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Abstract

We quantify differences in attitudes to loss from individuals with different demographic, personal and socio-economic characteristics. Our data are based on responses from an online survey of a representative sample of over 4,000 UK residents and allow us to produce the most comprehensive analysis of the heterogeneity of loss aversion measures to date. Using the canonical model proposed by Tversky and Kahneman (1992), we show that responses for the population as a whole differ substantially from those typically provided by students (who form the basis of many existing studies of loss aversion). The average aversion to a loss of £500 relative to a gain of the same amount is 2.41, but loss aversion correlates significantly with characteristics such as gender, age, education, financial knowledge, social class, employment status, management responsibility, income, savings and home ownership. Other related 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: Loss aversion, expected utility, risk attitudes, gender effects, survey data

JEL: G40, D40, C83, C90

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Statement by the Authors

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Conflict of interest statements

David Blake - none.

Edmund Cannon - none.

Douglas Wright - none.

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.

1. Introduction

The simplest canonical models in economics assume that agents have identical preferences and that they maximise the expected value of a concave utility function. In this paper, we use survey data to contribute to the literature both on heterogeneous agents and on more sophisticated models of human behaviour. Our data are collected from a survey of 4,016 respondents who form a representative sample of individuals in the United Kingdom and we are able to correlate loss aversion and risk attitude with a rich set of demographic and socio-economic variables, as well as self-reported character traits such as optimism and competitiveness. Using the standard parametric model of loss aversion first proposed by Kahneman and Tversky (1979), 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. We contrast our results with those of comparable studies which are frequently based on the analysis of university students and show that such students are unrepresentative of the population as a whole.

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:

$$\sum_i p_i u(c_i) \tag{1}$$

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:

$$\sum_i w(p_i) v(x_i) \tag{2}$$

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 confine our analysis to the standard model proposed by Tversky and Kahneman (1992) and hence use a widely accepted framework to compare the loss and risk attitudes of different respondents. In particular, we use the CRRA (constant relative risk aversion or iso-elastic) form of the value function which depends upon gains and losses, x, relative to the initial position:

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

where λ measures "direct" loss aversion, defined as the ratio of the value of a loss of one unit of currency to the value of again of one unit of currency. The parameter α measures risk attitude in the domain of gains. There is risk aversion in the domain of gains if $\alpha < 1$ and this is higher for lower values of α; there is risk seeking in the domain of gains if $\alpha > 1$. The parameter β measures risk attitude in the domain of losses. There is risk seeking in the domain of losses if $\beta < 1$ and this is higher if β is lower; there is risk aversion in the domain of losses if $\beta > 1$. There is risk neutrality in the relevant domain when these parameters take a value of unity.

In this paper, we estimate the value function, but 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. 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 $w(p_i) = p_i$ without a serious reduction in accuracy. Bleichrodt et al. (2001) suggest that using probabilities of one-third might reduce bias in parameter estimates, but we chose to use a probability of one half in our survey questions, because the 50:50 scenario is likely to involve the smallest cognitive load for the respondents.

