004	25.0%	25%
Widowed/separated/divorced	468	11.7%	12%
Employment status			
Full-time	1644	40.9%	43%
Part-time	612	15.2%	15%
Student	184	4.6%	7%
Retired	1155	28.8%	21%
Not working	324	8.1%	15%
No answer	97	2.4%	
Income			
Below £15,000	1057	26.3%	32%
£15,000-£29,999	1056	26.3%	30%
£30,000-£49,999	567	14.1%	12%
£50,000 & above	208	5.2%	5%
No answer	1128	28.1%	22%
Savings			
Below £1,000	938	23.4%	31%
£1,000 - £9,999	816	20.3%	23%
£10,000 - £49,999	690	17.2%	18%
£50,000 and above	596	14.8%	13%
No answer	976	24.3%	16%
Home ownership			
Own outright	713	40.9%	65%
Mortgage	610	35.0%	
Rent	420	24.1%	35%
No answer / don't know	2273	-	-

Note: Sources for UK population: ONS Population Estimates, NOMIS Labour Force Survey, statista.com. Income is gross personal income.

The first two columns of Table 1 show the representativeness of the sample. Compared with the national population, it is marginally (i) underweight young individuals (aged 18-34) and overweight middle-aged individuals (aged 45-64), (ii) underweight those on salaries below £30,000 and overweight those on salaries above £30,000, and (iii) underweight renters and overweight owner-occupiers (obviously these three factors may be related). Surveys of the national population covering income and savings also have a lower percentage of "no answer" than our survey.

2.2 Survey design and estimation method

Throughout the paper, we confine ourselves to the iso-elastic functional form of Equation (3), which requires estimation of the three parameters α, β and λ. We use the methodology proposed by Abdellaoui et al (2008) which is based on the elicitation of the certainty equivalent of a number of different risky prospects, each involving only two equally probable outcomes. Abdellaoui et al (2008, p.260) argue that their approach "minimises the cognitive burden for subjects by only using certainty equivalents for two-outcome prospects" and also suggest that the method is particularly useful where time is limited, which is the case for our sample of respondents.

The estimation is performed in three stages:

- First, to estimate α, respondents are asked to choose prospects in the gain domain only, comparing a certain outcome with a prospect containing only gains
- Second, to estimate β, respondents are asked to choose prospects in the loss domain only, comparing a certain outcome with a prospect containing only losses
- Third, respondents are asked to choose prospects with both gains and losses and the results are used to estimate λ conditional on the estimates of α and β from the first two stages.

A total of nine prospects (three for gains only, three for losses only and three involving both gains and losses) were presented to each individual: these are described in Table 2.

Table 2: The prospects presented to each individual

Gains only	Risky prospect	Certain prospect
Prospect 1	50% chance of a gain of £0 and 50% chance of a gain of £10	Certainty equivalent, G_1
Prospect 2	50% chance of a gain of £0 and 50% chance of a gain of £100	Certainty equivalent, G_2
Prospect 3	50% chance of a gain of £0 and 50% chance of a gain of £1,000	Certainty equivalent, G_3
Losses only		
Prospect 4	50% chance of a loss of £0 and 50% chance of a loss of £10	Certainty equivalent, L_4
Prospect 5	50% chance of a loss of £0 and 50% chance of a loss of £100	Certainty equivalent, L_5
Prospect 6	50% chance of a loss of £0 and 50% chance of a loss of £1,000	Certainty equivalent, L_6
Mixed gains and losses		
Prospect 7	50% chance of a gain of G_1 and 50% chance of a loss of M_7	Certainty equivalent, £0
Prospect 8	50% chance of a gain of G_2 and 50% chance of a loss of M_8	Certainty equivalent, £0
Prospect 9	50% chance of a gain of G_3 and 50% chance of a loss of M_9	Certainty equivalent, £0

A detailed description of our method for eliciting preferences can be found in Abdellaoui et al (2008, p. 263). For each prospect, the certainty equivalent was obtained by a series of six steps using an iterated bisection method requiring the participant to choose either the risky prospect or a certain prospect offering a fixed amount. Initially, the fixed amount was set equal to the expected value of the risky prospect. In each succeeding iteration, the certain prospect was reduced (increased) by 50% of the difference between the values of the risky and certain prospects if the respondent's previous choice had been to accept (reject) the certain prospect; the respondent was then asked to choose again. After six iterations, the result of this process is an interval in which the certainty equivalent (or indifference value) should lie and we took the midpoint of this interval as the estimator of the indifference value.

The final three prospects involved both gains and losses, and depended on the certainty equivalents elicited from Prospects 1, 2 and 3. Thus, in Prospect 7, participants were initially asked to choose between a riskless amount of £0 and a risky prospect offering a 50% chance of a gain of G_1 (i.e., the certainty equivalent elicited from Prospect 1) and 50% chance of a loss of the same amount. Then, depending on the choice made, the loss amount in the next iteration was either increased or decreased (using the same bisection method employed in Prospects 1-6). As before, this was repeated for six iterations to elicit the amount M_7 such that the individual is indifferent between a riskless amount of £0 and a risky prospect offering a 50% chance of a gain of G_1 and a 50% chance of a loss of M_7. This process was then repeated for Prospect 8 (using G_2 and eliciting a corresponding loss amount M_8) and Prospect 9 (using G_3 and eliciting a corresponding loss amount M_9); see third column of Table 2.

The certainty equivalents G_1, G_2 and G_3 are related to the prospects in the gain domain as follows:

$$\begin{array}{lcllc} v(G_1) & = & 0.5\times v(10)+0.5\times v(0) & \Rightarrow & G_1^{\alpha}=0.5\times 10^{\alpha} \\ v(G_2) & = & 0.5\times v(100)+0.5\times v(0) & \Rightarrow & G_2^{\alpha}=0.5\times 100^{\alpha} \\ v(G_3) & = & 0.5\times v(1000)+0.5\times v(0) & \Rightarrow & G_3^{\alpha}=0.5\times 1000^{\alpha} \end{array} \quad (5)$$

which can then be used to estimate the parameter α by non-linear least squares (NLS). At this point, we deviate from Abdellaoui et al (2008) in one important respect. We do not attempt to estimate parameters for each individual respondent: this is because we ask each respondent fewer questions than Abdellaoui et al (2008). In Appendix A1.2, we show that the NLS parameter estimates tend to be biased upwards in very small samples and, to avoid this bias, we estimate the value of α for groups of respondents and not for individuals separately. The estimation of β using prospects 4, 5 and 6 follows an analogous procedure.

The last step in the process is the estimation of the loss aversion parameter, λ, which is conditional on the estimates for α and β. We note that there are two issues with the estimates of λ. The first is econometric: because λ is estimated in a two-stage procedure, where both stages are non-linear, we are much less certain about the small-sample properties of the estimates (we calculate the standard errors by bootstrapping). The second is conceptual: the absolute value of λ depends upon the units of measurement (it is homogeneous of degree $\beta-\alpha$ in the magnitude of gains and losses). This makes comparison of λ parameters across different studies problematic: direct comparison is meaningful only when (i) the experiments in the various studies involve very similar magnitudes of gains and losses, or (ii) the studies involve similar values of α and β.

We will work with the measure of relative loss aversion defined in Equation (4). When $\beta \neq \alpha$, an individual can be loss averse for some values of x and loss seeking for other values. In our estimation analysis below, in all cases but one[2] we find that $\beta > \alpha$ and $\lambda \approx 1$: this means that individuals are loss averse (i.e., $\Lambda(x) > 1$) if $x > 1$ and loss seeking (i.e., $\Lambda(x) < 1$) if $x < 1$. Since our unit of measurement is the pound sterling, it seems reasonable to confine ourselves to values of $x > 1$. However, because the function $\Lambda(x)$ is homogenous of order $\beta - \alpha$, the magnitude of loss aversion also depends upon the size of x. We report our estimates of $\Lambda(5)$, $\Lambda(50)$ and $\Lambda(500)$ – the expected values of the three risky prospects – with the associated 90% confidence intervals estimated by boot-strapping. By itself, the fact that $\lambda \approx 1$ does not imply an absence of loss aversion: whether individuals are loss averse depends, as Equation (4) shows, on the values of x, α, and β, as well as λ.

In the following section, we present estimates of the LA parameters for each individual. Before doing this, we consider some further aspects of the experimental design.

(i) **Choice tasks vs. matching tasks**

There are two common experimental procedures for eliciting risk attitudes: choice tasks and matching tasks. In a choice tasks approach, subjects are asked to choose between two prospects. In a matching tasks approach, subjects are required to "fill in the blank" by stating the amount that equates the two options presented (e.g., in Prospect 1 above, individuals must choose G_1 which is the certainty equivalent that makes the individuals genuinely indifferent to taking the risky prospect (i.e., a 50% chance of a gain of £0 and a 50% chance of a gain of £10)).

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[2] The single counter-example is for the sub-sample of respondents who report their annual income to be above £50,000 per year, where $\alpha = 0.7901$ and $\beta = 0.7896$.

Frederick et al (2002, p. 387) criticise the choice tasks approach for "simply recovering the expectations of the experimenters that guided the experimental design", because results from choice tasks can be easily affected by the choices given. However, there is also evidence that in a matching tasks approach, many subjects "fill in the blank" in a manner that suggests they do not really understand what they are doing, especially in cases, as here, when the prospects are quite complex (e.g., Bostic et al (1990)). In a previous experiment, we used the matching tasks approach in a national population survey. For more than 90% of respondents, the responses were inconsistent across different prospects and we were forced to abandon the experiment.

The bisection method of Abdellaoui et al (2008) is a choice tasks approach and, despite the valid concern raised by Frederick et al (2002), we feel that this approach is the better of the two. This is supported by the fact that now only 16% of the sample gave inconsistent responses.

(ii) **Framing effect**

As discussed by Tversky and Kahneman (1981), an individual's responses to questions can be significantly affected by how a given question is "framed". Framing is, of course, unavoidable, but we wanted our questions to be as neutral as possible, so, for example, we wanted to avoid using gambling or gaming terms and worded our questions in terms of the more neutral "gains" and "losses", as per Abdellaoui et al (2008).

(iii) **Anchoring effect**

Anchoring is a psychological concept which is used to describe the common human tendency to rely too heavily on a particular piece of information when making decisions. As shown by Frederick et al. (2002), this suggests that when respondents are asked to make decisions on a series of questions, the previous questions faced (and responses given) often influence subsequent responses.

One solution to minimise this would be to ask the questions in a random order. We have nine questions arranged in three sets of triples. The third set uses as input the answers to the first set which limits the amount of randomness that is feasible across sets. Within each set, the gain or loss increases in sequence. We could have randomised the order here, but we felt that this could be more confusing to the respondents, given that the bisection procedure is already quite complex. Abdellaoui et al (2008, p.253) also found that their subjects (47 graduate students) were less confused if they answered all the gains questions first, followed by all the loss questions, ending with the mixed questions (i.e., in the same order as given in Table 2).

(iv) **Real rewards/losses vs. hypothetical rewards/losses**

The survey questions themselves involve “hypothetical” rewards and losses. The use of “real” rewards and losses is generally considered desirable, since it brings the experiment closer to the real world (Abdellaoui et al, 2007). However, hypothetical rewards/losses have the advantage that they allow respondents to be offered a wide range of reward amounts, including large gains and losses, which are generally infeasible in studies involving real rewards and losses.

Abdellaoui et al (2008) paid their subjects a fixed fee (€10) to participate in the experiment and one subject was, in addition, randomly selected to play out one of the gain questions with the actual payment divided by 10. “For ethical and feasibility reasons” (p.252), they did not use real losses. The respondents in our study receive a “points based reward” if they fully completed the survey. Most previous studies have shown that the results are similar whether hypothetical or real rewards (e.g., Beattie and Loomes (1997), Camerer and Hogarth (1999)) and losses (e.g., Etchart-Vincent and l’Haridon (2011)) are used. However, Holt and Laury (2002) found that the use of real incentives increased risk aversion.

3. Survey analysis

3.1 Bivariate analysis

We analyse the full set of 4,016 survey responses. Among these are some respondents who give answers which appear inconsistent, for example $G_2 < G_1$. Respondents with at least one such inconsistency comprise 16% of our data set, raising the question of what to do with these individuals. One possibility is to accept that they are hopelessly confused and hence should be omitted from the analysis. On the other hand, they may merely have made one mistake in a particular direction (in the previous example, choosing a value of G_2 which is too small) and there may be other individuals who made a mistake in the other direction (i.e., G_2 too large, but still with $G_2 > G_1$): omitting the first group would lead to biased estimates. As a robustness check, we consider in Appendix 2 a reduced sample which satisfy

$G_1 < G_2 < G_3$ and $L_4 < L_5 < L_6$ and it turns out that the question is moot, since the differences in the parameter estimates are small (typically about 0.02 for α and -0.05 for β, indicating that the reduced sample is marginally both less risk averse in the gain domain and more risk seeking in the loss domain than the full sample).

In the first part of our analysis, we present estimates of the values of α, β and λ both for the full sample and for sub-samples of the full sample based on the survey respondents' 25 profiling characteristics. These are shown in Table 3.[3] It is important to note that none of the results in this section necessarily indicate a causal relationship: they are bivariate comparisons between α, β and λ and a particular profiling characteristic. Furthermore, the measured effect could be influenced by omitted variable bias (failing to control for confounding effects, whereby the values of a risk or loss aversion parameter and a particular profiling characteristic are jointly determined by a third unidentified factor) or by reverse causation (some of the variables such as savings may be determined by α, β and λ).

[3] Note that nearly all of our potential correlates for α, β and λ are categorical variables, either because they are truly categorical (e.g., gender) or because of the way that the data were collected (e.g., the question about income asked for income in bands). In some cases, we have grouped categories together because the more precise categories have a relatively small number of observations.

Table 3: Estimated loss aversion parameters for different subgroups of survey respondents (full sample)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
All	4016	0.685 (0.005)	0.833 (0.008)	0.956 (0.011)	1.21 (1.16, 1.27)	1.71 (1.57, 1.85)	2.41 (2.13, 2.70)
Gender							
Male	1815	0.700 (0.008)	0.828 (0.011)	0.951 (0.016)	1.18 (1.11, 1.25)	1.59 (1.42, 1.77)	2.15 (1.82, 2.50)
Female	2201	0.673 (0.007)	0.837 (0.010)	0.959 (0.014)	1.25 (1.18, 1.32)	1.83 (1.64, 2.03)	2.68 (2.26, 3.14)
equality test		p = 0.013	p = 0.556				
Age							
18-24	350	0.736 (0.018)	0.904 (0.023)	1.170 (0.053)	1.53 (1.30, 1.75)	2.25 (1.69, 2.90)	3.33 (2.20, 4.76)
25-34	438	0.719 (0.016)	0.866 (0.023)	1.072 (0.039)	1.36 (1.19, 1.52)	1.92 (1.50, 2.36)	2.72 (1.93, 3.67)
35-44	630	0.746 (0.015)	0.798 (0.018)	0.923 (0.022)	1.01 (0.92, 1.11)	1.15 (0.95, 1.37)	1.31 (0.98, 1.69)
45-54	837	0.699 (0.012)	0.815 (0.016)	0.887 (0.020)	1.07 (0.98, 1.18)	1.41 (1.18, 1.70)	1.85 (1.41, 2.45)
55-64	939	0.646 (0.011)	0.834 (0.017)	0.948 (0.022)	1.29 (1.18, 1.40)	1.99 (1.72, 2.32)	3.09 (2.46, 3.85)
65 & over	822	0.635 (0.011)	0.831 (0.018)	0.943 (0.022)	1.29 (1.16, 1.41)	2.04 (1.67, 2.39)	3.22 (2.40, 4.08)
equality test		p = 0.000	p = 0.006				
Age and gender							
M 18-24	151	0.742 (0.028)	0.880 (0.034)	1.131 (0.067)	1.42 (1.16, 1.76)	1.98 (1.30, 2.90)	2.80 (1.48, 4.72)

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
M 25-34	143	0.751 (0.029)	0.888 (0.041)	1.015 (0.069)	1.31 (1.03, 1.58)	1.85 (1.22, 2.60)	2.66 (1.43, 4.29)
M 35-44	275	0.765 (0.023)	0.827 (0.028)	0.930 (0.036)	1.05 (0.90, 1.21)	1.24 (0.93, 1.62)	1.47 (0.96, 2.20)
M 45-54	401	0.730 (0.018)	0.821 (0.023)	0.908 (0.032)	1.06 (0.93, 1.23)	1.33 (1.04, 1.74)	1.67 (1.17, 2.47)
M 55-64	405	0.644 (0.017)	0.808 (0.023)	0.953 (0.039)	1.24 (1.06, 1.43)	1.81 (1.34, 2.37)	2.66 (1.71, 3.95)
M 65 & over	440	0.660 (0.016)	0.817 (0.023)	0.933 (0.030)	1.20 (1.06, 1.36)	1.74 (1.33, 2.16)	2.51 (1.69, 3.47)
F 18-24	199	0.732 (0.023)	0.923 (0.032)	1.203 (0.080)	1.64 (1.33, 1.99)	2.58 (1.74, 3.64)	4.10 (2.28, 6.60)
F 25-34	295	0.704 (0.019)	0.856 (0.028)	1.102 (0.048)	1.41 (1.20, 1.63)	2.03 (1.50, 2.62)	2.93 (1.91, 4.27)
F 35-44	355	0.732 (0.019)	0.777 (0.022)	0.919 (0.029)	1.01 (0.89, 1.14)	1.14 (0.89, 1.43)	1.31 (0.89, 1.80)
F 45-54	436	0.672 (0.016)	0.809 (0.023)	0.868 (0.025)	1.08 (0.97, 1.21)	1.48 (1.20, 1.81)	2.04 (1.46, 2.74)
F 55-64	534	0.648 (0.014)	0.853 (0.023)	0.944 (0.029)	1.32 (1.18, 1.48)	2.14 (1.70, 2.63)	3.48 (2.43, 4.71)
F 65 & over	382	0.607 (0.015)	0.848 (0.027)	0.952 (0.036)	1.41 (1.23, 1.61)	2.47 (1.87, 3.17)	4.36 (2.86, 6.23)
Marital status							
Married or living with partner	2544	0.681 (0.007)	0.829 (0.010)	0.944 (0.013)	1.20 (1.14, 1.26)	1.69 (1.55, 1.85)	2.38 (2.08, 2.72)

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Single	1004	0.721 (0.011)	0.846 (0.015)	1.002 (0.025)	1.23 (1.13, 1.34)	1.64 (1.39, 1.95)	2.20 (1.70, 2.85)
Widowed, separated or divorced	468	0.636 (0.016)	0.822 (0.023)	0.925 (0.026)	1.25 (1.12, 1.39)	1.93 (1.54, 2.40)	3.00 (2.13, 4.12)
equality test		p = 0.000	p = 0.553				
Number of children							
No children	2778	0.668 (0.006)	0.845 (0.009)	0.981 (0.014)	1.30 (1.23, 1.37)	1.96 (1.76, 2.16)	2.96 (2.53, 3.40)
One or more children	925	0.730 (0.012)	0.808 (0.015)	0.909 (0.017)	1.03 (0.96, 1.11)	1.24 (1.08, 1.42)	1.49 (1.20, 1.81)
No answer	313	0.713 (0.021)	0.796 (0.026)	0.909 (0.033)	1.05 (0.91, 1.19)	1.28 (0.98, 1.63)	1.58 (1.04, 2.25)
equality test (excl NA)		p = 0.000	p = 0.033				
Health status							
Better than average	1072	0.684 (0.011)	0.853 (0.015)	0.963 (0.020)	1.26 (1.17, 1.37)	1.86 (1.60, 2.17)	2.75 (2.19, 3.47)
Average	2065	0.687 (0.007)	0.825 (0.010)	0.968 (0.014)	1.21 (1.15, 1.29)	1.67 (1.50, 1.87)	2.30 (1.96, 2.71)
Worse than average	879	0.682 (0.012)	0.826 (0.017)	0.922 (0.019)	1.17 (1.08, 1.26)	1.65 (1.41, 1.88)	2.32 (1.83, 2.83)
equality test		p = 0.930	p = 0.279				
Personality type 1							
Type A (competitive)	1202	0.732 (0.011)	0.828 (0.013)	0.917 (0.017)	1.07 (1.00, 1.15)	1.34 (1.16, 1.53)	1.67 (1.35, 2.03)
Type B (laid back)	2814	0.666 (0.006)	0.835 (0.009)	0.974 (0.012)	1.28 (1.22, 1.34)	1.89 (1.73, 2.06)	2.79 (2.42, 3.19)
equality test		p = 0.000	p = 0.691				

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Personality type 2							
Optimist	2652	0.688 (0.007)	0.824 (0.009)	0.932 (0.011)	1.16 (1.10, 1.21)	1.58 (1.44, 1.73)	2.16 (1.88, 2.47)
Pessimist	1364	0.679 (0.009)	0.850 (0.013)	1.009 (0.020)	1.33 (1.24, 1.43)	1.98 (1.75, 2.25)	2.94 (2.45, 3.54)
equality test		$p = 0.425$	$p = 0.111$				
Emotional state							
Tense	343	0.667 (0.019)	0.830 (0.026)	0.969 (0.041)	1.25 (1.09, 1.48)	1.82 (1.39, 2.48)	2.67 (1.81, 4.10)
Neutral	1772	0.673 (0.008)	0.850 (0.012)	1.002 (0.019)	1.33 (1.25, 1.41)	2.00 (1.79, 2.23)	3.01 (2.55, 3.54)
Relaxed	1815	0.700 (0.008)	0.821 (0.011)	0.921 (0.015)	1.12 (1.04, 1.19)	1.49 (1.29, 1.66)	1.98 (1.59, 2.33)
Not sure	86	0.691 (0.044)	0.743 (0.045)	0.862 (0.073)	0.96 (0.67, 1.27)	1.13 (0.56, 1.95)	1.37 (0.46, 2.94)
equality test (excl NS)		$p = 0.040$	$p = 0.204$				
Education							
16 & under	1104	0.656 (0.010)	0.803 (0.015)	0.871 (0.015)	1.10 (1.02, 1.17)	1.54 (1.32, 1.74)	2.16 (1.70, 2.58)
17-19	893	0.663 (0.012)	0.824 (0.017)	0.939 (0.023)	1.23 (1.11, 1.36)	1.80 (1.48, 2.14)	2.65 (1.97, 3.36)
20 & over	1298	0.716 (0.010)	0.854 (0.012)	1.034 (0.022)	1.30 (1.21, 1.41)	1.80 (1.59, 2.09)	2.49 (2.07, 3.08)
Other	721	0.703 (0.013)	0.852 (0.018)	0.994 (0.028)	1.27 (1.15, 1.39)	1.80 (1.51, 2.14)	2.56 (1.97, 3.31)
equality test (excl Other)		$p = 0.000$	$p = 0.030$				
Financial knowledge							

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Low	967	0.665 (0.011)	0.851 (0.016)	0.975 (0.025)	1.33 (1.22, 1.45)	2.06 (1.74, 2.44)	3.21 (2.50, 4.07)
Medium	2640	0.684 (0.007)	0.820 (0.009)	0.948 (0.013)	1.18 (1.13, 1.25)	1.63 (1.49, 1.80)	2.24 (1.95, 2.59)
High	409	0.743 (0.020)	0.876 (0.023)	0.962 (0.037)	1.21 (1.03, 1.40)	1.68 (1.25, 2.18)	2.34 (1.50, 3.41)
equality test		p = 0.002	p = 0.035				
Social class							
A	646	0.711 (0.014)	0.792 (0.017)	0.932 (0.025)	1.07 (0.96, 1.18)	1.30 (1.07, 1.57)	1.59 (1.17, 2.09)
B	869	0.686 (0.011)	0.857 (0.016)	1.006 (0.023)	1.32 (1.22, 1.43)	1.97 (1.70, 2.28)	2.93 (2.36, 3.67)
C1	1053	0.710 (0.010)	0.845 (0.014)	0.988 (0.022)	1.24 (1.15, 1.33)	1.70 (1.49, 1.94)	2.33 (1.91, 2.83)
C2	581	0.684 (0.015)	0.827 (0.020)	0.905 (0.024)	1.14 (1.03, 1.26)	1.59 (1.30, 1.91)	2.24 (1.65, 2.91)
D	347	0.655 (0.017)	0.813 (0.027)	0.944 (0.033)	1.22 (1.06, 1.42)	1.76 (1.34, 2.32)	2.58 (1.69, 3.81)
E	390	0.607 (0.017)	0.844 (0.028)	0.891 (0.032)	1.31 (1.14, 1.52)	2.27 (1.69, 2.96)	3.96 (2.53, 5.83)
Not available	130	0.693 (0.033)	0.836 (0.045)	0.957 (0.060)	1.23 (0.91, 1.52)	1.76 (0.95, 2.65)	2.59 (0.99, 4.52)
equality test (excl NA)		p = 0.000	p = 0.093				
Employment status							
Full-time	1644	0.733 (0.009)	0.835 (0.011)	0.959 (0.017)	1.13 (1.05, 1.20)	1.43 (1.25, 1.61)	1.81 (1.48, 2.16)

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Part-time	612	0.685 (0.014)	0.810 (0.018)	0.928 (0.025)	1.15 (1.04, 1.29)	1.56 (1.28, 1.90)	2.11 (1.56, 2.80)
Student	184	0.726 (0.025)	0.933 (0.034)	1.214 (0.082)	1.70 (1.38, 2.07)	2.77 (1.89, 3.89)	4.55 (2.56, 7.26)
Retired	1155	0.635 (0.010)	0.819 (0.015)	0.929 (0.019)	1.25 (1.15, 1.36)	1.91 (1.64, 2.23)	2.92 (2.33, 3.67)
Not working	324	0.629 (0.016)	0.860 (0.028)	0.967 (0.037)	1.41 (1.24, 1.62)	2.42 (1.86, 3.14)	4.18 (2.75, 6.13)
No answer	97	0.634 (0.032)	0.832 (0.054)	0.980 (0.071)	1.37 (1.04, 1.81)	2.26 (1.27, 3.82)	3.82 (1.55, 8.04)
equality test (only FT, PT, NW)		p = 0.000	p = 0.282				
Management responsibility							
Owner, etc	300	0.699 (0.021)	0.808 (0.027)	0.981 (0.037)	1.17 (1.00, 1.34)	1.52 (1.10, 1.93)	1.99 (1.21, 2.80)
Senior manager	145	0.745 (0.034)	0.809 (0.033)	0.898 (0.050)	1.01 (0.83, 1.27)	1.19 (0.79, 1.81)	1.44 (0.75, 2.58)
Middle manager	302	0.759 (0.020)	0.762 (0.023)	0.868 (0.025)	0.87 (0.77, 0.99)	0.89 (0.69, 1.12)	0.90 (0.63, 1.27)
Junior manager	443	0.718 (0.017)	0.869 (0.022)	0.978 (0.034)	1.25 (1.10, 1.41)	1.77 (1.39, 2.23)	2.53 (1.75, 3.50)
No management responsibility	1073	0.701 (0.010)	0.846 (0.015)	0.980 (0.021)	1.24 (1.15, 1.35)	1.74 (1.51, 2.03)	2.44 (1.98, 3.09)
Other / NA	1753	0.649 (0.008)	0.835 (0.012)	0.955 (0.016)	1.28 (1.20, 1.36)	1.96 (1.73, 2.19)	3.00 (2.49, 3.52)
equality test (excl Oth/NA)		p = 0.078	p = 0.008				
Employment sector							

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Self-employed	375	0.673 (0.018)	0.815 (0.024)	0.994 (0.035)	1.26 (1.09, 1.42)	1.76 (1.36, 2.20)	2.47 (1.66, 3.39)
Private sector	1231	0.710 (0.010)	0.814 (0.013)	0.932 (0.017)	1.10 (1.03, 1.18)	1.41 (1.22, 1.62)	1.80 (1.45, 2.22)
Public corporation	533	0.698 (0.015)	0.844 (0.020)	0.944 (0.030)	1.19 (1.05, 1.33)	1.67 (1.31, 2.05)	2.36 (1.63, 3.17)
Public sector	465	0.667 (0.015)	0.867 (0.023)	0.983 (0.030)	1.35 (1.22, 1.52)	2.15 (1.74, 2.64)	3.43 (2.51, 4.60)
Charity sector	211	0.672 (0.023)	0.870 (0.034)	1.010 (0.051)	1.40 (1.15, 1.62)	2.23 (1.54, 2.94)	3.60 (2.10, 5.41)
Other / NA	1201	0.668 (0.010)	0.834 (0.014)	0.957 (0.020)	1.25 (1.15, 1.36)	1.83 (1.55, 2.14)	2.69 (2.09, 3.39)
equality test (excl Oth/NA)		p = 0.094	p = 0.181				
Job security							
Secure	1781	0.723 (0.008)	0.836 (0.011)	0.956 (0.016)	1.14 (1.07, 1.21)	1.48 (1.31, 1.66)	1.92 (1.59, 2.27)
Insecure	475	0.707 (0.017)	0.801 (0.021)	0.930 (0.030)	1.09 (0.95, 1.25)	1.37 (1.07, 1.74)	1.74 (1.21, 2.44)
No answer	1760	0.643 (0.008)	0.839 (0.012)	0.962 (0.016)	1.32 (1.24, 1.40)	2.07 (1.84, 2.34)	3.26 (2.74, 3.87)
equality test (excl NA)		p = 0.389	p = 0.135				
Income							
Below £15,000	1057	0.649 (0.010)	0.845 (0.015)	0.966 (0.021)	1.32 (1.22, 1.42)	2.07 (1.78, 2.37)	3.26 (2.61, 4.02)
£15,000-£29,999	1056	0.678 (0.010)	0.832 (0.015)	0.975 (0.020)	1.25 (1.16, 1.33)	1.78 (1.56, 1.99)	2.54 (2.09, 2.98)

Characteristic	N	α	β	λ	**Λ(5)**	**Λ(50)**	**Λ(500)**
£30,000-£49,999	567	0.746 (0.015)	0.827 (0.019)	0.931 (0.026)	1.06 (0.97, 1.18)	1.29 (1.07, 1.57)	1.56 (1.18, 2.10)
£50,000 & above	208	0.790 (0.027)	0.790 (0.028)	0.897 (0.037)	0.90 (0.75, 1.07)	0.90 (0.63, 1.26)	0.92 (0.52, 1.48)
No answer	1128	0.679 (0.010)	0.833 (0.015)	0.952 (0.019)	1.21 (1.13, 1.31)	1.71 (1.50, 1.99)	2.43 (1.99, 3.02)
equality test (excl NA)		p = 0.000	p = 0.387				
Home ownership							
Own outright	713	0.654 (0.013)	0.850 (0.020)	0.956 (0.028)	1.31 (1.18, 1.45)	2.06 (1.66, 2.49)	3.24 (2.37, 4.28)
Mortgage	610	0.694 (0.014)	0.816 (0.018)	0.962 (0.025)	1.19 (1.08, 1.31)	1.60 (1.34, 1.93)	2.15 (1.64, 2.84)
Rent	420	0.669 (0.018)	0.798 (0.024)	0.907 (0.032)	1.12 (0.97, 1.29)	1.53 (1.15, 1.99)	2.09 (1.35, 3.09)
No answer / don't know	2273	0.696 (0.007)	0.839 (0.010)	0.964 (0.013)	1.22 (1.15, 1.28)	1.70 (1.52, 1.88)	2.38 (2.01, 2.74)
equality test (excl NA/DK)		p = 0.104	p = 0.213				
Savings							
Below £1,000	938	0.689 (0.011)	0.814 (0.016)	0.922 (0.018)	1.13 (1.04, 1.24)	1.52 (1.28, 1.81)	2.04 (1.57, 2.65)
£1,000 - £9,999	816	0.708 (0.012)	0.841 (0.016)	0.970 (0.026)	1.21 (1.12, 1.33)	1.66 (1.43, 1.98)	2.28 (1.83, 2.97)
£10,000 - £49,999	690	0.672 (0.012)	0.830 (0.017)	1.026 (0.026)	1.32 (1.21, 1.45)	1.90 (1.62, 2.26)	2.75 (2.15, 3.53)
£50,000 and above	596	0.712 (0.014)	0.842 (0.020)	0.937 (0.026)	1.16 (1.04, 1.28)	1.57 (1.26, 1.90)	2.14 (1.53, 2.84)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
No answer	976	0.655 (0.011)	0.841 (0.016)	0.947 (0.022)	1.28 (1.16, 1.40)	1.97 (1.62, 2.32)	3.04 (2.26, 3.86)
equality test (excl NA)		p = 0.098	p = 0.620				
Ease of short-term saving							
Easy	2488	0.686 (0.007)	0.834 (0.010)	0.960 (0.013)	1.23 (1.17, 1.29)	1.74 (1.59, 1.90)	2.46 (2.17, 2.80)
Not easy	1528	0.684 (0.009)	0.831 (0.012)	0.949 (0.017)	1.20 (1.12, 1.27)	1.68 (1.46, 1.89)	2.36 (1.91, 2.81)
equality test		p = 0.861	p = 0.832				
Rainy day fund							
Yes	2719	0.677 (0.006)	0.842 (0.009)	0.979 (0.013)	1.28 (1.22, 1.34)	1.87 (1.70, 2.04)	2.74 (2.38, 3.12)
No	1297	0.702 (0.010)	0.814 (0.013)	0.915 (0.017)	1.10 (1.02, 1.19)	1.42 (1.24, 1.64)	1.85 (1.50, 2.27)
equality test		p = 0.039	p = 0.081				
Region							
North East	174	0.678 (0.024)	0.809 (0.033)	0.925 (0.044)	1.15 (0.96, 1.38)	1.57 (1.09, 2.24)	2.17 (1.24, 3.66)
North West	490	0.670 (0.014)	0.816 (0.021)	0.964 (0.032)	1.23 (1.10, 1.37)	1.74 (1.39, 2.09)	2.47 (1.78, 3.23)
Yorkshire and the Humber	370	0.676 (0.017)	0.820 (0.024)	0.942 (0.033)	1.20 (1.05, 1.35)	1.71 (1.30, 2.08)	2.43 (1.60, 3.24)
East Midlands	292	0.675 (0.019)	0.860 (0.029)	1.036 (0.044)	1.39 (1.19, 1.59)	2.14 (1.61, 2.74)	3.30 (2.18, 4.76)
West Midlands	300	0.725 (0.021)	0.865 (0.029)	0.950 (0.039)	1.20 (1.02, 1.38)	1.67 (1.25, 2.24)	2.35 (1.51, 3.63)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
East of England	352	0.677 (0.018)	0.857 (0.026)	0.970 (0.038)	1.30 (1.12, 1.49)	1.98 (1.52, 2.53)	3.03 (2.05, 4.33)
London	509	0.709 (0.017)	0.825 (0.021)	0.920 (0.025)	1.11 (1.00, 1.24)	1.45 (1.18, 1.80)	1.90 (1.39, 2.61)
South East	499	0.671 (0.014)	0.842 (0.022)	1.009 (0.033)	1.33 (1.15, 1.53)	1.99 (1.52, 2.57)	2.99 (1.99, 4.34)
South West	343	0.685 (0.018)	0.866 (0.027)	0.971 (0.038)	1.29 (1.13, 1.53)	1.96 (1.49, 2.68)	2.99 (1.96, 4.74)
Wales	192	0.662 (0.023)	0.771 (0.032)	0.939 (0.041)	1.13 (0.96, 1.35)	1.48 (1.09, 2.04)	1.95 (1.21, 3.07)
Scotland	391	0.703 (0.019)	0.818 (0.024)	0.906 (0.032)	1.10 (0.93, 1.24)	1.44 (1.05, 1.83)	1.90 (1.19, 2.70)
Northern Ireland	104	0.674 (0.038)	0.818 (0.051)	0.949 (0.069)	1.22 (0.95, 1.65)	1.76 (1.01, 3.14)	2.62 (1.09, 5.99)
equality test (excl oth)		$p = 0.495$	$p = 0.505$				
Newspaper							
Express / Mail	560	0.678 (0.015)	0.796 (0.020)	0.907 (0.024)	1.10 (0.96, 1.21)	1.45 (1.11, 1.76)	1.92 (1.28, 2.56)
Sun / Star	571	0.672 (0.014)	0.807 (0.020)	0.867 (0.023)	1.08 (0.99, 1.20)	1.48 (1.24, 1.79)	2.04 (1.55, 2.69)
Mirror / Record	402	0.701 (0.018)	0.807 (0.025)	0.854 (0.024)	1.01 (0.89, 1.13)	1.30 (0.99, 1.61)	1.67 (1.09, 2.31)
Guardian / Independent	378	0.670 (0.015)	0.892 (0.024)	1.214 (0.046)	1.74 (1.53, 1.98)	2.93 (2.29, 3.71)	4.94 (3.39, 6.96)
FT / Times / Telegraph	316	0.763 (0.021)	0.830 (0.025)	0.950 (0.035)	1.07 (0.91, 1.23)	1.27 (0.95, 1.64)	1.51 (0.97, 2.20)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
Other paper	419	0.687 (0.017)	0.840 (0.022)	0.980 (0.033)	1.25 (1.09, 1.42)	1.79 (1.37, 2.26)	2.58 (1.72, 3.56)
No paper	1370	0.675 (0.009)	0.850 (0.014)	1.005 (0.022)	1.32 (1.22, 1.43)	1.96 (1.69, 2.29)	2.92 (2.35, 3.66)
equality test		p = 0.006	p = 0.027				
Political party							
Conservative	950	0.710 (0.011)	0.828 (0.015)	0.945 (0.019)	1.15 (1.06, 1.25)	1.52 (1.30, 1.79)	2.02 (1.60, 2.55)
Labour	1339	0.685 (0.010)	0.828 (0.013)	0.929 (0.018)	1.17 (1.10, 1.27)	1.64 (1.42, 1.90)	2.29 (1.86, 2.83)
Liberal Democrat	333	0.657 (0.017)	0.888 (0.027)	1.113 (0.047)	1.63 (1.40, 1.89)	2.81 (2.14, 3.67)	4.89 (3.24, 7.12)
SNP or Plaid Cymru	100	0.729 (0.039)	0.808 (0.046)	0.893 (0.065)	1.02 (0.77, 1.32)	1.27 (0.71, 2.01)	1.61 (0.65, 3.07)
Other party	351	0.654 (0.018)	0.847 (0.028)	0.963 (0.039)	1.31 (1.12, 1.53)	2.06 (1.53, 2.68)	3.25 (2.09, 4.71)
No party	760	0.679 (0.013)	0.813 (0.017)	0.962 (0.026)	1.20 (1.08, 1.32)	1.65 (1.36, 1.97)	2.27 (1.69, 2.92)
Don't know / NA	183	0.678 (0.026)	0.862 (0.040)	1.003 (0.062)	1.38 (1.12, 1.75)	2.17 (1.43, 3.39)	3.47 (1.84, 6.66)
equality test (excl DK/NA)		p = 0.028	p = 0.265				
Religion							
None	498	0.707 (0.017)	0.832 (0.023)	0.950 (0.033)	1.16 (1.02, 1.34)	1.56 (1.19, 2.03)	2.09 (1.39, 3.06)
Ch of England	560	0.649 (0.014)	0.812 (0.020)	0.914 (0.026)	1.19 (1.07, 1.33)	1.74 (1.40, 2.14)	2.55 (1.83, 3.46)

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Roman Catholic	171	0.681 (0.029)	0.817 (0.040)	0.898 (0.049)	1.13 (0.91, 1.37)	1.57 (1.05, 2.33)	2.23 (1.19, 3.98)
Protestant	158	0.617 (0.023)	0.829 (0.032)	1.047 (0.056)	1.46 (1.25, 1.76)	2.39 (1.76, 3.32)	3.92 (2.42, 6.14)
Other	121	0.656 (0.030)	0.822 (0.040)	0.988 (0.060)	1.31 (1.07, 1.58)	1.96 (1.30, 2.84)	2.98 (1.58, 5.23)
NA	2508	0.695 (0.007)	0.840 (0.010)	0.965 (0.014)	1.22 (1.16, 1.29)	1.70 (1.54, 1.88)	2.38 (2.05, 2.75)
equality test (NA)		p = 0.017	p = 0.975				
Religiosity							
Religious	843	0.644 (0.011)	0.811 (0.017)	0.925 (0.022)	1.22 (1.11, 1.35)	1.80 (1.50, 2.18)	2.67 (2.03, 3.53)
Not religious	904	0.705 (0.012)	0.837 (0.016)	0.957 (0.024)	1.19 (1.07, 1.30)	1.62 (1.34, 1.92)	2.21 (1.67, 2.87)
Don't know / NA	2269	0.693 (0.007)	0.839 (0.010)	0.967 (0.012)	1.23 (1.18, 1.28)	1.72 (1.57, 1.87)	2.41 (2.10, 2.74)
equality test (excl DK/NA)		p = 0.000	p = 0.261				

Note: The table presents results for the full sample of 4,016 respondents. N = number of respondents with each characteristic, α = degree of risk aversion in the domain of gains, β = degree of risk aversion in the domain of losses, λ = direct loss aversion (i.e., when the loss $x=-1$), and $\Lambda(x)$ is relative loss aversion comparing a loss of x with a gain of x (see Equation (4)), where x = 5, 50 and 500. The null hypothesis for the equality test is that the parameters are equal across the categories of each characteristic and the null is rejected if the *p*-value is below the required significance level and accepted if it is above.