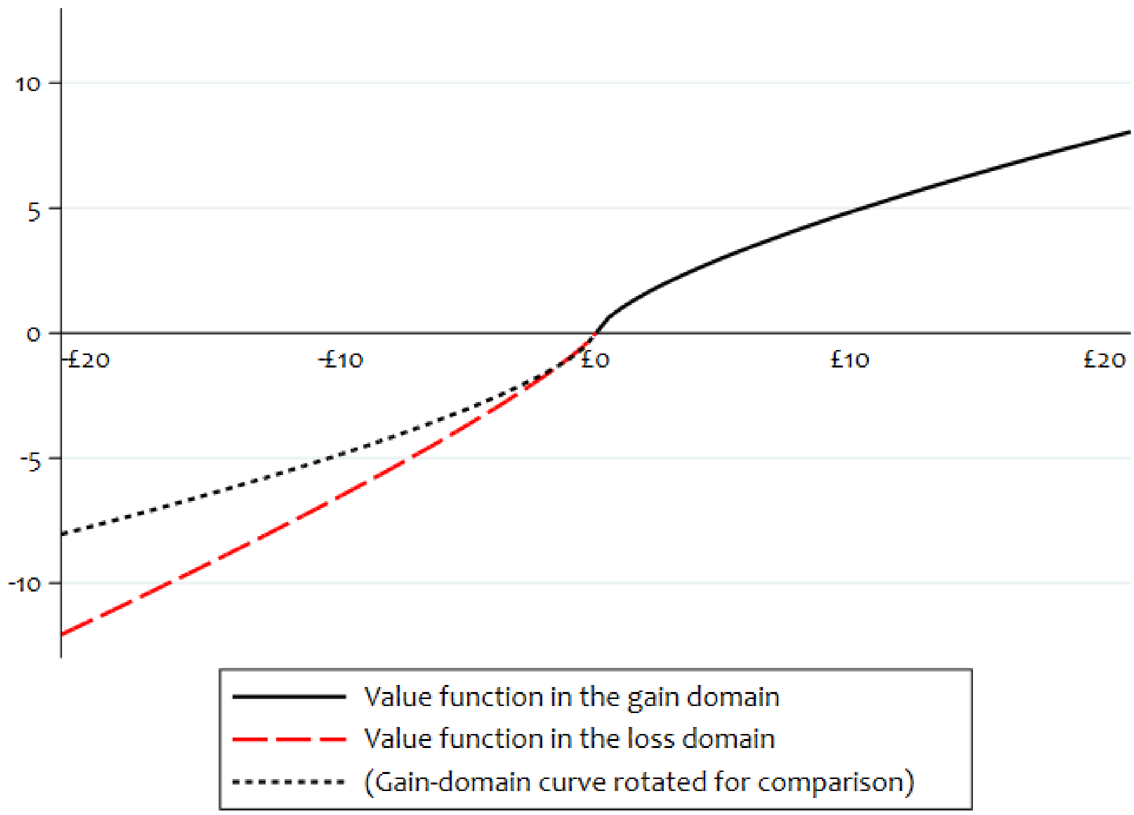
Second, there are significant trade-offs that need to be made when calibrating a utility or value function using real-world data. Studies of behaviour in response to loss and risk are usually based on questionnaires of a relatively small number of homogeneous individuals who are typically students of 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 30 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. 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 in the loss domain between their study and ours. In the loss domain, we find that the value function is convex as a function of x, whereas von Gaudecker et al. (2011), using the utility function of Kreps and Porteus (1978), assume that *dis*utility is concave.

The advantage of a data set involving students is that the respondents are usually willing (indeed required) to answer a sufficiently large number of questions – often about a hundred – 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, using 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 trade-off 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. The average time spent by respondents on the questions we asked was 29 minutes, shorter than the time reported in many experimental studies, which is typically between 40 minutes and one hour. 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) where the value function is concave in the gain domain and convex in the loss domain (whereas with EU the value function would be concave in the loss domain); 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 convex in the loss domain than it is concave in the gain domain, 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 hold for both men and women, at any age, for any level of income, for any level of education, although quantitatively the value functions vary considerably for each subgroup.

We now turn to the issue of quantifying loss aversion more precisely, since there is more than one possible definition.[1] A popular measure of "relative loss aversion" proposed by Köbberling and Wakker (2005) is:

$$\frac{v'_{\uparrow}(0)}{v'_{\downarrow}(0)} = -\lambda \frac{\lim_{x \nearrow 0} v^{-}(x)}{\lim_{x \searrow 0} v^{+}(x)} \tag{4}$$

which measures whether there is a "kink" in the value function at the origin. The hypothetical sums of money considered in our survey (with a minimum monetary value of 10 units of currency) are too large to allow us to analyse with any confidence what is happening for very small values of x close to zero and so it would be inappropriate for us to use this definition. For larger values of x, possibly the most helpful definition is that of Zank (2010), who notes that the weighting function in the loss domain $w^{-}(p)$ may differ from the weighting function in the gain domain $w^{+}(p)$, suggesting the definition of loss aversion:

$$-\lambda \frac{w^{-}(p)v^{-}(x)}{w^{+}(p)v^{+}(x)} \tag{5}$$

However, as we have already explained, the restrictions placed on our data collection mean that we shall be unable to identify the weighting function(s) and so we use instead the more standard definition originating from Tversky and Kahneman (1992):

$$\Lambda(x) = -\lambda \frac{v^{-}(x)}{v^{+}(x)} = -\lambda \frac{(-x)^{\beta}}{x^{\alpha}} \tag{6}$$

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 $\Lambda(x)$ equal λ.