(i) Overall

We start by estimating the parameters for the entire sample. Our point estimate for α is 0.685 and for β it is 0.833: combined with an estimate of λ of 0.956, these are the estimates used to plot Figure 1 above. The α and β estimates are much lower than those reported by Abdellaoui et al (2008) who get median individual estimates of 0.86 and 1.06, which are respectively 26% and 27% higher than our estimates. As previously mentioned, this may be due to a small sample upward bias from estimating the parameters at the individual level when there are only a relatively small number of questions per individual. Also as previously discussed, the estimates of λ are homogeneous of degree $\beta-\alpha$ and cannot be easily compared: for this reason, we do not view the difference between our estimated λ value close to unity with the median value of 2.61 reported by Abdellaoui et al (2008) as informative.

One of the most striking results is that in all cases, $\beta > \alpha$, meaning that the marginal disutility of a loss exceeds the marginal utility of a gain. Despite the finding that $\lambda \approx 1$, the fact that $\beta > \alpha$ implies individuals are loss averse (i.e. $\Lambda(x) > 1$) when x is larger than unity, effectively for all non-trivial values. We find, for example, $\Lambda(500) = 2.41$, which means that the loss of £500 causes 2.41 times more unhappiness than a gain of £50 would cause happiness.

These results have been obtained by estimating the preference parameters from the sample as a whole but, as we noted in the Introduction, the parameters vary for different groups of people. We now proceed to look at the association between the preference parameters and individual characteristics on a characteristic-by-characteristic basis.

(ii) Gender

The vast majority of studies show that, on average, women are more risk averse than men, particularly when it comes to financial investments (e.g., Bajtelsmit and Bernasek (1996), Powell and Ansic (1997), Jianakoplos and Bernasek (1998), Schubert et al. (1999), Finucane et al. (2000), Borghans et al. (2009), Croson and Gneezy (2009), Dohmen et al. (2011), and Sarin and Wieland (2012)). However, Filippin and Crosetto (2016) and Nelson (2017) review the more recent literature on gender differences in risk aversion and find that there is little conclusive evidence for a difference or that any difference is small.

Barber and Odean (2001) explain the observation that women are more risk averse than men in terms of men being more confident than women. A survey by Scottish Friendly (2018) found that 45% of men were either "very" or "extremely confident" about managing their finances, compared with 31% of women. We also find that, on average, women in the UK have greater risk aversion in the domain of gains than men: the median female $\alpha = 0.673$ is lower than the median male $\alpha = 0.700$. This difference is statistically significant with a *p*-value of 0.013, but is economically quite small. The differences in the parameter estimates for β and λ are even smaller and not statistically significant for the former. Nevertheless, when looking at relative loss aversion, $\Lambda(50)$ is 1.81 for females and 1.58 for males, and this difference is statistically significant. The Scottish Friendly survey found that women were more afraid of losing money than men.

(iii) Age

There is an extensive literature assessing whether risk aversion changes with age. Most studies show that young adults and very old people tend to be risk averse. Between these ages, risk aversion initially falls before rising again following a U-shaped pattern (e.g., Riley and Chow (1992), Bakshi and Chen (1994), and Pålsson (1996)). More recent studies give mixed results: some show that older people can be more risk averse than younger adults (e.g., Albert and Duffy (2012) and Bonsang and Dohmen (2015)), others show that older people can be more risk seeking than younger adults (e.g., Kellen et al. (2017)), while others show that there are no clear age-related differences as a function of choice framing, e.g., in terms of gains vs. losses (e.g., Mata et al. (2011)).

Table 3 shows the parameter estimates for age groups 18−24, 25–34, 35−44, 45−54, 55–64 and 65 and over. The α estimates have a broad hump-shaped pattern, with a peak (implying risk aversion in the domain of gains is lowest) in early middle age (35-44). In higher age ranges, it declines uniformly. It is lower in lower age ranges, although 18-24 year olds are less risk averse than 25-34 year olds. These differences are statistically significant. The β estimates exhibit a U-shaped pattern, with the lowest value (indicating that risk seeking in the domain of losses is greatest) in the 35-44 age range. The value is highest, indicating the lowest willingness to take risks in the loss domain, in the 18-24 year age range. Again, these differences are statistically significant. The estimated loss aversion parameter, λ, also has a U-shaped pattern, reaching a minimum in later middle age (45-54). It is highest with 18-24 year olds. So our survey respondents appear to be both less risk averse and less loss averse, as well as more risk seeking if facing losses, in middle age than at earlier or later ages. This is consistent with existing evidence.

Looking at the results by age and gender, Table 3 and Figure 2 suggest that women are more risk averse in the gain domain than men in the same age group, except marginally for the 55-64 age group. However, women appear to be more risk seeking in the loss domain than men between the ages of 24 and 55 and also less loss averse between 35 and 64.

(iv) Marital status

The degree of risk aversion can also be influenced by marital status. Sung and Hanna (1996), Grable and Lytton (1998), Jianakoplos and Bernasek (1998, 2006), and Yao and Hanna (2005) provide evidence that single women are more risk averse than single men or married couples. Hallahan et al. (2003) argue that married couples have greater capacity to absorb undesirable outcomes than singles. However, when married couples are analysed separately, single women are more risk averse than married men, but less risk averse than married women. Some studies find that single people actually take more risks (e.g., Cohn et al. (1975), Dohmen et al. (2011) and Roussanov and Savor (2014)).

Our data set indicates that widowed, divorced and separated people are the most risk averse in the gain domain, while single people are the least, with partnered people[4] lying between; the differences are statistically significant. Since the existing literature has not previously examined widowed, divorced and separated people, this would appear to be a new finding. We offer the following possible explanations: they could have (i) experienced a sharp and sudden fall in income, (ii) to provide for dependants (both younger and older) and (iii) become more cautious as a result of their negative experience. On the other hand, their risk seeking behaviour in the loss domain is greater than the other two groups (although the difference is not significant), and they appear to be less loss averse.

[4] Married/living with partner, including "civil partnership".

(v) Number of children

Having children tends to be associated with higher risk aversion according to Chaulk et al. (2003), Hallahan et al. (2004) and Gilliam et al. (2010). However, our study shows people without children are more risk averse in the gain domain, less risk taking in the loss domain, and more loss averse overall than people with children. On the face of it, this result might seem surprising. One might have thought that having children would make people more loss averse. But the causality could be the other way around: people who are both risk and loss averse might decide not to have children.

(vi) Health status

Risk attitudes in both domains of gains and losses do not appear to depend on self-reported health status: note that the question explicitly asked respondents to report their health status compared to people of the same age, so this should not be confounded with age effects. However, loss aversion is much lower for people in poor health than for people with average or above average health.

(vii) Personality type 1: Type A vs Type B

The first personality type variable contrasts individuals who are competitive, outgoing, ambitious, impatient or aggressive with those who are more laid back. Type A competitive personalities are both less loss averse and less risk averse in the gain domain than Type B laid-back personalities. There is, however, no difference in risk seeking behaviour in the loss domain.

(viii) Personality type 2: Optimists vs pessimists

There is also no difference in the risk attitudes of optimists and pessimists, although pessimists are significantly more loss averse than optimists.

(ix) Emotional state

Individuals who report that they were tense at the beginning of the survey have higher risk aversion than those in a neutral or relaxed state. However, those in a neutral state are both less risk seeking in the loss domain and more loss averse than those in other groups.

(x) Education

Individuals with higher levels of general education or higher IQs tend to be more risk tolerant (e.g., Grable (2000) and Grinblatt et al (2011)). This is strongly reinforced if individuals also have a high degree of financial literacy (Behrman et al (2012), and Lusardi and Mitchell (2014)). Bluethgen et al (2008) find that financial advice can also help to overcome risk aversion, especially for women, and lead to more diversified portfolios that are better targeted to achieving an investor's goals.

In our sample, there is an interesting mixture of results. Risk aversion in the gain domain falls with higher levels of general education, consistent with existing evidence. Risk seeking in the loss domain also falls, but loss aversion increases with terminal education age.

(xi) Financial knowledge

The degree of financial knowledge has a significant impact on risk and loss attitudes, unsurprisingly. Individuals reporting a high level of financial knowledge – just 10% of the sample – have both significantly lower risk aversion in the gain domain and risk seeking in the loss domain than those reporting medium and low financial knowledge. However, the differences in loss aversion, λ, are not significant across the three groups. Nevertheless, the differences in α and β mean that relative loss aversion is much higher for those with low financial knowledge than for the other two groups.

(xii) Social class[5]

Individuals from higher social classes generally have higher values of α and lower values of β (statistically significant in both cases), suggesting that they are less risk averse in the gain

[5] Social class definitions are: A - Higher professional and managerial occupations; B - Lower managerial and professional occupations; C1 - Supervisory, clerical and administrative occupations; small employers and own account workers; C2 - Lower supervisory and technical occupations; skilled manual workers; D - Semi and unskilled manual workers, semi-routine and routine occupations, casual workers; E - Never worked and long-term unemployed. Sources: NRS classifications, www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/; webarchive.nationalarchives.gov.uk/20010627021525/http://www.statistics.gov.uk:80/methods_quality/ns_sec/

domain and more risk seeking in the loss domain than those from lower social classes. Members of social class A have the lowest degree of relative loss aversion, Λ. For example, for $x = £10$, their $\Lambda(10)$ at 1.36 is half that of members of social class E at 2.64. An outlier in this pattern is social class B whose members from the lower managerial and professional occupations are much more risk and loss averse than members of neighbouring social classes: their $\Lambda(10)$ at 2.21 is the second highest after social class E.

(xiii) Employment status

Employment status has a big and predictable effect on the parameter estimates. Those not working (including the unemployed), those classified as other/no answer and retired people have the greatest risk aversion in the gain domain, and full-time workers and students the lowest, with part-time workers in between. Yet, part-time workers are the most risk seeking in the loss domain and students the least. Consistent with this, part-time workers are the least loss averse and students the most.

(xiv) Management responsibility

In terms of management responsibility, there is a hump-shaped pattern in α values, with business owners and those without management responsibility being more risk averse in the gain domain than managers. In turn, senior and junior managers are more risk averse than middle managers, although the differences are not statistically significant. Middle managers are also more risk seeking in the loss domain than other groups and now the difference is significant. This is followed by owners and senior managers, with junior managers and those without managerial responsibility being the least willing to take such risks, consistent with the social class findings. Middle managers' direct loss aversion, λ, is also significantly lower than all other groups, so low, in fact, that their relative loss aversion, $\Lambda(x)$, is independent of the size of x.[6]

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[6] The technical reason why this holds is that their α and β parameters are approximately equal, so that their $\Lambda(x) = \lambda$ for all x. This is what Tversky and Kahneman (1992) found for their group of graduate students.

(xv) Employment sector

Public and charity sector workers are the most risk averse in the gain domain, the least risk seeking in the loss domain and the most loss averse of all groups of workers. The self-employed are also risk averse in gains, but are amongst the most risk seeking in the loss domain, and are much less loss averse than public and charity sector workers. Private sector employees (followed by those working for public corporations) have the lowest risk aversion in the gain domain, are amongst the most risk seeking in the loss domain, and have the lowest loss aversion. It is possible that an individual's risk attitude and employment sector are jointly determined: for example, someone who is risk averse chooses to work in the public sector.

(xvi) Job security

Job security has no effect on risk attitudes.

(xvii) Income (gross personal)

Most studies suggest that risk aversion decreases with higher income and wealth, controlling for other factors, such as gender, age, education and financial knowledge (e.g., Riley and Chow (1992), Grable (2000), Hartog et al. (2002), Campbell (2006), Guiso and Paiella (2008), and Grinblatt et al. (2011)). However, individuals who are more likely to face income uncertainty or to become liquidity constrained exhibit a higher degree of risk aversion (Guiso and Paiella (2008)). Similarly, individuals become more risk averse after a negative shock to wealth, such as a reduction in the value of their home (Paravisini et al. (2017)). We look at income in this sub-section and different measures of wealth in the following two sub-sections.

Risk aversion in the gain domain falls monotonically as income increases. By contrast, risk seeking behaviour in the loss domain increases monotonically as income increases. Our study shows the importance of income in determining the degree of direct loss aversion, λ, which generally falls as income increases: it is above the national average (0.956) for incomes below £30,000, and below for incomes above £30,000.[7] However, relative loss aversion, $\Lambda(x)$, falls monotonically as income rises.

(xviii) Home ownership

In terms of home ownership, relative loss aversion is lowest for those who rent, next highest for those with a mortgage, and highest for those who own their home outright. However, these differences are not statistically significant, since there is no significant difference in α, β or λ across the three groups. In short, the extent of home ownership appears to have little effect on risk and loss attitudes.

(xix) Savings

For savings, we observe a hump-shaped pattern for λ: it is low at low levels of savings (below £1,000), but then increases as the level of savings increases, reaching a peak for savings in the range £10,000 to £49,999, but is then much lower for savings of £50,000 and above. Those with little savings have little to lose and this is reflected in a relatively low λ. This group also has the lowest β parameter, indicating the strongest risk seeking behaviour in the domain of losses. The β parameter is highest for those with savings above £50,000, suggesting that this group is the least willing to take risks in the face of losses. But the pattern in between is non-monotonic. The α parameters exhibit a similar wave like pattern as the β parameters. The lowest α parameters (the most risk averse in the gain domain) are for those with savings below £1,000 or between £10,000 and £49,999. The highest α parameters (the least risk averse in the gain domain) are for those with savings between £1,000 and £9,999 or above £50,000. The differences in the α parameters are statistically significant, while the differences in the β parameters are not.

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[7] This figure is just above median earnings at the time of the survey. In April 2017, median gross annual earnings for full-time employees in the UK were £28,600 (https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2017provisionaland2016revisedresults).

We should note the possibility of reverse causality in the case of savings. Past savings decisions are likely to have been influenced by an individual's α, β and λ parameters. At the same time, the attitude of individuals to risk or loss today depends partly on their current financial status.

(xx) Ease of short-term savings

Whether people find it easy or difficult to engage in short-term savings – and remarkably 38% of the sample find it difficult – has little effect on risk and loss attitudes.

(xxi) Rainy day fund

By contrast, whether or not people have a rainy day fund (i.e., precautionary savings) – and 32% of the sample do not – has a significant effect on risk attitudes. Those with a rainy day fund are more risk averse in the gain domain, less risk seeking in the loss domain, and more loss averse than those without such a fund. Again, it is important to note that the causation could be reversed.

(xxii) Region

A global test indicates that there is no statistical difference in α and β parameters across the regions. But this masks some interesting regional differences, although it is hard to explain why they hold. For example, respondents living in Wales have both the greatest risk aversion in the gain domain and the greatest risk seeking in the loss domain, while the opposite holds for those living in the West Midlands. Relative loss aversion, $\Lambda(x)$, is lowest in Wales, Scotland and London, and highest in the East Midlands.

(xxiii) Newspaper

The newspaper read by respondents – and indeed whether they read a newspaper at all – is a powerful indicator of risk and loss attitudes. *Guardian* and *Independent* readers have the highest level of risk aversion in the gain domain, the lowest level of risk seeking in the loss domain and highest level of loss aversion. Their relative loss aversion, $\Lambda(x)$, is considerably higher than any other group and this is followed by those who do not take a paper. Readers of the *Financial Times*, the *Times*, and the *Telegraph* have the lowest relative loss aversion, as well as being the least risk averse in the gain domain. This is closely followed by *Mirror* and *Record* readers and then by *Express*, *Mail*, *Sun* and *Star* readers.

These results are likely to be linked to other profiling characteristics, such as age, social class and political party. For example, the *Guardian*'s readership comes predominantly from the 15-34 age group, from social classes ABC1, and with left-leaning and liberal democrat political views.[8]

(xxiv) Political party

Liberal Democrats (whom we can conjecture are largely *Guardian* readers) stand out as having the highest level of risk aversion in the gain domain, the lowest level of risk seeking in the loss domain and highest level of loss aversion. Their relative loss aversion is considerably higher than that of any other political party. By contrast, Scottish National and Plaid Cymru Party members appear to be the least risk and loss averse. Lying in between are Conservative and Labour Party members, with the latter being more risk averse and having marginally higher relative loss aversion than the former.

(xxv) Religion

There is a strong correlation of α with self-reported religion. This is not driven by non-Christian religions: the total number of Jews, Moslems, Hindus and Sikhs is only 3% of the sample. Instead it is due to the fact that non-religious people and Roman Catholics have higher values of α (indicating lower risk aversion) than all other religious affiliations (Church of England, other Protestant denominations, other religions). Risk seeking in the loss domain (β) is virtually identical across all groups. Non-CofE Protestants have the highest relative loss aversion, while Catholics and those without a religion the lowest.

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[8] https://www.theguardian.com/advertising/guardian-circulation-readership-statistics; https://www.statista.com/statistics/380687/the-guardian-the-observer-monthly-reach-by-demographic-uk/; https://www.pressgazette.co.uk/mail-uks-most-read-newspaper-brand-under-35s-favour-sun/

(xxvi) Religiosity

The final profiling characteristic is the level of religiosity. Those who report themselves to be religious, are significantly more risk averse than those who report themselves as being non-religious. There is no difference in risk seeking in the loss domain (consistent with the previous section) and religious people have very marginally higher relative loss aversion.

3.2 Analysing graduate students

So far our results are not directly comparable with existing studies, such as Tversky and Kahneman (1992) or Abdellaoui et al (2008). In order to make a direct comparison, we would need to analyse graduate students. To do this, we examine respondents in full-time education aged 21-23 of whom there are 71 graduates in our sample. This compares with 25 in the Tversky and Kahneman (1992) study and 47 in the Abdellaoui et al (2008) study.

Table 4: Estimated loss aversion parameters for graduate students in three studies

	N	α	β	λ	$\Lambda(1000)$
This study	71	0.703 (0.034)[a]	0.924 (0.050)[a]	1.256 (0.119)	7.08 (2.86, 14.97)[b]
Tversky and Kahnemann (1992)	25	0.88	0.88	2.25	2.25
Abdellaoui et al (2008)	47	0.86[c] (0.66, 1.08)[e]	1.06[c,d] (0.92,1.49)[e]	-	2.61 (1.51, 5.51)[e]

Note: The table presents results for the graduate students in our study together with those from two other studies. N = number of respondents, α = degree of risk aversion in the domain of gains, β = degree of risk aversion in the domain of losses, λ = direct loss aversion (i.e., when the loss $x = -1$), and $\Lambda(1000)$ is relative loss aversion comparing a loss of 1,000 with a gain of 1,000 (see Equation (4)). [a] Standard errors; [b] 90% confidence interval; [c] Median of estimates of individuals' parameters: all estimates from Abdellaoui et al (2008) are from Table 6; [d] This is significantly different from unity; [e] Inter-quartile range of estimates of individuals' parameters. To enable comparison with the other respondents in our study, we report the following for our 71 graduate students: $\Lambda(5)$ = 1.81 (1.31, 2.39), $\Lambda(50)$ = 3.05 (1.70, 4.84), and $\Lambda(500)$ = 5.24 (2.20, 9.77).

Table 4 presents the NLS estimates of the LA parameters for the sub-sample of our respondents who are graduate students, together with the median[9] of the individual parameter estimates for the other two studies. The table shows the results for a homogeneous group of respondents across three studies, although there is no particular reason to expect that groups of students in different countries and at different times should have identical LA parameters.

We make the following observations. Our α estimate is significantly below that of Tversky and Kahneman (1992) – indicating greater risk aversion in the gain domain – but our β estimate is not significantly different. Tversky and Kahneman also find that $\alpha = \beta (= 0.88)$ which means that their estimated λ = 2.25 is independent of the gain or loss amount, x. However, this does not hold when $\alpha \neq \beta$ which is likely to be the general case. The Abdellaoui et al (2008) estimates of α and β are, respectively, 22% and 15% higher than ours and this, together with their finding that β is significantly greater than unity, could reflect the small sample bias in the NLS estimator they used.[10]

Since Abdellaoui et al (2008, pp.253-4) use a normalisation constant of €1,000, we report $\Lambda(1,000)$ for the three studies.[11] The relative loss aversion coefficient for our group of students (7.08) is much higher than for the other groups, largely because they have such a low α estimate. Nevertheless, the difference $\beta - \alpha$ at around 0.2 is similar for our study and the Abdellaoui et al (2008) study, indicating that the elasticity of relative loss aversion with respect to the magnitude of gains and losses will be similar. Overall, it seems fair to conclude that the three groups of students have different risk and loss attitudes.

Table 4 also highlights a major contribution of our study: looking at the behaviour of students may be highly misleading when it comes to determining risk and loss aversion for the population as a whole. Our students are very different from the wider population in surprising ways. Comparing the first rows of Table 3 and 4, we can see that our graduate students are

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[9] Both Tversky and Kahneman (1992) and Abdellaoui et al (2008) estimate parameters separately for each individual respondent and then report the median of the individual estimates.

[10] See Appendix A1.2.

[11] These will correspond to slightly different amounts when expressed in a common currency.

less risk averse in the gain domain, less risk seeking in the loss domain, but also much more loss averse overall: $\Lambda(500)$ = 5.24 compared with 2.41 for the overall sample. Our 71 graduate students also differ from the 113 other students in the sample: the former are more risk averse in the gain domain, more risk seeking in the loss domain, but overall more loss averse. This shows the importance of a study that considers all members of society.

3.3 Multivariate analysis

In the previous section, we presented correlations between the LA parameters and various profiling characteristics. There are two key weaknesses with this approach. First, the correlations are unconditional, i.e., they do not condition on other profiling characteristics that could influence risk and loss attitudes. Second, a number of profiling characteristics could be highly correlated with each other, e.g., socio-economic variables, such as education, social class and income.

Table 5 reports NLS estimates of a multivariate regression which includes the profiling characteristics as explanatory variables. There are two dependent variables: α, risk aversion in the gain domain, and β, risk taking in the loss domain. The estimates can be interpreted as partial correlations between a dependent variable and a potential explanatory variable, conditional on holding all the other potential explanatory variables fixed. Apart from the constant term, what is reported are estimated deviations from a reference individual who is a member of the first group in the list of each profiling characteristic – see Table 3.

Table 5: Multivariate regressions of α and β on the profiling characteristics (full sample)

Characteristic	Category dummy	α	s.e.(α)	β	s.e.(β)
	Constant	0.713	(0.068)	0.820	(0.096)
Gender	Female	-0.005	(0.012)	0.009	(0.017)
Age	25-34	-0.042	(0.028)	-0.054	(0.038)
	35-44	-0.020	(0.029)	-0.104	(0.038)
	45-54	-0.054	(0.028)	-0.091	(0.038)
	55-64	-0.083	(0.028)	-0.080	(0.038)
	65 & over	-0.074	(0.030)	-0.084	(0.042)
Marital status	Single	0.024	(0.016)	-0.029	(0.022)
	Widowed, separated or divorced	-0.001	(0.018)	-0.018	(0.025)
No of children	One or more children	0.033	(0.016)	-0.035	(0.020)
	No answer re children	0.023	(0.029)	-0.073	(0.037)
Health status	Average	0.009	(0.013)	-0.031	(0.018)

Characteristic	Category dummy	α	s.e.(α)	β	s.e.(β)
	Worse than average	0.024	(0.016)	-0.025	(0.024)
Personality 1	Type B (laid back)	-0.048	(0.013)	0.011	(0.016)
Personality 2	Pessimist	-0.011	(0.012)	0.026	(0.017)
Emotional state	Neutral	0.001	(0.021)	0.035	(0.028)
	Relaxed	0.040	(0.022)	0.015	(0.029)
	Not sure	0.034	(0.048)	-0.076	(0.052)
Education	17-19	-0.020	(0.015)	0.015	(0.023)
	20 & over	0.016	(0.016)	0.050	(0.022)
	Other / NA	-0.022	(0.023)	0.058	(0.034)
Financial knowledge	Medium	0.015	(0.013)	-0.029	(0.020)
	High	0.046	(0.024)	0.041	(0.032)
Social class	B	-0.023	(0.018)	0.069	(0.024)
	C1	0.012	(0.018)	0.045	(0.024)
	C2	-0.009	(0.021)	0.047	(0.029)
	D	-0.027	(0.024)	0.042	(0.035)
	E	-0.044	(0.024)	0.078	(0.037)
	No answer	-0.006	(0.035)	0.041	(0.049)
Employment status	Part-time*	-0.018	(0.018)	-0.040	(0.024)
Management responsibility	Senior manager	0.019	(0.044)	-0.023	(0.049)
	Middle manager	0.024	(0.033)	-0.074	(0.043)
	Junior manager	-0.007	(0.032)	0.043	(0.042)
	None	0.001	(0.028)	0.020	(0.038)
	Other / NA	0.010	(0.031)	-0.004	(0.041)
Employment sector	Private sector	0.020	(0.024)	-0.008	(0.035)
	Public corporation	0.013	(0.028)	0.022	(0.039)
	Public sector	-0.014	(0.027)	0.047	(0.040)
	Charity sector	-0.012	(0.031)	0.061	(0.048)
	Other / NA	0.011	(0.027)	0.004	(0.038)
Job security	Insecure	0.001	(0.020)	-0.031	(0.025)
	No answer	-0.053	(0.023)	-0.013	(0.033)
Income	£15,000-£29,999	0.003	(0.015)	-0.023	(0.023)
	£30,000-£49,999	0.047	(0.021)	-0.026	(0.029)
	£50,000 or more	0.075	(0.032)	-0.044	(0.037)
	No answer	0.015	(0.017)	-0.016	(0.026)
Home ownership	Mortgage	-0.004	(0.020)	-0.039	(0.029)
	Rent	0.005	(0.022)	-0.072	(0.033)
	No answer / don't know	0.029	(0.025)	-0.044	(0.038)
Savings	£1,000 - £9,999	0.024	(0.019)	0.003	(0.025)
	£10,000 - £49,999	-0.001	(0.020)	-0.006	(0.027)
	£50,000 and above	0.052	(0.023)	0.005	(0.032)
	No answer	-0.005	(0.019)	0.013	(0.026)
Ease of saving	Not easy	0.007	(0.013)	0.028	(0.018)
Rainy day fund	No	0.032	(0.015)	-0.039	(0.021)
Region	North West	-0.013	(0.028)	0.013	(0.039)

Characteristic	Category dummy	α	s.e.(α)	β	s.e.(β)
	Yorkshire and the Humber	-0.006	(0.030)	0.005	(0.040)
	East Midlands	-0.004	(0.031)	0.056	(0.044)
	West Midlands	0.033	(0.031)	0.054	(0.044)
	East of England	-0.011	(0.030)	0.048	(0.042)
	London	0.011	(0.030)	0.015	(0.040)
	South East	-0.014	(0.028)	0.030	(0.040)
	South West	0.002	(0.031)	0.053	(0.042)
	Wales	-0.015	(0.034)	-0.044	(0.046)
	Scotland	0.009	(0.032)	-0.005	(0.043)
	Northern Ireland	-0.008	(0.044)	0.011	(0.060)
Newspaper	Sun / Star	-0.017	(0.020)	0.022	(0.029)
	Mirror / Record	0.026	(0.024)	0.028	(0.033)
	Guardian / Independent	-0.041	(0.022)	0.073	(0.034)
	FT / Times / Telegraph	0.049	(0.025)	0.017	(0.032)
	Other paper	0.003	(0.022)	0.043	(0.030)
	No newspaper	-0.017	(0.017)	0.055	(0.025)
Political party	Labour	-0.017	(0.015)	-0.008	(0.022)
	Liberal Democrat	-0.054	(0.020)	0.039	(0.031)
	SNP or Plaid Cymru	0.039	(0.042)	-0.022	(0.053)
	Other party	-0.030	(0.021)	0.001	(0.032)
	No party	-0.013	(0.017)	-0.040	(0.024)
	Don't know / NA	-0.018	(0.028)	0.009	(0.043)
Religion	Ch of England	-0.010	(0.030)	0.010	(0.044)
	Roman Catholic	0.002	(0.039)	0.027	(0.057)
	Protestant	-0.042	(0.036)	0.035	(0.053)
	Other	-0.037	(0.039)	0.022	(0.055)
	NA	0.009	(0.025)	-0.001	(0.034)
Religiosity	Not religious	0.033	(0.027)	0.040	(0.039)
	Don't know / NA	-0.010	(0.035)	0.047	(0.050)

Note: The table presents multiple regressions of α (the degree of risk aversion in the domain of gains) and β (the degree of risk aversion in the domain of losses) on category dummies for each characteristic that differentiate respondents from a reference individual. The constant term shows the estimated α or β for the reference individual and the other coefficients show positive or negative deviations from this. The reference individual is male, aged 18-24, married/living with partner, no children, better than average health, Type A (competitive) personality, optimist, tense at the time of the survey, terminal education age of 16 & under, low financial knowledge, social class A, full-time employment, management responsibility of an owner, self-employed, secure job security, income below £15,000, owns home outright, savings below £1,000, finds short-term savings easy, has a rainy day fund, Express / Mail reader, Conservative voter, no religion, but religious. *Only one employment-status categorical variable is included since the other possibilities (student, retired) are collinear with other categorical variables. Standard errors in parentheses, enabling hypothesis tests of whether a particular deviation is significantly different from zero to be conducted.

Looking across the two dependent variables, α and β, together, we observe the following, once we condition on all other profiling characteristics. There are five characteristics for which there are now no statistically significant differences between respondents. The first is male and female attitudes to risk: this implies that the significant unconditional difference in Table 3 is explained by other characteristics, such as income differences. The other four are marital status, employment sector, religion and religiosity. In addition, there are five factors which are not significant: health status, personality type 2 (optimists vs pessimists), job security, ease of short-term savings and region.

In all other cases, the multivariate analysis generally supports the findings of the bivariate analysis, although the relationship is sometimes weaker than before:

- Age is a statistically significant indicator with people over 65 being more risk averse in the gain domain and those between 45 and 64 more risk seeking in the loss domain than other age groups. This was apparent in the unconditional correlations in Table 3: conditioning reinforces the significance of the age effect. Young people are very loss averse.

- Having children is associated with greater risk taking when facing losses.

- In terms of personality type 1, Type A (competitive) personalities are less risk averse in the gain domain than Type B (laid back) personalities.

- Individuals who declare their emotional state to be relaxed are less risk averse than individuals in other emotional states.

- Individuals with a terminal educational age above 20 are both less risk averse and less willing to take risks when facing losses than those who completed their education at an earlier age.

- Individuals who classify themselves as having a high level of financial knowledge are less willing to take risks when facing losses.

- Members of social class C1 are (weakly) less risk averse than those in other social classes, while those in social class E are considerably more. Members of social class B are less willing to take risks when facing losses, compared with other social classes.

- In terms of employment status, part-time workers are more willing to take risks when facing losses, compared with full-time workers.

- Middle managers are more willing to take risks when facing losses than either other types of managers or those without management responsibility.

- Those on incomes in the range £30,000-£49,999 are less risk averse than those in other income groups, while those on incomes in the range £15,000-£49,999 are more willing to take risks when facing losses than those in other income groups.

- Renters are more willing to take risks when facing losses than mortgagors or those who own their home outright.

- Those with savings of £50,000 and above are less risk averse than those with lower savings levels.

- Those with a rainy day fund are more risk averse that those without.

- In terms of newspaper, the only effects that are now significant are that risk-seeking behaviour in the loss domain is lower by readers of the Sun / Star and by those who do not read a newspaper. The results are much weaker than in the unconditional case.

- In terms of political party, Liberal Democrats are less willing to take risks when facing losses than members of other political parties. Again, these results are much weaker than in the unconditional case.

We have a large number of potential explanatory categorical variables and so we summarise their effect in Table 6 which reports *p*-values for joint tests of significance, when the dependent variables are again α and β. The null hypothesis of each test is that there is no relationship between the dependent variable and the group of potential explanatory variables and so a low *p*-value indicates rejection of the null in favour of the alternative hypothesis that there is a relationship.[12] For example, the test for age in the α regression ($p = 0.007$) is for a joint test that all age groups have the same value of α (after controlling for all other factors in the regression): there are six age groups and five dummy variables (one each for ages 25-

[12] See Appendix A1.3 for an explanation of how the hypothesis tests were constructed.

34, 35-44, 45-54, 55-64 and 65+) and the test is the joint test that all five dummies have zero coefficients, which we reject.

Table 6: Tests of joint hypotheses from multivariate regressions: p-values

Characteristic	α	β
Gender	0.642	0.580
Age	0.007	0.077
Marital status	0.308	0.371
No of children	0.036	0.089
Health status	0.347	0.246
Personality 1: Competitive v laid back	0.000	0.482
Personality 2: Optimist v pessimist	0.333	0.121
Emotional state	0.002	0.274
Education	0.071	0.064
Financial knowledge	0.143	0.012
Social class	0.063	0.089
Employment status	0.310	0.096
Management responsibility	0.800	0.008
Employment sector	0.317	0.152
Job security	0.960	0.217
Income	0.023	0.631
Home ownership	0.934	0.090
Savings	0.026	0.979
Ease of short-term saving	0.602	0.123
Rainy day fund	0.038	0.063
Region	0.863	0.413
Newspaper	0.005	0.169
Political party	0.057	0.168
Religion	0.543	0.896
Religiosity	0.213	0.313

Note: The figures in the table are the *p*-values for a joint test that all of the category dummies for a given characteristic in Table 5 are equal to zero (i.e., the null hypothesis is that there is no relationship between a given characteristic and α (the degree of risk aversion in the domain of gains) or β (degree of risk aversion in the domain of losses), after conditioning on the other characteristics. For example, for age, the null hypothesis is that the coefficients on the categorical variables for the age dummies 25-34, 35-44, 45-54, 55-64 and 65+ are all equal to zero. The low *p*-value of 0.007 indicates that the null hypothesis of no relationship between the dependent variable and the group of categorical variables is rejected.

The results are more broad brush than those in Table 5. The only profiling characteristics that are significant (at the 10% level) are:

- in the gain domain only: personality type 1 (competitive v laid back), emotional state, income, savings, rainy day fund, newspaper and political party
- in the loss domain only: financial knowledge, employment status, management responsibility, and home ownership
- in both domains: age, number of children, education, and social class.

These results are broadly consistent with Table 5, although the number of profiling characteristics that are significant is lower.

Finally in this section, we draw comparison with two other studies that conducted a multivariate analysis. The first is Dohmen et al (2011, Table A1) which finds that women self report that they are less likely to take financial risks, after conditioning on other variables.

The second is von Gaudecker et al (2011) which is the only other study of which we are aware that surveys from a national population. Their sample size, at 1,422 individuals, is smaller than ours and they assess far fewer characteristics: only gender, age, education, income, wealth, and whether the respondent has financial knowledge or is the household's financial administrator. While their baseline estimates of the risk and loss aversion parameters (γ = 0.0316 and λ = 2.960) are not directly comparable with ours, their findings in terms of characteristics can be compared: women are more risk and loss averse than men (even after conditioning on other characteristics such as income), risk aversion increases and loss aversion falls with age, risk aversion decreases and loss aversion increases with education, risk aversion increases and loss aversion falls with income, risk and loss aversion both fall with wealth, and risk and loss aversion are lower for those with financial knowledge or who are the household's financial administrator. These are mostly similar to our findings, although there are some differences. For example, we find: a U-shaped relationship between loss aversion and age, that risk aversion decreases with income, and a hump-shaped relationship between loss aversion and total savings.

4. Conclusions

We have estimated a simple parametric version of the Kahneman-Tversky (1992) value function for a representative sample of around four thousand respondents from the UK. The estimated value function is S-shaped, exhibiting both direct loss aversion (measured by λ), risk aversion in the domain of gains (measured by $\alpha < 1$), risk seeking behaviour in the domain of losses (measured by $\beta < 1$), and with the marginal disutility of losses exceeding the marginal utility of gains ($\beta > \alpha$). In other words, the value function is concave in gains, but less concave in losses.

These findings are consistent with most previous studies, but while these other studies are mainly of students, ours is one of the few studies to sample from a national population. We also have much more detailed information about the respondents to our survey than all previous studies. We had information on 25 profiling characteristics for each respondent which enabled us to conduct both bivariate and multivariate analyses to assess if there is a statistically significant relationship (both unconditionally and conditionally) between the estimated parameters of the respondents' value function and their profiling characteristics. When conditioning on all the characteristics, we find that some characteristics are correlated with loss and risk attitudes in the gain domain only (personality type 1 (competitive v laid back), emotional state, income, savings, rainy day fund, newspaper and political party), some are correlated in the loss domain only (financial knowledge, employment status, management responsibility, and home ownership), while some are correlated in both domains (age, number of children, education, and social class).

We also document that some characteristics that were found to be unconditionally significant in the bivariate analysis were not significant when conditioned on other characteristics. One example is marital status. We find that widowed, divorced and separated people are more risk averse than partnered people who are, in turn, more risk averse than single people. But these differences disappear when we condition. Another example is gender. Our study shows that women are more loss and risk averse than men, but this is no longer the case when we condition, suggesting that gender differences can possibly be explained by other factors, such as income differences. This result is different from the most similar study to ours, namely von Gaudecker et al (2011)'s survey of over a thousand Dutch respondents, which finds gender differences in loss and risk attitudes remain, even after conditioning.