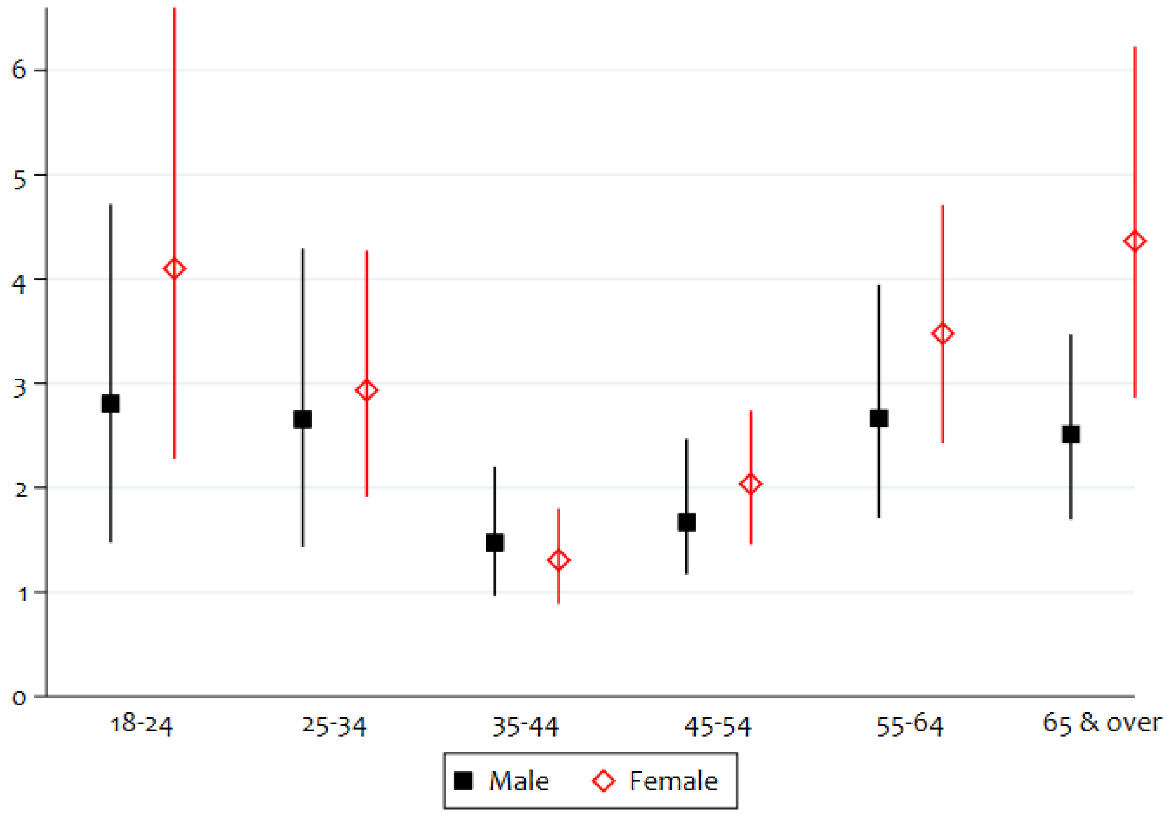
Figure 2 shows our point estimates and 90% confidence intervals for $\Lambda(500)$, estimated separately for our data broken down by gender and into six age groups. There is a strong U-shaped relationship between loss aversion and age; there is also evidence that women have slightly higher (unconditional) loss aversion than men at most ages. It is notable that loss

[1] We discuss this in more detail in Appendix 4.

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.

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. We also have five online appendices.

Figure 2: Relative loss aversion with a gain or loss of 500, $\Lambda(\mathbf{500})$, across gender and age



Note: The figure shows the expected value of $\Lambda(500)$and the associated 90% confidence interval. The numbers in this figure come from Table A4 in Appendix 2. The graph would have a similar shape if we plotted $\Lambda(x)$ for other values of x.

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 provided information on 25 variables which we shall discuss in detail later.[2] We compare the characteristics of our sample to the population as a whole for some significant demographic and economic variables in Table 1. Relative to the national population, the sample is marginally (i) underweight young individuals (aged 18-34) and overweight middle-aged individuals (aged 45-64), (ii) underweight those on incomes below £30,000 and overweight those on incomes above £30,000, (iii) overweight social class A and underweight in social classes C2 and D, and (iv) underweight renters and overweight owner-occupiers (obviously these four factors may be related). Surveys of the national population covering income and savings also have a lower percentage of “no answer” than our survey. With these caveats, the sample was considered by YouGov to be broadly representative of the UK population and certainly more so than studies based on students: we discuss the issue of student responses in section 3.2.