One of the challenges facing researchers wishing to estimate loss aversion parameters for the general public is to find a simple set of questions that (i) minimise the cognitive burden on those answering those questions and (ii) avoid recovering the expectations of the experimenters who guided the experimental design. Many previous attempts to do this used procedures that turned out to be too complex for many respondents to understand, resulting in the elimination of those producing inconsistent responses, thereby reducing significantly the size of the usable sample. A breakthrough came with the study of Abdellaoui et al (2008), which used a simple bisection approach involving only certainty equivalents for two-outcome prospects. This is the approach adopted in the present study. It resulted in just 16% of the sample producing apparently inconsistent responses. When this group was excluded, it made a negligible difference to the estimates of the parameters of the value function.

Yet even in this simplified framework, the magnitude of loss aversion depends not only on the values of the three parameters specifying the value function, but also in general on the size of any loss relative to a gain. Only in the rare case when the concavity in the gain and loss domains is identical (i.e., when $\alpha = \beta$) will loss aversion be independent of the size of a loss. For a representative member of our sample, we estimate relative loss aversion to be 2.41 for a loss of £500 compared with a gain of the same amount.

Because many existing studies are based on the responses of students, it is interesting to compare our results for the whole sample with a sub-sample of the respondents in our sample who are students. We estimate relative loss aversion for these students to be 5.24 for a loss of £500 compared with a gain of the same amount. This is more than twice the size of that for the whole sample. This follows because although the value functions for the two groups have similar concavities in the gain domain, the students' value function is much less concave in the loss domain. This clearly emphasises the problem in generalising from studies of students to the population as a whole.

Another important finding relates to a potential small sample estimation bias. We demonstrate that there is a potential upward bias in the estimated parameters of the value function if the sample size is low. This is likely to be the case when the value function is estimated for individual respondents and they have answered only a small number of questions, so the total number of data points is low. In our case, we have only nine data points per respondent, and we calculate that this will lead to an upward bias in the estimated parameters of up to 17%. To reduce the bias, we needed to pool the responses of respondents with similar profiling characteristics until we have a minimum sample size of 200.

The existing literature has emphasised the relationship between risk and loss attitudes and factors such as gender, age, education, income, and savings. Our study of a representative sample of the UK population finds that some of these factors (age, education, income, and savings) are also important, but others, in particular gender differences, are not significant, once we have controlled for the other factors. We have also found some other characteristics not previously studied in the literature that influence risk attitudes, in particular, personality type, social class, management responsibility, rainy day fund, newspaper, and political party.

By including questions on these factors in a client fact find, financial advisers might be able to get a better fix on the true loss and risk attitudes of their clients. In particular, they can be used to confirm the findings from a more direct elicitation of such attitudes.

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Statement by the authors

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Statement by YouGov

YouGov maintains a highly engaged panel of over 5 million respondents worldwide, who have specifically opted in to participate in online research activities (both qualitative and quantitative). The value of our panel, as opposed to many other types of online sample sources, lies in having continuous access to a responsive audience ready-profiled on important demographic, attitudinal and lifestyle attributes.

Engagement with panellists is maintained via a transparent points based reward system for the completion of surveys. Sophisticated sampling techniques ensure that members are always given a survey to complete, meaning that being screened out of a survey doesn't equal no reward, reducing the propensity to claim or misremember behaviour for fear of missing out on reward. Panellists also have their own portal and web community through which they can communicate with each other and which is used to make them aware of the impact of their contribution, via regular newsletters highlighting media coverage of YouGov and sharing findings from key surveys (that aren't commercially sensitive). On average, *panellists complete a survey no more than once per week, a threshold that ensures continued engagement without over-burdening panellists with too many surveys. We monitor and control the number and frequency of invitations and completions both at an overall level and within subject areas. Respondents are not informed of the specific survey topic to minimise response bias based on the panellists own level of interest in the subject matter.*

Appendix 1: Data and estimation issues

A1.1 Analysis of the data

The 4,016 responses to each question in the gain and loss domains are shown in Figure A1 and summary statistics are reported in Table A1. There are spikes at the expected values of the prospects and at the extremes. Responses are distributed throughout the range. For all six questions, the majority of the responses lie below the mean (which equals the expected value of the prospects).

Figure A1: The distribution of certainty equivalent scores for the three gain and three loss risky prospects

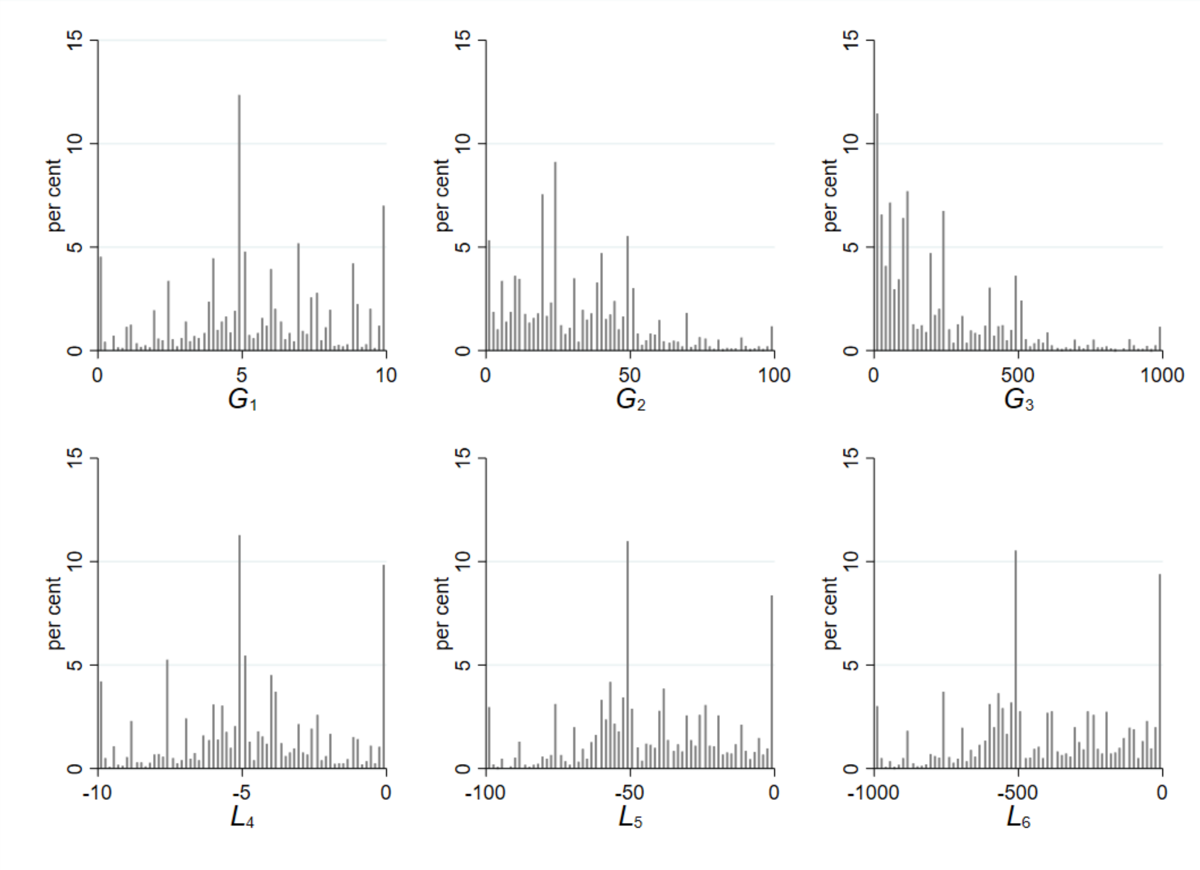


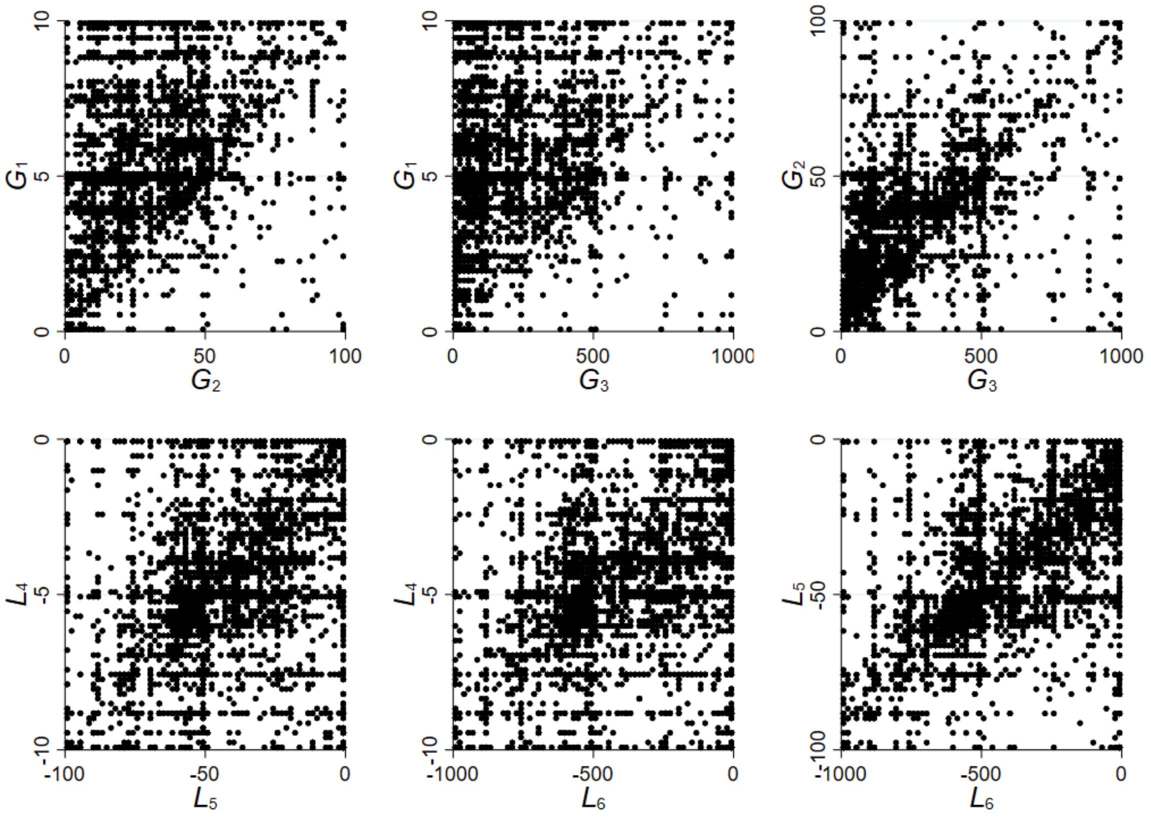
Table A1: Summary statistics for the distribution of the certainty equivalent scores for the three gain and three risky prospects

	G_1	G_2	G_3	L_4	L_5	L_6
Mean	5.52	31.70	221.73	-4.63	-42.63	-415.73
Percentage of responses less than the mean	53	56	61	56	54	53
Percentage of responses greater than the mean	47	44	39	44	46	47
St. dev.	2.65	21.74	220.16	2.67	25.08	268.78
5^{th} centile	0.54	0.78	7.81	-9.45	-88.28	-882.81
Lower quartile	3.98	14.84	54.68	-6.17	-57.03	-585.93
Median	5.07	25.78	132.81	-4.92	-47.65	-492.18
Upper quartile	7.42	46.09	335.93	-2.89	-24.21	-195.31
95^{th} centile	9.92	74.21	679.68	-0.07	-0.78	-7.81

Note: The table shows properties of the distribution of certainty equivalent scores for the three gain and three loss risky prospects.

Figure A2 presents the correlations between the 4,016 responses to the different questions. The correlations are positive and, in most of the graphs, the observations lie on or near the 45° line, which provides some evidence for the internal validity of most of the responses: if there were no relationship then this would mean that individual respondents were answering with no consistency.

Figure A2: The correlations between the responses to the three gain and three loss risky prospects



A test for the internal validity of the data is that respondents' choices are rational: $G_1 < G_2 < G_3$ and $L_4 < L_5 < L_6$. However, these conditions are satisfied for 3,359 out of 4,016 respondents, with 657 respondents (16% of the total) reporting at least one apparently irrational choice. As a robustness test we repeat our analysis with these respondents excluded, which we call the reduced sample – see Appendix 2.

A1.2 Estimation

Our assumption about the iso-elastic functional form of the value function in Equation (3) in the main text suggests that we should expect that $100G_1 \approx 10G_2 \approx G_3$ (i.e., do not differ by an order of magnitude) and so it is useful to define

$$\left.\begin{aligned} g_i &\equiv \frac{G}{10^i}, \quad i = 1,2,3 \\ l_i &\equiv \frac{-L}{10^{i-3}}, \quad i = 4,5,6 \\ m_i &\equiv \frac{-M}{10^{i-6}}, \quad i = 7,8,9 \end{aligned}\right\} \tag{A1}$$

to remove scale effects. Thus, we should expect $g_i = 0.5^{1/\alpha}$ and $l_i = 0.5^{1/\beta}$, regardless of which question is being considered. However, it is clear from Figures A1 and A2 that the data for g and l are very noisy.

We analyse our data using non-linear least squares in Stata to estimate the α and β parameters separately and then estimate the λ parameter in a second-stage procedure and in this section we explore the econometric reasoning behind this. Harrison and Swarthout (2016) note the importance of applying appropriate econometric methods to experimental data and suggest that it is often best to use probit models to estimate the effect of explanatory variables on choices between different prospects. We will be less ambitious than Harrison and Swarthout because we estimate prospects solely with equal probabilities of gain or loss and hence we are unable to distinguish the different behavioural models that they consider.

Our methodology is closest to that of Abdellaoui et al (2008) who use a bisection method. As discussed in the main text, this involves asking a series of questions to elicit an estimate of the certainty equivalent value (in both the gain or loss domain) compared with a given expected amount which differs across the questions. However, unlike Abdellaoui et al (2008), we report the results of NLS estimation where we pool responses from sub-groups of the survey, clustering the standard errors to allow for within-respondent correlations. We do not attempt to estimate individual preference parameters for reasons we shall now discuss.

We will consider preferences in the gain domain (the reasoning is analogous in the loss domain). The NLS estimator minimises

$$\sum_{i=1,2,3} \left\{ g_i - (0.5)^{1/\alpha} \right\}^2$$

resulting in closed-form solutions for the parameter estimates of

$$\hat{\alpha} = \frac{\ln 0.5}{\ln\left(n^{-1}\Sigma g_i\right)} = \frac{\ln 0.5}{\ln\left(\overline{g}\right)}$$

where the denominator is the logarithm of the arithmetic mean, $\overline{g}$, which is calculated over the full data set considered. This estimator is consistent so long as $\mathbb{E}\left[g\right] = 0.5^{(1/\alpha)}$

$$plim\left[\hat{\alpha}\right] = plim\left[\frac{\ln 0.5}{\ln\left(n^{-1}\Sigma g_i\right)}\right] = \frac{\ln 0.5}{\ln\left(plim\left[n^{-1}\Sigma g_i\right]\right)} = \frac{\ln 0.5}{\ln\left(\mathbb{E}\left[g\right]\right)} = \frac{\ln 0.5}{\ln\left(0.5^{(1/\alpha)}\right)} = \alpha$$

Our concern, however, is with small-sample bias and the variance of the estimator.

In principle, we could estimate the preference parameter α_i for each individual, since we have three data points per individual for each parameter and need a minimum of just one data point to derive an estimate.

Since we have a closed-form solution for the parameter estimates, we know that

$$\frac{d\hat{\alpha}}{d\overline{g}} = \frac{\ln 2}{\overline{g}\left(\ln \overline{g}\right)^2} > 0; \qquad \frac{d^2\hat{\alpha}}{d\overline{g}^2} = \frac{-\ln 2}{\left(\overline{g}\ln \overline{g}\right)^2}\left\{1 + \frac{2}{\ln \overline{g}}\right\} \gtrless 0$$

so $\hat{\alpha}$ is a concave function in the relevant range if $\overline{g} < exp\left(-2\right) \approx 0.13$ and convex otherwise. Furthermore, the function is extremely convex as $\overline{g} \to 1$ which is the value that we should expect if individuals are close to risk neutral (which clearly cannot be ruled out *a priori*). There is likely to be a considerable amount of experimental and sampling error in the individual responses, suggesting that, in small samples, the variance of the statistic $\overline{g}$ will also be large. Consequently, the convexity of the $\hat{\alpha}$ function will result in an upward bias in our parameter estimates. To get some idea of the numerical importance of this, we conducted a Monte Carlo analysis, calculating the distribution of $\hat{\alpha}$ and $\hat{\beta}$ for different sample sizes, where we draw (with replacement) the g_i and l_i values from the full set of 12,048 observations in our dataset, treating each observation as independent.

The results are reported in Table A2. The mean parameter estimates change very little in our Monte Carlo simulation when the sample size is more than 200. We will assume that a sample size of 1,000 is sufficient for the consistency result above to hold. When we draw 1,000 values of g, the mean value of $\hat{\alpha}$ is 0.68. We get a similar figure with only 50 observations. However, if we only had three observations, the parameter estimate is 0.80, indicating an upward bias of up to 17% in small samples. Combined with the fact that the standard deviation of the parameter estimate is also much higher, this upward bias means that the parameter estimate is greater than unity 21% of the time. These individuals appear to be risk-loving despite the true value of the risk-aversion parameter in gains space being 0.68 which is considerably less than unity.

Table A2: Summary statistics for the distribution of $\hat{\alpha}$ and $\hat{\beta}$ for different sample sizes

Sample size	**3**	**12**	**50**	**200**	**1000**
$\hat{\alpha}$					
Mean	0.802	0.701	0.685	0.687	0.684
St Dev	0.747	0.167	0.071	0.036	0.016
90%	1.296	0.914	0.780	0.732	0.705
50%	0.672	0.682	0.681	0.684	0.683
10%	0.411	0.513	0.597	0.644	0.663
$\Pr\left[\hat{\alpha} > 1\right]$	0.209	0.055	0.000	0.000	0.000
$\hat{\beta}$					
Mean	0.922	0.852	0.838	0.834	0.833
St Dev	0.474	0.185	0.088	0.042	0.019
90%	1.514	1.087	0.949	0.889	0.857
50%	0.808	0.832	0.831	0.831	0.833
10%	0.496	0.642	0.729	0.783	0.809
$\Pr\left[\hat{\beta} > 1\right]$	0.325	0.188	0.039	0.001	0.000

The estimated values of l are typically larger than for g, implying $\beta > \alpha$. This suggests that the bias in $\hat{\beta}$ is potentially larger than for $\hat{\alpha}$. However, in our data set, the variance of l is lower. The consequence is that the upward bias of $\hat{\beta}$ at 11% is a little lower than that for $\hat{\alpha}$ in our Monto Carlo simulation. The implication of a larger $\hat{\beta}$ is that the probability of the parameter estimate exceeding unity is now very high (at 33%) and does not really disappear until the sample size comfortably exceeds 50 observations.

Table A3: Summary statistics for g, l and m

Variable	Mean	Type	Std. dev.	Min	Max	Observations
g	0.364	overall	0.273	0.007	0.992	N = 12048
		between	0.184	0.008	0.992	n = 4016
		within	0.202	-0.293	1.020	T = 3
l	-0.435	overall	0.263	-0.992	-0.007	N = 12048
		between	0.209	-0.992	-0.008	n = 4016
		within	0.160	-1.092	0.222	T = 3
m	-0.400	overall	0.447	-1.969	0	N = 12048
		between	0.325	-1.968	-0.000	n = 4016
		within	0.307	-1.707	0.904	T = 3

Note: g, l and m are defined in (A1). The "overall" standard deviation refers to the standard deviation of the responses across all 3 questions for all 4,016 respondents. The "between" standard deviation refers to the standard deviation of the responses across the 4,016 respondents (i.e., the responses to the 3 questions are aggregated). The "within" standard deviation refers to the standard deviation of the responses across the 3 questions (i.e., the responses of the 4,016 respondents are aggregated). Since the overall variance is the sum of the between and within variances, the overall standard deviation is less than the sum of the two standard deviations.

Our Monte Carlo results are based on the values of g being independent, but this would be insufficiently conservative. Table A3 reports summary statistics for g, l and m. This confirms what we observed in Figure A2, namely that there is a positive correlation between the reported values for g and l for each respondent, but this correlation is imperfect since the within standard deviations are non-zero. To interpret the estimates of α and β in the light of the Monte Carlo simulations, we need to account for the fact that, although we have three responses for each individual, they are not independent and hence the true bias is likely to be larger than suggested by the Monte Carlo simulations. For this reason, we argue that we need a minimum of 200 observations in any NLS estimation to remove any biases. The table also shows evidence of a positive correlation in the reported values across respondents (since the between standard deviations are non-zero).

There are two consequences of these results. First, we cannot reliably estimate the α and β parameters based on individual response data. We need to aggregate data across (potentially similar) respondents until we have at least 200 observations in order to minimise the bias due to sampling error. Second, it suggests that the variance of responses in questionnaires is sufficiently large that there is a high chance of finding apparent risk-loving behaviour in the domain of gains $(\alpha > 1)$ for any given individual. In the light of this, the findings of Abdellaoui et al. (2008, Table 4), which shows significant proportions of individuals having convex preferences, are quite possibly due to a mixture of bias and sampling error: the estimated curvature of the value function in the gain or loss domain appears to be based on only six observations (since they do not report the details of their NLS estimation, it is difficult to say much more about this).

Finally, we estimate λ using a two-stage process. Recall that in the last three questions of the survey, the choice facing respondents is between a prospect of a 50% chance of a gain of $G_i\ (i = 1,2,3)$ and a 50% chance of a loss of $M_j\ (j = 7,8,9)$, on the one hand, and a prospect of zero with certainty, on the other. To be indifferent between the choices it must be the case that (using re-scaled responses (A1))

$$\tfrac{1}{2} g_i^{\alpha} - \tfrac{1}{2}\lambda m_{i+6}^{\beta} = 0 \Rightarrow m_{i+6} = \left(\frac{g_i^{\alpha}}{\lambda}\right)^{1/\beta} = g_i^{\alpha/\beta}\lambda^{-1/\beta}$$

and this motivates our two-stage estimator, which chooses the value of λ to minimise (conditional of the estimated $\hat{\alpha}$ and $\hat{\beta}$)

$$\sum_{i=1,2,3}\left\{m_{i+6} - g_i^{\hat{\alpha}/\hat{\beta}}\lambda^{-1/\hat{\beta}}\right\}^2$$

We calculate the standard errors by boot-strapping to allow for the fact that the estimation of λ is based upon $\hat{\alpha}$ and $\hat{\beta}$ rather than α and β.

We will illustrate the procedure using the age variable. We divided the respondents into six age brackets and estimated six separate estimates of α: $\hat{\alpha}^{[18-24]}, \hat{\alpha}^{[25-34]}, \hat{\alpha}^{[35-44]}, \hat{\alpha}^{[45-54]}, \hat{\alpha}^{[55-64]}$ and $\hat{\alpha}^{[65+]}$. The estimate of $\hat{\alpha}^{[18-24]}$ across 350 respondents is found by minimising

$$\sum_{i=1,2,3}\left\{g_i-(0.5)^{1/\left(\alpha^{[18-24]}\right)}\right\}^2$$

Stata also produces the standard error of $\hat{\alpha}^{[18-24]}$. The six β parameters and their standard errors are estimated in a similar way.

Conditional on $\hat{\alpha}^{[18-24]}$ and $\hat{\beta}^{[18-24]}$, the estimate of $\lambda^{[18-24]}$ is found by minimising

$$\sum_{i=1,2,3}\left\{m_{i+6}-g_i^{\hat{\alpha}^{[18-24]}/\hat{\beta}^{[18-24]}}\left(\lambda^{[18-24]]}\right)^{-1/\hat{\beta}^{[18-24]}}\right\}^2$$

To estimate the standard error of $\lambda^{[18-24]}$, we use the following procedure. In each bootstrap replication, we re-sample 350 times with replacement from the 350 respondents aged 18-24. We take complete sets of the nine answers to questions 1-9 to allow for any correlation of answers between questions from each respondent and then re-estimate $\alpha^{[18-24]}$, $\beta^{[18-24]}$ and $\lambda^{[18-24]}$. From this we obtain the distribution of the estimated λ parameters and hence the standard errors.

All the parameter estimates and their standard errors are shown in Table 3.

A1.3 Hypothesis testing

In this section, we explain how the hypothesis tests in Table 6 in the main text are constructed. These involve a chi-squared test for the equality of the parameters.

Again, we will illustrate this using the age variable. We need to estimate jointly the six parameters $\hat{\alpha}^{[18-24]},\hat{\alpha}^{[25-34]},\hat{\alpha}^{[35-44]},\hat{\alpha}^{[45-54]},\hat{\alpha}^{[55-64]}$ and $\hat{\alpha}^{[65+]}$ and test whether they are equal. This is easiest to do by choosing a transformed set of parameters $\alpha^{[18-24]}$ and $\Delta^{[25-34]},\ldots,\ \Delta^{[65+]}$ to minimise

$$\sum_{i=1,2,3}\left\{g_i-(0.5)^{1/\left(\alpha^{[18-24]}+\Delta^{[25-34]}d_i^{[25-34]}+\Delta^{[35-44]}d_i^{[35-44]}+\Delta^{[45-54]}d_i^{[45-54]}+\Delta^{[55-64]}d_i^{[55-64]}+\Delta^{[65+]}d_i^{[65+]}\right)}\right\}^2$$

where $d_i^{[25-34]}$ is a dummy variable taking the value unity for individuals aged 25-34 and zero otherwise and $\Delta^{[25-34]}\equiv\alpha^{[25-34]}-\alpha^{[18-24]}$ etc.

We can then test the null hypothesis

$$H_0 : \Delta^{[25-34]} = \Delta^{[35-44]} = \Delta^{[45-54]} = \Delta^{[55-64]} = \Delta^{[65+]} = 0$$

which is equivalent to the desired null hypothesis

$$H_0 : \alpha^{[18-24]} = \alpha^{[25-34]} = \alpha^{[35-44]} = \alpha^{[45-54]} = \alpha^{[55-64]} = \alpha^{[65+]}$$

Exactly analogous procedures are used to estimate and test the equality between the six β parameters.

We do not conduct hypotheses tests involving the λ parameters for a number of reasons. First, since we know that the $\hat{\alpha}$ and $\hat{\beta}$ estimates are significantly different, it is a moot point whether testing for equality of the λ parameters is a conceptually interesting exercise. Second and more importantly, the boot-strapping procedure does not allow us to perform a test for equality of the λ parameters alone.

To see why, we note that the null hypothesis of a test for equality of the λ parameters would be (in the case of the age variables)

$$H_0 : \lambda^{[18-24]} = \lambda^{[25-34]} = \lambda^{[35-44]} = \lambda^{[45-54]} = \lambda^{[55-64]} = \lambda^{[65+]}$$

and we wish to test this rather than the more restrictive null hypothesis that

$$\begin{aligned} H_0 &: \alpha^{[18-24]} = \alpha^{[25-34]} = \alpha^{[35-44]} = \alpha^{[45-54]} = \alpha^{[55-64]} = \alpha^{[65+]} \\ &\textit{and } \beta^{[18-24]} = \beta^{[25-34]} = \beta^{[35-44]} = \beta^{[45-54]} = \beta^{[55-64]} = \beta^{[65+]} \\ &\textit{and } \lambda^{[18-24]} = \lambda^{[25-34]} = \lambda^{[35-44]} = \lambda^{[45-54]} = \lambda^{[55-64]} = \lambda^{[65+]} \end{aligned}$$

However, our boot-strapping procedure only allows us to test the more restrictive null hypothesis. Under the restricted null hypothesis, the value of λ would be the same for the 18-24 age group as for all of the other age groups. So the bootstrapping procedure generates the distribution relevant for the equality test by randomly drawing from all age groups when generating the simulated 18-24 age group's observations. Further, because we must allow for correlation between individual responses to the nine questions, we sample at an individual rather than at a question level. By sampling in this way, we would allocate individuals to the 18-24 age group with the average values of α and β across all age groups and hence be imposing the null hypothesis that the α and β parameters were equal. Thus the test of the marginal hypothesis that the λ parameters are equal would be conditional on the already-rejected hypothesis that the α and β parameters were equal, so cannot be tested independently.

Appendix 2: Reduced sample results

As noted in the main text, 657 respondents (16% of the total) reported at least one apparently irrational choice, i.e., their responses did not completely satisfy the satiation requirement that $G_1 < G_2 < G_3$ and $L_4 < L_5 < L_6$. In Table A4, we report a complete set of results for the reduced sample of 3,359 whose responses fully satisfy satiation.

Table A5 compares and contrasts the full sample and reduced sample results. The first two columns show the difference between the estimates for the full sample and the sub-sample, together with the *p*-value for the equality test. In nearly all cases, we can reject the null hypothesis that the parameter estimates are the same in the full and sub-samples. However, this is mainly because the large sample size leads to small standard errors, so the parameters are estimated with a high degree of precision. Nevertheless, the magnitude of the difference is typically very small: the average difference between the corresponding estimates in Table 3 and Table A4 is 0.02 for α and -0.05 for β. Hence the reduced sample is marginally less risk averse in gains and more risk seeking in losses.

The final two columns present relative loss aversion $\Lambda(50)$ for the full and reduced samples (taken from Table 3 and Table A.4, respectively). The reduced sample typically displays higher loss aversion, although not much higher and the confidence intervals overlap.

Table A4: Estimated loss aversion parameters for different subgroups of survey respondents (reduced sample)

Characteristic	**N**	α	β	λ	**Λ(5)**	**Λ(50)**	**Λ(500)**
All	3359	0.704 (0.006)	0.868 (0.008)	0.996 (0.013)	1.30 (1.23, 1.35)	1.89 (1.73, 2.05)	2.76 (2.42, 3.10)
Gender							
Male	1547	0.718 (0.009)	0.856 (0.012)	0.987 (0.019)	1.23 (1.14, 1.31)	1.70 (1.48, 1.91)	2.34 (1.89, 2.76)
Female	1812	0.692 (0.008)	0.877 (0.012)	1.003 (0.019)	1.35 (1.26, 1.44)	2.07 (1.82, 2.32)	3.17 (2.62, 3.76)
equality test		$p = 0.031$	$p = 0.215$				
Age							
18-24	327	0.748 (0.018)	0.908 (0.023)	1.187 (0.055)	1.55 (1.33, 1.79)	2.26 (1.72, 2.92)	3.33 (2.18, 4.78)
25-34	374	0.735 (0.017)	0.896 (0.025)	1.147 (0.051)	1.50 (1.31, 1.73)	2.20 (1.71, 2.83)	3.24 (2.20, 4.58)
35-44	523	0.770 (0.017)	0.825 (0.019)	0.954 (0.029)	1.05 (0.94, 1.16)	1.20 (0.97, 1.43)	1.37 (0.99, 1.77)
45-54	684	0.719 (0.013)	0.845 (0.018)	0.923 (0.025)	1.13 (1.01, 1.25)	1.52 (1.23, 1.83)	2.04 (1.50, 2.70)
55-64	787	0.662 (0.012)	0.879 (0.019)	0.982 (0.028)	1.39 (1.25, 1.54)	2.30 (1.86, 2.82)	3.81 (2.74, 5.18)
65 & over	664	0.652 (0.013)	0.878 (0.021)	0.981 (0.027)	1.41 (1.26, 1.57)	2.37 (1.94, 2.91)	4.01 (2.95, 5.35)
equality test		$p = 0.000$	$p = 0.045$				
Age and gender							
M 18-24	145	0.738 (0.028)	0.883 (0.035)	1.164 (0.072)	1.50 (1.22, 1.80)	2.16 (1.43, 2.93)	3.14 (1.66, 4.89)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
M 25-34	119	0.780 (0.030)	0.926 (0.044)	1.112 (0.102)	1.45 (1.05, 1.84)	2.09 (1.18, 3.22)	3.09 (1.30, 5.59)
M 35-44	230	0.784 (0.025)	0.842 (0.030)	0.950 (0.046)	1.06 (0.89, 1.25)	1.24 (0.87, 1.67)	1.47 (0.84, 2.29)
M 45-54	338	0.745 (0.020)	0.842 (0.024)	0.945 (0.041)	1.11 (0.95, 1.31)	1.40 (1.01, 1.90)	1.78 (1.10, 2.76)
M 55-64	344	0.656 (0.018)	0.857 (0.026)	1.007 (0.046)	1.39 (1.20, 1.67)	2.23 (1.68, 3.09)	3.62 (2.35, 5.80)
M 65 & over	371	0.687 (0.018)	0.846 (0.027)	0.941 (0.037)	1.22 (1.02, 1.40)	1.77 (1.28, 2.30)	2.59 (1.59, 3.76)
F 18-24	182	0.756 (0.023)	0.929 (0.032)	1.207 (0.081)	1.61 (1.33, 2.00)	2.44 (1.73, 3.41)	3.71 (2.21, 5.92)
F 25-34	255	0.715 (0.021)	0.882 (0.030)	1.164 (0.058)	1.52 (1.30, 1.83)	2.25 (1.64, 3.09)	3.36 (2.08, 5.26)
F 35-44	293	0.759 (0.022)	0.811 (0.025)	0.958 (0.036)	1.05 (0.91, 1.21)	1.19 (0.90, 1.53)	1.36 (0.89, 2.00)
F 45-54	346	0.694 (0.018)	0.848 (0.026)	0.902 (0.030)	1.17 (1.02, 1.35)	1.71 (1.30, 2.22)	2.51 (1.64, 3.65)
F 55-64	443	0.667 (0.016)	0.896 (0.027)	0.963 (0.031)	1.39 (1.22, 1.57)	2.37 (1.84, 2.93)	4.05 (2.76, 5.52)
F 65 & over	293	0.611 (0.018)	0.921 (0.033)	1.037 (0.053)	1.71 (1.44, 2.02)	3.51 (2.52, 4.75)	7.26 (4.42, 11.06)
Marital status							
Married or living with partner	2122	0.699 (0.007)	0.868 (0.011)	0.983 (0.015)	1.29 (1.21, 1.37)	1.90 (1.69, 2.15)	2.81 (2.35, 3.36)
Single	866	0.743 (0.012)	0.866 (0.016)	1.028 (0.028)	1.25 (1.12, 1.38)	1.66 (1.34, 1.98)	2.20 (1.61, 2.86)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
Widowed, separated or divorced	371	0.642 (0.018)	0.872 (0.028)	0.994 (0.041)	1.44 (1.24, 1.70)	2.48 (1.82, 3.31)	4.28 (2.72, 6.46)
equality test		p = 0.000	p = 0.981				
Number of children							
No children	2328	0.687 (0.007)	0.880 (0.010)	1.021 (0.016)	1.39 (1.31, 1.47)	2.18 (1.95, 2.41)	3.40 (2.89, 3.95)
One or more children	771	0.741 (0.013)	0.844 (0.017)	0.959 (0.026)	1.14 (1.02, 1.27)	1.46 (1.16, 1.78)	1.88 (1.34, 2.49)
No answer	260	0.751 (0.024)	0.828 (0.027)	0.923 (0.041)	1.06 (0.90, 1.25)	1.29 (0.93, 1.78)	1.58 (0.96, 2.53)
equality test (excl NA)		p = 0.000	p = 0.064				
Health status							
Better than average	889	0.703 (0.012)	0.896 (0.017)	1.021 (0.030)	1.40 (1.28, 1.55)	2.19 (1.84, 2.64)	3.44 (2.66, 4.50)
Average	1754	0.704 (0.008)	0.856 (0.011)	1.001 (0.018)	1.28 (1.20, 1.37)	1.82 (1.62, 2.05)	2.59 (2.17, 3.09)
Worse than average	716	0.703 (0.013)	0.862 (0.019)	0.957 (0.027)	1.24 (1.09, 1.40)	1.79 (1.42, 2.24)	2.59 (1.84, 3.60)
equality test		p = 0.992	p = 0.132				
Personality type 1							
Type A (competitive)	1017	0.752 (0.012)	0.862 (0.014)	0.963 (0.022)	1.15 (1.05, 1.24)	1.48 (1.24, 1.72)	1.91 (1.48, 2.38)
Type B (laid back)	2342	0.684 (0.007)	0.870 (0.010)	1.012 (0.016)	1.37 (1.29, 1.45)	2.10 (1.87, 2.35)	3.24 (2.73, 3.81)
equality test		p = 0.000	p = 0.666				
Personality type 2							

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
Optimist	2202	0.704 (0.007)	0.860 (0.010)	0.972 (0.015)	1.25 (1.18, 1.33)	1.79 (1.60, 2.00)	2.57 (2.16, 3.02)
Pessimist	1157	0.704 (0.010)	0.882 (0.014)	1.046 (0.027)	1.40 (1.27, 1.52)	2.12 (1.76, 2.46)	3.22 (2.45, 4.01)
equality test		p = 0.999	p = 0.216				
Emotional state							
Tense	286	0.682 (0.020)	0.864 (0.029)	1.025 (0.051)	1.38 (1.18, 1.62)	2.12 (1.59, 2.82)	3.27 (2.12, 4.94)
Neutral	1503	0.693 (0.008)	0.883 (0.013)	1.055 (0.021)	1.44 (1.34, 1.54)	2.23 (1.96, 2.54)	3.48 (2.87, 4.20)
Relaxed	1502	0.718 (0.009)	0.858 (0.013)	0.951 (0.018)	1.19 (1.11, 1.27)	1.65 (1.41, 1.85)	2.30 (1.80, 2.71)
Not sure	68	0.723 (0.050)	0.769 (0.050)	0.823 (0.076)	0.92 (0.63, 1.35)	1.09 (0.49, 2.05)	1.34 (0.38, 3.17)
equality test (excl NS)		p = 0.067	p = 0.391				
Education							
16 & under	868	0.669 (0.011)	0.855 (0.018)	0.910 (0.020)	1.22 (1.11, 1.35)	1.87 (1.55, 2.27)	2.88 (2.17, 3.81)
17-19	737	0.682 (0.013)	0.861 (0.019)	0.974 (0.026)	1.30 (1.19, 1.45)	1.98 (1.63, 2.39)	3.00 (2.22, 3.93)
20 & over	1148	0.735 (0.010)	0.870 (0.013)	1.064 (0.024)	1.33 (1.23, 1.42)	1.82 (1.56, 2.06)	2.49 (1.99, 2.98)
Other	606	0.724 (0.014)	0.890 (0.019)	1.035 (0.033)	1.36 (1.22, 1.52)	2.01 (1.62, 2.45)	2.97 (2.15, 3.96)
equality test (excl Other)		p = 0.000	p = 0.772				
Financial knowledge							