[2] These are 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.

Table 1: Survey sample broken down by key profiling characteristics

Characteristic / category	**Full sample**	**UK population**		**Characteristic / category**	**Full sample**	**UK population**
Gender				**Employment status**		
Male	45.2%	49%		Full-time	40.9%	43%
Female	54.8%	51%		Part-time	15.2%	15%
Age				Student	4.6%	7%
18-24	8.7%	15%		Retired	28.8%	21%
25-34	10.9%	17%		Not working	8.1%	15%
35-44	15.7%	16%		No answer	2.4%	
45-54	20.8%	17%		**Income**		
55-64	23.4%	13%		Below £15,000	26.3%	32%
65 & over	20.5%	22%		£15,000-£29,999	26.3%	30%
Marital status				£30,000-£49,999	14.1%	12%
Married/living with partner	63.3%	63%		£50,000 & above	5.2%	5%
Single	25.0%	25%		No answer	28.1%	22%
Widowed/separated/divorced	11.7%	12%		**Savings**		
Social class				Below £1,000	23.4%	31%
A – Higher managerial, admin, professional	16.1%	4%		£1,000 - £9,999	20.3%	23%
B – Intermediate managerial, admin, professional	21.6%	23%		£10,000 - £49,999	17.2%	18%
C1 – Junior managerial, admin professional	26.2%	28%		£50,000 and above	14.8%	13%
C2 – Skilled manual workers	14.5%	20%		No answer	24.3%	16%
D – Semi-skilled and unskilled manual workers	8.6%	15%		**Home ownership**		
E – Pensioners, low-grade workers, unemployed	9.7%	10%		Own outright	40.9%	65%
No answer	3.2%			Mortgage	35.0%	
				Rent	24.1%	35%
				No answer / don't know	-	-

Sources for UK population: ONS Population Estimates, NOMIS Labour Force Survey, statista.com. Income is gross personal income. For the full definition of social class, see Appendix 5.

2.2 Survey design and estimation method

Our chosen method to elicit preferences was driven partly by the fact that respondents were being asked many other questions. To collect our data, we used the methodology advocated by Abdellaoui et al. (2008) which is based on the elicitation of the certainty equivalent of a number of different risky prospects. Respondents are asked to choose between one risky and one certain outcome (a "choice task") rather than asking them to match the risky prospect with their own suggested certain outcome (a "match task") – as suggested by Frederick et al. (2002).[3] In common with many studies, the gains and losses are hypothetical rather than actual: there are ethical problems in imposing actual losses on respondents apart from the financial problems involved when sums of money are significant.[4]

A potential alternative method based on a choice task would be some variant of the "multiple price list" method used by von Gaudecker et al. (2012) and described in detail by Andersen et al. (2006). Unfortunately, there is no clear reason to prefer one method over the other and we chose our method because of its convenience where time is limited and there is a corresponding need to minimise the cognitive burden on respondents.

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. 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

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[3] Respondents can find match tasks confusing and give implausible answers (Bostic et al. (1990)). In an earlier study, we used a match task approach, but the results contained too many inconsistent answers to be plausible and the study was abandoned.

[4] 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.

- 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. A detailed description of our method for eliciting preferences can be found in Abdellaoui et al. (2008, p. 263).

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

For each prospect, the certainty equivalent was obtained by a series of six steps using an iterative 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 fact that we asked the questions in the order shown in Table 2 means that there is potentially an anchoring effect. An alternative approach would have been to ask the first six questions in a random order, but Abdellaoui et al. (2008, p.253) report 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 and we decided that it was safest to use the order shown.

If there were no experimental or sampling error, then the certainty equivalents G_1, G_2 and G_3 would be related to the prospects in the gain domain as follows:

$$\begin{aligned} v(G_1) &= 0.5 \times v(10) + 0.5 \times v(0) &\Rightarrow\quad G_1^\alpha &= 0.5 \times 10^\alpha \\ v(G_2) &= 0.5 \times v(100) + 0.5 \times v(0) &\Rightarrow\quad G_2^\alpha &= 0.5 \times 100^\alpha \\ v(G_3) &= 0.5 \times v(1000) + 0.5 \times v(0) &\Rightarrow\quad G_3^\alpha &= 0.5 \times 1000^\alpha \end{aligned} \qquad (7)$$