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
Low	801	0.685 (0.012)	0.892 (0.018)	1.022 (0.029)	1.43 (1.29, 1.58)	2.31 (1.88, 2.76)	3.75 (2.73, 4.84)
Medium	2201	0.701 (0.007)	0.855 (0.010)	0.985 (0.015)	1.26 (1.19, 1.33)	1.80 (1.62, 1.98)	2.56 (2.19, 2.97)
High	357	0.763 (0.021)	0.891 (0.024)	1.004 (0.044)	1.26 (1.09, 1.49)	1.73 (1.32, 2.33)	2.39 (1.56, 3.63)
equality test		p = 0.004	p = 0.126				
Social class							
A	558	0.733 (0.015)	0.819 (0.019)	0.954 (0.028)	1.09 (0.97, 1.23)	1.33 (1.05, 1.67)	1.63 (1.13, 2.27)
B	753	0.704 (0.012)	0.889 (0.017)	1.039 (0.030)	1.41 (1.27, 1.54)	2.17 (1.77, 2.63)	3.36 (2.49, 4.44)
C1	898	0.719 (0.011)	0.881 (0.016)	1.049 (0.027)	1.37 (1.25, 1.48)	2.00 (1.70, 2.30)	2.92 (2.32, 3.58)
C2	470	0.704 (0.017)	0.850 (0.023)	0.947 (0.029)	1.21 (1.07, 1.37)	1.70 (1.34, 2.15)	2.42 (1.67, 3.38)
D	281	0.671 (0.020)	0.865 (0.032)	0.976 (0.045)	1.36 (1.14, 1.63)	2.18 (1.54, 3.01)	3.51 (2.09, 5.64)
E	294	0.631 (0.019)	0.901 (0.035)	0.929 (0.046)	1.46 (1.21, 1.72)	2.77 (1.93, 3.81)	5.33 (3.07, 8.36)
Not available	105	0.722 (0.038)	0.866 (0.051)	0.980 (0.069)	1.27 (0.97, 1.65)	1.84 (1.04, 2.95)	2.73 (1.11, 5.26)
equality test (excl NA)		p = 0.000	p = 0.065				
Employment status							
Full-time	1407	0.743 (0.009)	0.856 (0.012)	0.998 (0.020)	1.20 (1.12, 1.30)	1.56 (1.39, 1.79)	2.03 (1.70, 2.50)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
Part-time	506	0.704 (0.015)	0.854 (0.021)	0.979 (0.032)	1.26 (1.12, 1.39)	1.79 (1.42, 2.16)	2.56 (1.80, 3.33)
Student	168	0.742 (0.026)	0.957 (0.036)	1.271 (0.087)	1.81 (1.46, 2.28)	3.03 (2.05, 4.59)	5.12 (2.87, 9.06)
Retired	935	0.660 (0.011)	0.865 (0.017)	0.959 (0.024)	1.34 (1.22, 1.48)	2.16 (1.81, 2.59)	3.50 (2.68, 4.57)
Not working	264	0.646 (0.018)	0.893 (0.031)	1.004 (0.044)	1.52 (1.27, 1.80)	2.73 (1.92, 3.69)	4.94 (2.89, 7.73)
No answer	79	0.674 (0.036)	0.931 (0.064)	1.033 (0.089)	1.56 (1.12, 2.24)	2.92 (1.55, 5.24)	5.62 (2.09, 12.29)
equality test (only FT, PT, NW)		p = 0.000	p = 0.525				
Management responsibility							
Owner, etc	256	0.700 (0.022)	0.838 (0.029)	1.023 (0.050)	1.31 (1.11, 1.55)	1.84 (1.34, 2.42)	2.61 (1.61, 3.87)
Senior manager	125	0.748 (0.037)	0.822 (0.037)	0.927 (0.056)	1.06 (0.85, 1.32)	1.29 (0.80, 1.93)	1.59 (0.76, 2.86)
Middle manager	263	0.778 (0.021)	0.768 (0.024)	0.883 (0.032)	0.88 (0.77, 1.01)	0.88 (0.68, 1.13)	0.88 (0.60, 1.27)
Junior manager	373	0.731 (0.018)	0.903 (0.024)	1.049 (0.039)	1.40 (1.20, 1.58)	2.10 (1.58, 2.64)	3.17 (2.07, 4.42)
No management responsibility	908	0.717 (0.011)	0.879 (0.016)	1.024 (0.026)	1.34 (1.22, 1.46)	1.95 (1.65, 2.31)	2.86 (2.23, 3.67)
Other / NA	1434	0.673 (0.009)	0.881 (0.014)	0.993 (0.020)	1.39 (1.30, 1.50)	2.26 (1.99, 2.58)	3.67 (3.03, 4.44)
equality test (excl Oth/NA)		p = 0.075	p = 0.001				
Employment sector							

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
Self-employed	315	0.684 (0.019)	0.857 (0.027)	1.055 (0.043)	1.40 (1.21, 1.67)	2.12 (1.56, 2.87)	3.22 (2.03, 5.01)
Private sector	1025	0.722 (0.011)	0.858 (0.015)	0.993 (0.024)	1.25 (1.15, 1.35)	1.72 (1.47, 2.01)	2.38 (1.87, 3.01)
Public corporation	459	0.716 (0.016)	0.847 (0.022)	0.950 (0.032)	1.17 (1.03, 1.32)	1.58 (1.25, 2.03)	2.15 (1.50, 3.07)
Public sector	387	0.691 (0.017)	0.891 (0.025)	1.010 (0.040)	1.39 (1.21, 1.59)	2.20 (1.65, 2.85)	3.52 (2.28, 5.12)
Charity sector	173	0.704 (0.025)	0.913 (0.036)	1.050 (0.061)	1.48 (1.19, 1.84)	2.43 (1.62, 3.45)	4.05 (2.19, 6.61)
Other / NA	1000	0.691 (0.011)	0.874 (0.016)	0.992 (0.023)	1.34 (1.22, 1.45)	2.05 (1.72, 2.38)	3.14 (2.42, 3.90)
equality test (excl Oth/NA)		p = 0.356	p = 0.447				
Job security							
Secure	1506	0.737 (0.009)	0.864 (0.012)	1.003 (0.018)	1.23 (1.16, 1.31)	1.66 (1.45, 1.87)	2.24 (1.82, 2.64)
Insecure	407	0.717 (0.018)	0.824 (0.023)	0.958 (0.035)	1.15 (1.01, 1.31)	1.48 (1.16, 1.88)	1.92 (1.32, 2.68)
No answer	1446	0.667 (0.009)	0.884 (0.014)	1.000 (0.018)	1.42 (1.33, 1.52)	2.35 (2.07, 2.66)	3.88 (3.21, 4.65)
equality test		p = 0.323	p = 0.120				
Income							
Below £15,000	859	0.674 (0.011)	0.887 (0.018)	1.019 (0.031)	1.45 (1.31, 1.61)	2.39 (1.97, 2.93)	3.96 (2.94, 5.32)
£15,000-£29,999	897	0.691 (0.011)	0.863 (0.016)	1.003 (0.028)	1.33 (1.22, 1.48)	2.00 (1.68, 2.39)	3.01 (2.31, 3.89)

Characteristic	N	α	β	λ	$\Lambda(5)$	$\Lambda(50)$	$\Lambda(500)$
£30,000-£49,999	487	0.739 (0.015)	0.863 (0.021)	1.011 (0.031)	1.24 (1.10, 1.37)	1.67 (1.34, 2.03)	2.25 (1.62, 2.97)
£50,000 & above	188	0.813 (0.028)	0.821 (0.030)	0.907 (0.039)	0.92 (0.75, 1.10)	0.95 (0.63, 1.32)	0.99 (0.53, 1.58)
No answer	928	0.705 (0.011)	0.867 (0.016)	0.982 (0.022)	1.27 (1.17, 1.38)	1.84 (1.57, 2.16)	2.67 (2.10, 3.40)
equality test (excl NA)		$p = 0.000$	$p = 0.278$				
Home ownership							
Own outright	595	0.670 (0.014)	0.894 (0.023)	0.993 (0.038)	1.44 (1.26, 1.65)	2.45 (1.89, 3.10)	4.20 (2.86, 5.81)
Mortgage	515	0.720 (0.015)	0.856 (0.020)	1.005 (0.032)	1.25 (1.13, 1.39)	1.70 (1.41, 2.04)	2.34 (1.76, 3.06)
Rent	326	0.688 (0.020)	0.853 (0.029)	0.963 (0.045)	1.26 (1.06, 1.50)	1.85 (1.34, 2.53)	2.75 (1.65, 4.27)
No answer / don't know	1923	0.712 (0.008)	0.866 (0.011)	1.001 (0.016)	1.28 (1.21, 1.36)	1.82 (1.63, 2.02)	2.60 (2.20, 3.04)
equality test (excl NA/DK)		$p = 0.055$	$p = 0.378$				
Savings							
Below £1,000	744	0.717 (0.013)	0.855 (0.018)	0.971 (0.024)	1.22 (1.11, 1.33)	1.69 (1.42, 1.98)	2.36 (1.82, 2.94)
£1,000 - £9,999	700	0.717 (0.013)	0.866 (0.018)	1.013 (0.028)	1.30 (1.18, 1.44)	1.86 (1.54, 2.21)	2.66 (2.01, 3.42)
£10,000 - £49,999	589	0.688 (0.013)	0.860 (0.019)	1.052 (0.031)	1.39 (1.25, 1.53)	2.06 (1.68, 2.46)	3.08 (2.26, 3.97)
£50,000 and above	530	0.719 (0.015)	0.872 (0.021)	0.966 (0.035)	1.24 (1.08, 1.41)	1.77 (1.34, 2.24)	2.56 (1.68, 3.58)

Characteristic	N	α	β	λ	Λ(5)	Λ(50)	Λ(500)
No answer	796	0.682 (0.012)	0.885 (0.019)	0.988 (0.030)	1.37 (1.24, 1.55)	2.20 (1.82, 2.72)	3.54 (2.64, 4.74)
equality test (excl NA)		p = 0.300	p = 0.934				
Ease of short-term saving							
Easy	2111	0.705 (0.007)	0.867 (0.011)	0.995 (0.015)	1.30 (1.22, 1.37)	1.91 (1.70, 2.11)	2.79 (2.35, 3.24)
Not easy	1248	0.702 (0.010)	0.869 (0.014)	0.997 (0.023)	1.31 (1.21, 1.42)	1.93 (1.67, 2.23)	2.86 (2.30, 3.48)
equality test		p = 0.850	p = 0.910				
Rainy day fund							
Yes	2294	0.696 (0.007)	0.873 (0.010)	1.012 (0.016)	1.34 (1.26, 1.43)	2.01 (1.79, 2.27)	3.03 (2.54, 3.61)
No	1065	0.720 (0.011)	0.856 (0.015)	0.966 (0.021)	1.20 (1.10, 1.29)	1.64 (1.39, 1.88)	2.24 (1.76, 2.75)
equality test		p = 0.073	p = 0.331				
Region							
North East	142	0.696 (0.028)	0.848 (0.037)	0.977 (0.059)	1.25 (0.98, 1.54)	1.81 (1.13, 2.55)	2.64 (1.28, 4.28)
North West	398	0.681 (0.015)	0.865 (0.024)	1.037 (0.040)	1.39 (1.24, 1.60)	2.14 (1.70, 2.69)	3.29 (2.34, 4.62)
Yorkshire and the Humber	317	0.689 (0.018)	0.863 (0.027)	0.993 (0.042)	1.33 (1.13, 1.53)	2.01 (1.47, 2.58)	3.05 (1.90, 4.41)
East Midlands	252	0.692 (0.020)	0.881 (0.031)	1.078 (0.052)	1.48 (1.25, 1.74)	2.34 (1.72, 3.16)	3.71 (2.32, 5.69)
West Midlands	248	0.767 (0.024)	0.907 (0.032)	0.979 (0.053)	1.24 (1.00, 1.52)	1.76 (1.13, 2.52)	2.51 (1.29, 4.19)

Characteristic	**N**	α	β	λ	**Λ(5)**	**Λ(50)**	**Λ(500)**
East of England	290	0.695 (0.020)	0.892 (0.029)	1.016 (0.052)	1.41 (1.18, 1.71)	2.27 (1.56, 3.19)	3.68 (2.11, 5.98)
London	422	0.732 (0.019)	0.852 (0.023)	0.941 (0.032)	1.14 (1.00, 1.30)	1.51 (1.15, 1.95)	2.02 (1.33, 2.94)
South East	421	0.691 (0.016)	0.869 (0.025)	1.027 (0.035)	1.39 (1.21, 1.56)	2.12 (1.64, 2.70)	3.27 (2.21, 4.62)
South West	293	0.690 (0.020)	0.907 (0.029)	1.042 (0.052)	1.49 (1.23, 1.78)	2.48 (1.75, 3.38)	4.16 (2.47, 6.46)
Wales	154	0.703 (0.026)	0.797 (0.038)	0.918 (0.047)	1.08 (0.89, 1.33)	1.36 (0.94, 1.95)	1.75 (0.98, 3.00)
Scotland	341	0.717 (0.020)	0.842 (0.026)	0.936 (0.039)	1.15 (0.99, 1.35)	1.56 (1.14, 2.05)	2.13 (1.33, 3.12)
Northern Ireland	81	0.683 (0.040)	0.879 (0.064)	1.084 (0.116)	1.56 (1.12, 2.29)	2.65 (1.36, 5.02)	4.66 (1.64, 11.41)
equality test (excl oth)		$p = 0.221$	$p = 0.584$				
Newspaper							
Express / Mail	472	0.695 (0.016)	0.831 (0.022)	0.935 (0.029)	1.17 (1.05, 1.31)	1.61 (1.31, 2.01)	2.22 (1.61, 3.05)
Sun / Star	435	0.694 (0.016)	0.852 (0.024)	0.892 (0.031)	1.16 (1.03, 1.33)	1.70 (1.30, 2.21)	2.50 (1.66, 3.60)
Mirror / Record	307	0.714 (0.021)	0.870 (0.030)	0.905 (0.039)	1.17 (0.97, 1.40)	1.70 (1.18, 2.37)	2.51 (1.42, 4.01)
Guardian / Independent	340	0.679 (0.016)	0.911 (0.025)	1.273 (0.052)	1.86 (1.61, 2.12)	3.21 (2.43, 4.07)	5.56 (3.67, 7.77)
FT / Times / Telegraph	291	0.772 (0.021)	0.861 (0.026)	0.974 (0.039)	1.13 (0.98, 1.32)	1.42 (1.08, 1.89)	1.78 (1.18, 2.70)

Characteristic	**N**	α	β	λ	**Λ(5)**	**Λ(50)**	**Λ(500)**
Other paper	354	0.714 (0.018)	0.858 (0.024)	1.020 (0.035)	1.29 (1.12, 1.46)	1.80 (1.35, 2.27)	2.53 (1.65, 3.58)
No paper	1160	0.696 (0.010)	0.881 (0.015)	1.039 (0.026)	1.40 (1.29, 1.53)	2.16 (1.83, 2.50)	3.32 (2.61, 4.12)
equality test		p = 0.026	p = 0.307				
Political party							
Conservative	828	0.724 (0.012)	0.849 (0.015)	0.974 (0.023)	1.20 (1.10, 1.31)	1.60 (1.37, 1.87)	2.14 (1.71, 2.68)
Labour	1086	0.696 (0.011)	0.872 (0.015)	0.972 (0.022)	1.29 (1.17, 1.41)	1.94 (1.61, 2.27)	2.93 (2.22, 3.69)
Liberal Democrat	296	0.676 (0.018)	0.915 (0.028)	1.146 (0.053)	1.68 (1.42, 1.99)	2.94 (2.16, 4.00)	5.16 (3.27, 8.02)
SNP or Plaid Cymru	82	0.751 (0.043)	0.823 (0.051)	0.909 (0.084)	1.03 (0.72, 1.43)	1.27 (0.64, 2.28)	1.63 (0.55, 3.65)
Other party	297	0.682 (0.020)	0.891 (0.032)	1.003 (0.052)	1.44 (1.20, 1.68)	2.40 (1.72, 3.18)	4.02 (2.46, 6.06)
No party	617	0.704 (0.014)	0.857 (0.020)	1.023 (0.033)	1.33 (1.19, 1.50)	1.93 (1.57, 2.41)	2.80 (2.07, 3.86)
Don't know / NA	153	0.721 (0.029)	0.878 (0.044)	0.999 (0.071)	1.30 (0.99, 1.70)	1.93 (1.13, 3.13)	2.94 (1.31, 5.84)
equality test (excl DK/NA)		p = 0.139	p = 0.325				
Religion							
None	422	0.728 (0.018)	0.874 (0.026)	0.993 (0.046)	1.27 (1.09, 1.51)	1.81 (1.35, 2.45)	2.59 (1.68, 3.99)
Ch of England	451	0.670 (0.016)	0.874 (0.024)	0.952 (0.033)	1.32 (1.17, 1.53)	2.12 (1.64, 2.84)	3.44 (2.28, 5.25)

Characteristic	**N**	α	β	λ	**Λ(5)**	**Λ(50)**	**Λ(500)**
Roman Catholic	136	0.698 (0.032)	0.862 (0.048)	0.950 (0.059)	1.24 (0.96, 1.62)	1.85 (1.11, 3.01)	2.81 (1.29, 5.51)
Protestant	128	0.652 (0.026)	0.851 (0.034)	1.095 (0.075)	1.49 (1.19, 1.85)	2.36 (1.53, 3.33)	3.79 (1.98, 6.14)
Other	102	0.676 (0.033)	0.849 (0.044)	1.035 (0.064)	1.37 (1.11, 1.69)	2.07 (1.37, 3.03)	3.17 (1.70, 5.48)
NA	2120	0.711 (0.007)	0.867 (0.010)	1.003 (0.017)	1.29 (1.21, 1.38)	1.86 (1.65, 2.08)	2.68 (2.25, 3.15)
equality test (NA)		*p* = 0.086	*p* = 0.969				
Religiosity							
Religious	672	0.667 (0.013)	0.860 (0.020)	0.972 (0.027)	1.33 (1.20, 1.46)	2.07 (1.72, 2.48)	3.24 (2.47, 4.22)
Not religious	768	0.725 (0.013)	0.875 (0.018)	0.995 (0.029)	1.27 (1.14, 1.42)	1.81 (1.43, 2.19)	2.59 (1.82, 3.44)
Don't know / NA	1919	0.709 (0.008)	0.868 (0.011)	1.005 (0.017)	1.30 (1.23, 1.38)	1.89 (1.68, 2.10)	2.74 (2.31, 3.19)
equality test (excl DK/NA)		*p* = 0.002	*p* = 0.579				

Note: The table presents results for the reduced sample of 3,359 respondents which excludes the 657 respondents who reported at least one apparently irrational choice, i.e., their responses did not completely satisfy the satiation requirement that $G_1 < G_2 < G_3$ and $L_4 < L_5 < L_6$. N = number of respondents with each characteristic, α = degree of risk aversion in the domain of gains, β = degree of risk aversion in the domain of losses, λ = direct loss aversion (i.e., when the loss $x = -1$), and $\Lambda(x)$ is relative loss aversion comparing a loss of x with a gain of x (see Equation (4)), where x = 5, 50 and 500. The null hypothesis for the equality test is that the parameters are equal across the categories of each characteristic and the null is rejected if the *p*-value is below the required significance level and accepted if it is above.