To estimate the parameter α from our noisy data, we start by defining $g_1^\alpha \equiv G_1^\alpha/10^\alpha$, $g_2^\alpha \equiv G_2^\alpha/100^\alpha$ etc, suggesting the following econometric model:

$$g_i = 0.5^{1/\alpha} + \varepsilon_i \qquad (8)$$

where the error ε_i is due to experimental and sampling error. This 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. Having asked each individual only nine questions, we do not attempt to estimate parameters for each individual respondent. 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 direct 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 (6). 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,[5] 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 below in Table 3 our estimate of $\Lambda(500)$ with the associated 90% confidence interval estimated by boot-strapping.[6,7] By itself, the fact that $\lambda \approx 1$ does not imply an absence of loss aversion: whether individuals are loss averse depends, as Equation (6) shows, on the values of x, α and β, as well as λ.

[5] 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 $\beta = 0.7896$, i.e., the parameter estimates are effectively equal.
[6] Note that $E[x] = 500$ in Prospects 3 and 6 in Table 2.
[7] Table A4 in Appendix 2 additionally reports estimates of $\Lambda(5)$ and $\Lambda(50)$.

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 could lead to biased estimates. As a robustness test, we consider in Appendix 3 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 very marginally both less risk averse in the gain domain and more risk seeking in the loss domain than the full sample).

The first part of our analysis reports 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.[8] 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. 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).

For the whole sample, we have the following estimates:

[8] 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.

α (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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)

Our point estimate across the whole sample 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. A striking feature is that $\beta > \alpha$, meaning that the marginal disutility of a loss exceeds the marginal utility of a gain – and this applies not only for the whole sample but for each of the 25 characteristics as Table 3 below shows. Further, despite the finding that $\lambda \approx 1$ (which again holds across most characteristics), 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. For sample as a whole, $\Lambda(500) = 2.41$, which means that the loss of £500 causes 2.41 times more unhappiness than a gain of £500 would cause happiness. $\Lambda(x)$ is always greater than unity and increases with x.

Table 3: Estimated risk and loss aversion parameters (full sample of respondents, summary results)

Characteristic	Category	N	α		β		λ	$\Lambda(500)$
All		4016	0.685		0.833		0.956	2.41 (2.13, 2.70)
Gender	Male	1815	0.700	*	0.828		0.951	2.15 (1.82, 2.50)
	Female	2201	0.673		0.837		0.959	2.68 (2.26, 3.14)
Age	18-24	350	0.736		0.904		1.170	3.33 (2.20, 4.76)
	25-34	438	0.719		0.866		1.072	2.72 (1.93, 3.67)
	35-44	630	0.746	***	0.798	**	0.923	1.31 (0.98, 1.69)
	45-54	837	0.699		0.815		0.887	1.85 (1.41, 2.45)
	55-64	939	0.646		0.834		0.948	3.09 (2.46, 3.85)
	65 & over	822	0.635		0.831		0.943	3.22 (2.40, 4.08)
Marital status	Married or living with partner	2544	0.681		0.829		0.944	2.38 (2.08, 2.72)
	Single	1004	0.721	***	0.846		1.002	2.20 (1.70, 2.85)
	Widowed, separated or divorced	468	0.636		0.822		0.925	3.00 (2.13, 4.12)
Number of children	No children	2778	0.668		0.845		0.981	2.96 (2.53, 3.40)
	One or more children	925	0.730	***	0.808	*	0.909	1.49 (1.20, 1.81)
	No answer	313	0.713		0.796		0.909	1.58 (1.04, 2.25)
Health Status	Better than average	1072	0.684		0.853		0.963	2.75 (2.19, 3.47)
	Average	2065	0.687		0.825		0.968	2.30 (1.96, 2.71)
	Worse than average	879	0.682		0.826		0.922	2.32 (1.83, 2.83)
Personality 1	Type A (competitive)	1202	0.732	***	0.828		0.917	1.67 (1.35, 2.03)
	Type B (laid back)	2814	0.666		0.835		0.974	2.79 (2.42, 3.19)
Personality 2	Optimist	2652	0.688		0.824		0.932	2.16 (1.88, 2.47)
	Pessimist	1364	0.679		0.850		1.009	2.94 (2.45, 3.54)
Emotional state	Tense	343	0.667		0.830		0.969	2.67 (1.81, 4.10)
	Neutral	1772	0.673	*	0.850		1.002	3.01 (2.55, 3.54)
	Relaxed	1815	0.700		0.821		0.921	1.98 (1.59, 2.33)
	Not sure	86	0.691		0.743		0.862	1.37 (0.46, 2.94)
Final educational attainment	16 & under	1104	0.656		0.803		0.871	2.16 (1.70, 2.58)
	17-19	893	0.663	***	0.824	*	0.939	2.65 (1.97, 3.36)
	20 & over	1298	0.716		0.854		1.034	2.49 (2.07, 3.08)
	Other	721	0.703		0.852		0.994	2.56 (1.97, 3.31)