Table A5: Comparison of full sample and reduced sample estimation results

Characteristic	$\alpha^{\text{Reduced}} - \alpha^{\text{Full}}$ equality test	$\beta^{\text{Reduced}} - \beta^{\text{Full}}$ equality test	Λ(50) full	Λ(50) reduced
All	0.019 *p* = 0.000	0.035 *p* = 0.000	1.71 (1.57, 1.85)	1.89 (1.73, 2.05)
Gender				
Male	0.018 *p* = 0.000	0.029 *p* = 0.000	1.59 (1.42, 1.77)	1.70 (1.48, 1.91)
Female	0.019 *p* = 0.000	0.041 *p* = 0.000	1.83 (1.64, 2.03)	2.07 (1.82, 2.32)
Age				
18-24	0.012 *p* = 0.030	0.004 *p* = 0.626	2.25 (1.69, 2.90)	2.26 (1.72, 2.92)
25-34	0.016 *p* = 0.030	0.029 *p* = 0.004	1.92 (1.50, 2.36)	2.20 (1.71, 2.83)
35-44	0.024 *p* = 0.000	0.026 *p* = 0.002	1.15 (0.95, 1.37)	1.20 (0.97, 1.43)
45-54	0.020 *p* = 0.001	0.031 *p* = 0.000	1.41 (1.18, 1.70)	1.52 (1.23, 1.83)
55-64	0.016 *p* = 0.001	0.045 *p* = 0.000	1.99 (1.72, 2.32)	2.30 (1.86, 2.82)
65 & over	0.018 *p* = 0.001	0.047 *p* = 0.000	2.04 (1.67, 2.39)	2.37 (1.94, 2.91)
Age and gender				
M 18-24	-0.003 *p* = 0.679	0.003 *p* = 0.641	1.98 (1.30, 2.90)	2.16 (1.43, 2.93)
M 25-34	0.029 *p* = 0.055	0.038 *p* = 0.065	1.85 (1.22, 2.60)	2.09 (1.18, 3.22)
M 35-44	0.020 *p* = 0.053	0.015 *p* = 0.303	1.24 (0.93, 1.62)	1.24 (0.87, 1.67)
M 45-54	0.015 *p* = 0.076	0.021 *p* = 0.047	1.33 (1.04, 1.74)	1.40 (1.01, 1.90)
M 55-64	0.013 *p* = 0.097	0.049 *p* = 0.000	1.81 (1.34, 2.37)	2.23 (1.68, 3.09)
M 65 & over	0.027 *p* = 0.000	0.029 *p* = 0.002	1.74 (1.33, 2.16)	1.77 (1.28, 2.30)
F 18-24	0.024 *p* = 0.001	0.006 *p* = 0.672	2.58 (1.74, 3.64)	2.44 (1.73, 3.41)
F 25-34	0.011 *p* = 0.185	0.026 *p* = 0.025	2.03 (1.50, 2.62)	2.25 (1.64, 3.09)
F 35-44	0.027 *p* = 0.001	0.034 *p* = 0.000	1.14 (0.89, 1.43)	1.19 (0.90, 1.53)
F 45-54	0.022 *p* = 0.011	0.039 *p* = 0.001	1.48 (1.20, 1.81)	1.71 (1.30, 2.22)

Characteristic	$\alpha^{\text{Reduced}} - \alpha^{\text{Full}}$ equality test	$\beta^{\text{Reduced}} - \beta^{\text{Full}}$ equality test	Λ(50) full	Λ(50) reduced
F 55-64	0.019 *p* = 0.002	0.043 *p* = 0.000	2.14 (1.70, 2.63)	2.37 (1.84, 2.93)
F 65 & over	0.004 *p* = 0.608	0.073 *p* = 0.000	2.47 (1.87, 3.17)	3.51 (2.52, 4.75)
Marital status				
Married or living with partner	0.019 *p* = 0.000	0.038 *p* = 0.000	1.69 (1.55, 1.85)	1.90 (1.69, 2.15)
Single	0.022 *p* = 0.000	0.020 *p* = 0.002	1.64 (1.39, 1.95)	1.66 (1.34, 1.98)
Widowed, separated or divorced	0.005 *p* = 0.501	0.050 *p* = 0.000	1.93 (1.54, 2.40)	2.48 (1.82, 3.31)
Number of children				
No children	0.019 *p* = 0.000	0.035 *p* = 0.000	1.96 (1.76, 2.16)	2.18 (1.95, 2.41)
One or more children	0.012 *p* = 0.046	0.036 *p* = 0.000	1.24 (1.08, 1.42)	1.46 (1.16, 1.78)
No answer	0.037 *p* = 0.000	0.032 *p* = 0.017	1.28 (0.98, 1.63)	1.29 (0.93, 1.78)
Health status				
Better than average	0.019 *p* = 0.000	0.043 *p* = 0.000	1.86 (1.60, 2.17)	2.19 (1.84, 2.64)
Average	0.017 *p* = 0.000	0.031 *p* = 0.000	1.67 (1.50, 1.87)	1.82 (1.62, 2.05)
Worse than average	0.021 *p* = 0.000	0.035 *p* = 0.000	1.65 (1.41, 1.88)	1.79 (1.42, 2.24)
Personality type 1				
Type A (competitive)	0.020 *p* = 0.000	0.034 *p* = 0.000	1.34 (1.16, 1.53)	1.48 (1.24, 1.72)
Type B (laid back)	0.018 *p* = 0.000	0.035 *p* = 0.000	1.89 (1.73, 2.06)	2.10 (1.87, 2.35)
Personality type 2				
Optimist	0.016 *p* = 0.000	0.036 *p* = 0.000	1.58 (1.44, 1.73)	1.79 (1.60, 2.00)
Pessimist	0.025 *p* = 0.000	0.032 *p* = 0.000	1.98 (1.75, 2.25)	2.12 (1.76, 2.46)
Emotional state				
Tense	0.015 *p* = 0.117	0.034 *p* = 0.002	1.82 (1.39, 2.48)	2.12 (1.59, 2.82)
Neutral	0.019 *p* = 0.000	0.033 *p* = 0.000	2.00 (1.79, 2.23)	2.23 (1.96, 2.54)
Relaxed	0.018 *p* = 0.000	0.037 *p* = 0.000	1.49 (1.29, 1.66)	1.65 (1.41, 1.85)

Characteristic	$\alpha^{Reduced} - \alpha^{Full}$ equality test	$\beta^{Reduced} - \beta^{Full}$ equality test	Λ(50) full	Λ(50) reduced
Not sure	0.032 *p* = 0.171	0.027 *p* = 0.296	1.13 (0.56, 1.95)	1.09 (0.49, 2.05)
Education				
16 & under	0.013 *p* = 0.012	0.052 *p* = 0.000	1.54 (1.32, 1.74)	1.87 (1.55, 2.27)
17-19	0.019 *p* = 0.001	0.037 *p* = 0.000	1.80 (1.48, 2.14)	1.98 (1.63, 2.39)
20 & over	0.018 *p* = 0.000	0.016 *p* = 0.001	1.80 (1.59, 2.09)	1.82 (1.56, 2.06)
Other	0.021 *p* = 0.000	0.038 *p* = 0.000	1.80 (1.51, 2.14)	2.01 (1.62, 2.45)
Financial knowledge				
Low	0.020 *p* = 0.000	0.041 *p* = 0.000	2.06 (1.74, 2.44)	2.31 (1.88, 2.76)
Medium	0.017 *p* = 0.000	0.035 *p* = 0.000	1.63 (1.49, 1.80)	1.80 (1.62, 1.98)
High	0.020 *p* = 0.016	0.015 *p* = 0.136	1.68 (1.25, 2.18)	1.73 (1.32, 2.33)
Social class				
A	0.022 *p* = 0.000	0.028 *p* = 0.000	1.30 (1.07, 1.57)	1.33 (1.05, 1.67)
B	0.018 *p* = 0.000	0.032 *p* = 0.000	1.97 (1.70, 2.28)	2.17 (1.77, 2.63)
C1	0.009 *p* = 0.054	0.036 *p* = 0.000	1.70 (1.49, 1.94)	2.00 (1.70, 2.30)
C2	0.020 *p* = 0.004	0.023 *p* = 0.023	1.59 (1.30, 1.91)	1.70 (1.34, 2.15)
D	0.016 *p* = 0.044	0.052 *p* = 0.000	1.76 (1.34, 2.32)	2.18 (1.54, 3.01)
E	0.023 *p* = 0.015	0.057 *p* = 0.000	2.27 (1.69, 2.96)	2.77 (1.93, 3.81)
Not available	0.029 *p* = 0.055	0.030 *p* = 0.157	1.76 (0.95, 2.65)	1.84 (1.04, 2.95)
Employment status				
Full-time	0.010 *p* = 0.007	0.021 *p* = 0.000	1.43 (1.25, 1.61)	1.56 (1.39, 1.79)
Part-time	0.019 *p* = 0.004	0.044 *p* = 0.000	1.56 (1.28, 1.90)	1.79 (1.42, 2.16)
Student	0.016 *p* = 0.066	0.024 *p* = 0.015	2.77 (1.89, 3.89)	3.03 (2.05, 4.59)
Retired	0.025 *p* = 0.000	0.046 *p* = 0.000	1.91 (1.64, 2.23)	2.16 (1.81, 2.59)

Characteristic	$\alpha^{\text{Reduced}} - \alpha^{\text{Full}}$ equality test	$\beta^{\text{Reduced}} - \beta^{\text{Full}}$ equality test	Λ(50) full	Λ(50) reduced
Not working	0.017 *p* = 0.026	0.033 *p* = 0.020	2.42 (1.86, 3.14)	2.73 (1.92, 3.69)
No answer	0.040 *p* = 0.005	0.099 *p* = 0.000	2.26 (1.27, 3.82)	2.92 (1.55, 5.24)
Management responsibility				
Owner, etc	0.001 *p* = 0.931	0.030 *p* = 0.007	1.52 (1.10, 1.93)	1.84 (1.34, 2.42)
Senior manager	0.003 *p* = 0.820	0.013 *p* = 0.268	1.19 (0.79, 1.81)	1.29 (0.80, 1.93)
Middle manager	0.019 *p* = 0.011	0.006 *p* = 0.569	0.89 (0.69, 1.12)	0.88 (0.68, 1.13)
Junior manager	0.013 *p* = 0.120	0.034 *p* = 0.001	1.77 (1.39, 2.23)	2.10 (1.58, 2.64)
No management responsibility	0.017 *p* = 0.000	0.033 *p* = 0.000	1.74 (1.51, 2.03)	1.95 (1.65, 2.31)
Other / NA	0.024 *p* = 0.000	0.046 *p* = 0.000	1.96 (1.73, 2.19)	2.26 (1.99, 2.58)
Employment sector				
Self-employed	0.011 *p* = 0.192	0.042 *p* = 0.000	1.76 (1.36, 2.20)	2.12 (1.56, 2.87)
Private sector	0.012 *p* = 0.013	0.044 *p* = 0.000	1.41 (1.22, 1.62)	1.72 (1.47, 2.01)
Public corporation	0.018 *p* = 0.004	0.003 *p* = 0.726	1.67 (1.31, 2.05)	1.58 (1.25, 2.03)
Public sector	0.025 *p* = 0.000	0.023 *p* = 0.026	2.15 (1.74, 2.64)	2.20 (1.65, 2.85)
Charity sector	0.032 *p* = 0.004	0.042 *p* = 0.023	2.23 (1.54, 2.94)	2.43 (1.62, 3.45)
Other / NA	0.023 *p* = 0.000	0.041 *p* = 0.000	1.83 (1.55, 2.14)	2.05 (1.72, 2.38)
Job security				
Secure	0.014 *p* = 0.000	0.028 *p* = 0.000	1.48 (1.31, 1.66)	1.66 (1.45, 1.87)
Insecure	0.010 *p* = 0.157	0.023 *p* = 0.004	1.37 (1.07, 1.74)	1.48 (1.16, 1.88)
No answer	0.024 *p* = 0.000	0.045 *p* = 0.000	2.07 (1.84, 2.34)	2.35 (2.07, 2.66)
Income				
Below £15,000	0.025 *p* = 0.000	0.042 *p* = 0.000	2.07 (1.78, 2.37)	2.39 (1.97, 2.93)
£15,000-£29,999	0.013 *p* = 0.001	0.031 *p* = 0.000	1.78 (1.56, 1.99)	2.00 (1.68, 2.39)

Characteristic	$\alpha^{Reduced} - \alpha^{Full}$ equality test	$\beta^{Reduced} - \beta^{Full}$ equality test	Λ(50) full	Λ(50) reduced
£30,000-£49,999	-0.007 *p* = 0.382	0.036 *p* = 0.000	1.29 (1.07, 1.57)	1.67 (1.34, 2.03)
£50,000 & above	0.023 *p* = 0.014	0.031 *p* = 0.000	0.90 (0.63, 1.26)	0.95 (0.63, 1.32)
No answer	0.026 *p* = 0.000	0.033 *p* = 0.000	1.71 (1.50, 1.99)	1.84 (1.57, 2.16)
Home ownership				
Own outright	0.016 *p* = 0.006	0.044 *p* = 0.000	2.06 (1.66, 2.49)	2.45 (1.89, 3.10)
Mortgage	0.026 *p* = 0.000	0.039 *p* = 0.000	1.60 (1.34, 1.93)	1.70 (1.41, 2.04)
Rent	0.020 *p* = 0.040	0.056 *p* = 0.000	1.53 (1.15, 1.99)	1.85 (1.34, 2.53)
No answer / don't know	0.017 *p* = 0.000	0.027 *p* = 0.000	1.70 (1.52, 1.88)	1.82 (1.63, 2.02)
Savings				
Below £1,000	0.027 *p* = 0.000	0.040 *p* = 0.000	1.52 (1.28, 1.81)	1.69 (1.42, 1.98)
£1,000 - £9,999	0.009 *p* = 0.082	0.026 *p* = 0.000	1.66 (1.43, 1.98)	1.86 (1.54, 2.21)
£10,000 - £49,999	0.016 *p* = 0.003	0.030 *p* = 0.000	1.90 (1.62, 2.26)	2.06 (1.68, 2.46)
£50,000 and above	0.007 *p* = 0.181	0.030 *p* = 0.000	1.57 (1.26, 1.90)	1.77 (1.34, 2.24)
No answer	0.026 *p* = 0.000	0.044 *p* = 0.000	1.97 (1.62, 2.32)	2.20 (1.82, 2.72)
Ease of short-term saving				
Easy	0.019 *p* = 0.000	0.033 *p* = 0.000	1.74 (1.59, 1.90)	1.91 (1.70, 2.11)
Not easy	0.018 *p* = 0.000	0.038 *p* = 0.000	1.68 (1.46, 1.89)	1.93 (1.67, 2.23)
Rainy day fund				
Yes	0.019 *p* = 0.000	0.031 *p* = 0.000	1.87 (1.70, 2.04)	2.01 (1.79, 2.27)
No	0.018 *p* = 0.000	0.042 *p* = 0.000	1.42 (1.24, 1.64)	1.64 (1.39, 1.88)
Region				
North East	0.018 *p* = 0.106	0.038 *p* = 0.018	1.57 (1.09, 2.24)	1.81 (1.13, 2.55)
North West	0.011 *p* = 0.150	0.049 *p* = 0.000	1.74 (1.39, 2.09)	2.14 (1.70, 2.69)

Characteristic	$\alpha^{\text{Reduced}} - \alpha^{\text{Full}}$ equality test	$\beta^{\text{Reduced}} - \beta^{\text{Full}}$ equality test	Λ(50) full	Λ(50) reduced
Yorkshire and the Humber	0.013 p = 0.078	0.043 p = 0.000	1.71 (1.30, 2.08)	2.01 (1.47, 2.58)
East Midlands	0.017 p = 0.029	0.021 p = 0.093	2.14 (1.61, 2.74)	2.34 (1.72, 3.16)
West Midlands	0.042 p = 0.000	0.042 p = 0.003	1.67 (1.25, 2.24)	1.76 (1.13, 2.52)
East of England	0.018 p = 0.036	0.035 p = 0.004	1.98 (1.52, 2.53)	2.27 (1.56, 3.19)
London	0.023 p = 0.002	0.027 p = 0.004	1.45 (1.18, 1.80)	1.51 (1.15, 1.95)
South East	0.020 p = 0.001	0.028 p = 0.006	1.99 (1.52, 2.57)	2.12 (1.64, 2.70)
South West	0.005 p = 0.522	0.041 p = 0.000	1.96 (1.49, 2.68)	2.48 (1.75, 3.38)
Wales	0.041 p = 0.000	0.026 p = 0.081	1.48 (1.09, 2.04)	1.36 (0.94, 1.95)
Scotland	0.014 p = 0.062	0.025 p = 0.007	1.44 (1.05, 1.83)	1.56 (1.14, 2.05)
Northern Ireland	0.010 p = 0.684	0.060 p = 0.011	1.76 (1.01, 3.14)	2.65 (1.36, 5.02)
Newspaper				
Express / Mail	0.017 p = 0.010	0.036 p = 0.000	1.45 (1.11, 1.76)	1.61 (1.31, 2.01)
Sun / Star	0.022 p = 0.003	0.045 p = 0.000	1.48 (1.24, 1.79)	1.70 (1.30, 2.21)
Mirror / Record	0.013 p = 0.223	0.063 p = 0.000	1.30 (0.99, 1.61)	1.70 (1.18, 2.37)
Guardian / Independent	0.009 p = 0.117	0.019 p = 0.031	2.93 (2.29, 3.71)	3.21 (2.43, 4.07)
FT / Times / Telegraph	0.009 p = 0.144	0.031 p = 0.000	1.27 (0.95, 1.64)	1.42 (1.08, 1.89)
Other paper	0.026 p = 0.001	0.018 p = 0.078	1.79 (1.37, 2.26)	1.80 (1.35, 2.27)
No paper	0.021 p = 0.000	0.031 p = 0.000	1.96 (1.69, 2.29)	2.16 (1.83, 2.50)
Political party				
Conservative	0.014 p = 0.001	0.021 p = 0.000	1.52 (1.30, 1.79)	1.60 (1.37, 1.87)
Labour	0.012 p = 0.012	0.043 p = 0.000	1.64 (1.42, 1.90)	1.94 (1.61, 2.27)
Liberal Democrat	0.019 p = 0.000	0.026 p = 0.009	2.81 (2.14, 3.67)	2.94 (2.16, 4.00)
SNP or Plaid Cymru	0.022 p = 0.222	0.015 p = 0.503	1.27 (0.71, 2.01)	1.27 (0.64, 2.28)

Characteristic	$\alpha^{\text{Reduced}} - \alpha^{\text{Full}}$ equality test	$\beta^{\text{Reduced}} - \beta^{\text{Full}}$ equality test	Λ(50) full	Λ(50) reduced
Other party	0.028 *p* = 0.000	0.044 *p* = 0.000	2.06 (1.53, 2.68)	2.40 (1.72, 3.18)
No party	0.025 *p* = 0.000	0.044 *p* = 0.000	1.65 (1.36, 1.97)	1.93 (1.57, 2.41)
Don't know / NA	0.043 *p* = 0.000	0.015 *p* = 0.395	2.17 (1.43, 3.39)	1.93 (1.13, 3.13)
Religion				
None	0.021 *p* = 0.004	0.042 *p* = 0.000	1.56 (1.19, 2.03)	1.81 (1.35, 2.45)
Ch of England	0.021 *p* = 0.002	0.062 *p* = 0.000	1.74 (1.40, 2.14)	2.12 (1.64, 2.84)
Roman Catholic	0.017 *p* = 0.271	0.044 *p* = 0.015	1.57 (1.05, 2.33)	1.85 (1.11, 3.01)
Protestant	0.034 *p* = 0.001	0.022 *p* = 0.183	2.39 (1.76, 3.32)	2.36 (1.53, 3.33)
Other	0.019 *p* = 0.125	0.028 *p* = 0.106	1.96 (1.30, 2.84)	2.07 (1.37, 3.03)
NA	0.016 *p* = 0.000	0.028 *p* = 0.000	1.70 (1.54, 1.88)	1.86 (1.65, 2.08)
Religiosity				
Religious	0.023 *p* = 0.000	0.049 *p* = 0.000	1.80 (1.50, 2.18)	2.07 (1.72, 2.48)
Not religious	0.020 *p* = 0.000	0.038 *p* = 0.000	1.62 (1.34, 1.92)	1.81 (1.43, 2.19)
Don't know / NA	0.016 *p* = 0.000	0.028 *p* = 0.000	1.72 (1.57, 1.87)	1.89 (1.68, 2.10)

Note: The table compares α (the degree of risk aversion in the domain of gains), β (the degree of risk aversion in the domain of losses) and $\Lambda(50)$ (relative loss aversion comparing a loss of 50 with a gain of 50, see Equation (4)) for the full sample of 4,016 respondents and the reduced sample of 3,359 respondents which excludes the 657 respondents who reported at least one apparently irrational choice, i.e., their responses did not completely satisfy the satiation requirement that $G_1 < G_2 < G_3$ and $L_4 < L_5 < L_6$. The null hypothesis for the equality test is that the parameters for the full and reduced samples are equal across the categories of each characteristic and the null is rejected if the *p*-value is below the required significance level and accepted if it is above.