Characteristic	Category	N	α		β		λ	Λ(500)
Social class	A	646	0.711		0.792		0.932	1.59 (1.17, 2.09)
	B	869	0.686		0.857		1.006	2.93 (2.36, 3.67)
	C1	1053	0.710		0.845		0.988	2.33 (1.91, 2.83)
	C2	581	0.684	***	0.827	+	0.905	2.24 (1.65, 2.91)
	D	347	0.655		0.813		0.944	2.58 (1.69, 3.81)
	E	390	0.607		0.844		0.891	3.96 (2.53, 5.83)
	Not available	130	0.693		0.836		0.957	2.59 (0.99, 4.52)
Employment type	Full-time	1644	0.733		0.835		0.959	1.81 (1.48, 2.16)
	Part-time	612	0.685		0.810		0.928	2.11 (1.56, 2.80)
	Student	184	0.726	***	0.933		1.214	4.55 (2.56, 7.26)
	Retired	1155	0.635		0.819		0.929	2.92 (2.33, 3.67)
	Not working	324	0.629		0.860		0.967	4.18 (2.75, 6.13)
	No answer	97	0.634		0.832		0.980	3.82 (1.55, 8.04)
Management responsibility	Owner, etc	300	0.699		0.808		0.981	1.99 (1.21, 2.80)
	Senior manager	145	0.745		0.809		0.898	1.44 (0.75, 2.58)
	Middle manager	302	0.759	+	0.762	**	0.868	0.90 (0.63, 1.27)
	Junior manager	443	0.718		0.869		0.978	2.53 (1.75, 3.50)
	No management responsibility	1073	0.701		0.846		0.980	2.44 (1.98, 3.09)
	Other / NA	1753	0.649		0.835		0.955	3.00 (2.49, 3.52)
Employment sector	Self-employed	375	0.673		0.815		0.994	2.47 (1.66, 3.39)
	Private sector	1231	0.710		0.814		0.932	1.80 (1.45, 2.22)
	Public corporation	533	0.698	+	0.844		0.944	2.36 (1.63, 3.17)
	Public sector	465	0.667		0.867		0.983	3.43 (2.51, 4.60)
	Charity sector	211	0.672		0.870		1.010	3.60 (2.10, 5.41)
	Other / NA	1201	0.668		0.834		0.957	2.69 (2.09, 3.39)
Job security	Secure	1781	0.723		0.836		0.956	1.92 (1.59, 2.27)
	Insecure	475	0.707		0.801		0.930	1.74 (1.21, 2.44)
	No answer	1760	0.643		0.839		0.962	3.26 (2.74, 3.87)
Personal gross income	Below £15,000	1057	0.649		0.845		0.966	3.26 (2.61, 4.02)
	£15,000-£29,999	1056	0.678		0.832		0.975	2.54 (2.09, 2.98)
	£30,000-£49,999	567	0.746	***	0.827		0.931	1.56 (1.18, 2.10)
	£50,000 & above	208	0.790		0.790		0.897	0.92 (0.52, 1.48)
	No answer	1128	0.679		0.833		0.952	2.43 (1.99, 3.02)

Characteristic	Category	N	α		β		λ	$\Lambda(500)$
Home ownership	Own outright	713	0.654		0.850		0.956	3.24 (2.37, 4.28)
	Mortgage	610	0.694		0.816		0.962	2.15 (1.64, 2.84)
	Rent	420	0.669		0.798		0.907	2.09 (1.35, 3.09)
	No answer / don't know	2273	0.696		0.839		0.964	2.38 (2.01, 2.74)
Total savings	Below £1,000	938	0.689		0.814		0.922	2.04 (1.57, 2.65)
	£1,000 - £9,999	816	0.708		0.841		0.970	2.28 (1.83, 2.97)
	£10,000 - £49,999	690	0.672	+	0.830		1.026	2.75 (2.15, 3.53)
	£50,000 and above	596	0.712		0.842		0.937	2.14 (1.53, 2.84)
	No answer	976	0.655		0.841		0.947	3.04 (2.26, 3.86)
Ease of short-term saving	Easy	2488	0.686		0.834		0.960	2.46 (2.17, 2.80)
	Not easy	1528	0.684		0.831		0.949	2.36 (1.91, 2.81)
Rainy day fund	Yes	2719	0.677	*	0.842	+	0.979	2.74 (2.38, 3.12)
	No	1297	0.702		0.814		0.915	1.85 (1.50, 2.27)
Financial understanding	Low	967	0.665		0.851		0.975	3.21 (2.50, 4.07)
	Medium	2640	0.684	**	0.820	*	0.948	2.24 (1.95, 2.59)
	High	409	0.743		0.876		0.962	2.34 (1.50, 3.41)
Region	North East	174	0.678		0.809		0.925	2.17 (1.24, 3.66)
	North West	490	0.670		0.816		0.964	2.47 (1.78, 3.23)
	Yorkshire and the Humber	370	0.676		0.820		0.942	2.43 (1.60, 3.24)
	East Midlands	292	0.675		0.860		1.036	3.30 (2.18, 4.76)
	West Midlands	300	0.725		0.865		0.950	2.35 (1.51, 3.63)
	East of England	352	0.677		0.857		0.970	3.03 (2.05, 4.33)
	London	509	0.709		0.825		0.920	1.90 (1.39, 2.61)
	South East	499	0.671		0.842		1.009	2.99 (1.99, 4.34)
	South West	343	0.685		0.866		0.971	2.99 (1.96, 4.74)
	Wales	192	0.662		0.771		0.939	1.95 (1.21, 3.07)
	Scotland	391	0.703		0.818		0.906	1.90 (1.19, 2.70)
	Northern Ireland	104	0.674		0.818		0.949	2.62 (1.09, 5.99)
Newspaper	Express / Mail	560	0.678		0.796		0.907	1.92 (1.28, 2.56)
	Sun / Star	571	0.672		0.807		0.867	2.04 (1.55, 2.69)
	Mirror / Record	402	0.701	**	0.807	*	0.854	1.67 (1.09, 2.31)
	Guardian / Independent	378	0.670		0.892		1.214	4.94 (3.39, 6.96)
	FT / Times / Telegraph	316	0.763		0.830		0.950	1.51 (0.97, 2.20)

Characteristic	Category	N	α		β	λ	$\Lambda(500)$
	Other paper	419	0.687		0.840	0.980	2.58 (1.72, 3.56)
	No Paper	1370	0.675		0.850	1.005	2.92 (2.35, 3.66)
Party identification	Conservative	950	0.710		0.828	0.945	2.02 (1.60, 2.55)
	Labour	1339	0.685		0.828	0.929	2.29 (1.86, 2.83)
	Liberal Democrat	333	0.657		0.888	1.113	4.89 (3.24, 7.12)
	SNP or Plaid Cymru	100	0.729	*	0.808	0.893	1.61 (0.65, 3.07)
	Other party	351	0.654		0.847	0.963	3.25 (2.09, 4.71)
	No party	760	0.679		0.813	0.962	2.27 (1.69, 2.92)
	Don't know / NA	183	0.678		0.862	1.003	3.47 (1.84, 6.66)
Religion	None	498	0.707		0.832	0.950	2.09 (1.39, 3.06)
	Ch of England	560	0.649		0.812	0.914	2.55 (1.83, 3.46)
	Roman Catholic	171	0.681	*	0.817	0.898	2.23 (1.19, 3.98)
	Protestant	158	0.617		0.829	1.047	3.92 (2.42, 6.14)
	Other	121	0.656		0.822	0.988	2.98 (1.58, 5.23)
	NA	2508	0.695		0.840	0.965	2.38 (2.05, 2.75)
Religiosity	Religious	843	0.644		0.811	0.925	2.67 (2.03, 3.53)
	Not religious	904	0.705	***	0.837	0.957	2.21 (1.67, 2.87)
	Don't know / NA	2269	0.693		0.839	0.967	2.41 (2.10, 2.74)

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 $\Lambda(500)$ is our measure of relative loss aversion comparing the disutility of a loss of £500 to the utility of a gain of £500 (see Equation (6), where we report both the expected value of our measure and (in parentheses) the 90% confidence interval, both estimated by bootstrapping as described in the text and Appendix A1.2. The table also summarises the results of equality tests on the α and β parameters. As one example, in the case of gender, the null hypotheses for the equality tests are respectively $H_0: \alpha^{male} = \alpha^{female}$ and $H_0: \beta^{male} = \beta^{female}$ and these nulls are rejected if the *p*-value is below the relevant significance level where *** < 0.001, ** < 0.01, * < 0.05, + < 0.1. As another example, in the fifth row, the characteristic "number of children" can be either "no children", "one or more children" or "no answer" and the null hypothesis tested in the first numerical column is $H_0: \alpha^{no\ children} = \alpha^{one\ or\ more\ children}$ (note that we always omit the category "no answer" or "don't know" from the tests). Note the equality tests are not applied to λ for reasons explained in the text and Appendix A1.3. More information, including estimates of $\Lambda(5)$ and $\Lambda(50)$ are reported in Appendix 2, Table A4.

The table containing the full set of results across all 25 profiling characteristics is very long and is presented in Table A4 in Appendix 2. Table 3 presents a summary of the results.

We start with the issue of gender, where there is a large literature suggesting that women are more risk averse than men (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)). We observe that the male α is above average, while the female α is below average (with both below unity), and * indicates that the difference between men and women is statistically significant at the 5% level. This shows that women are more risk averse in the domain of gains than men. By contrast, the male and female β parameters are not significantly different, suggesting that men and women are equally risk seeking in the domain of losses. However, the statistically significant difference in α translates into a statistically significant difference in $\Lambda(500)$. The 90% confidence interval is shown to the right of the point estimate.

The second demographic variable in our data set is age. Most early studies show that risk aversion follows a U-shaped pattern with age (e.g., Riley and Chow (1992), Bakshi and Chen (1994), and Pålsson (1996)). More recent studies show more mixed results: some show 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 no clear-cut results (e.g., Mata et al. (2011)).

Table 3 shows the parameter estimates for six age groups. 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) and 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 the early studies. As a further check on this, we break down our estimates by both age and gender and this confirms that the U-shaped pattern is found for both men and women: these estimates were used to plot Figure 2 (detailed results are reported in Appendix 2).

The degree of risk aversion can also be influenced by marital status. Hallahan et al. (2003) argue that married couples have greater capacity to absorb undesirable outcomes than singles. 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. 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 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.

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.

We briefly summarise the remaining findings in Table 3. To judge whether there is a relationship between a particular variable and the parameter estimates, we concentrate on the equality tests rather than looking at the significance of individual parameter estimates.

There are several variables which appear to have no systematic correlation with the preference parameters. These are health status, job security, home ownership, how easy respondents find it to save short term, or the region of the UK where the respondent lives.

Turning to variables which do have a systematic correlation, we begin with personality type. When comparing personality type 1 (competitive v laid-back respondents), there are very large differences in loss aversion, despite the parameter estimates for β being almost the same: competitive people are less loss averse than laid-back respondents. When comparing personality type 2 (optimists v pessimists), both α and β appear similar (and the difference is statistically insignificant), but again loss aversion is very different: optimists are less loss averse than pessimists. In both of these cases, the parameter which drives the difference in loss aversion is λ rather than the curvature parameters: this is despite the fact that λ is the parameter which appears to vary less across sub-groups based on other variables. A consequence of this would appear to be that personality type may influence loss aversion via a different route than the socio-economic variables, considered below. Although there are also statistically significant differences in our estimates of α, a similar point could be made about the self-reported emotional state.

The parameters α, β and λ are very different across different educational attainment groups, but the effects partly cancel out and so the differences in relative loss aversion are much smaller and statistically insignificant. The parameters α and β vary with self-reported financial understanding and the differences are statistically significant, but again the differences in relative loss aversion are smaller and only respondents with low self-reported financial understanding have a significantly higher measure.

There is a strong relationship between preferences and socio-economic variables: social class, employment status, management responsibility, employment sector, income, political party and newspaper. These variables may well be correlated with each other. The evidence seems fairly clear that full-time workers, people with management responsibility, private sector workers, people with higher incomes, reading more right-wing broadsheet newspapers and possibly more conservative politically tend to be less risk averse and less loss averse than other groups. Take income for example. Table 3 shows that relative loss aversion declines as income increases and the point estimate at 0.92 for $\Lambda(500)$ is actually below unity for incomes above £50,000, implying that the disutility of a loss of £500 is less than the utility of a gain of £500 (although the 90% confidence interval suggests that the estimate is not significantly different from unity).

The issue of direction of causation is most clearly highlighted in self-reported savings. Total reported savings (excluding pension assets) demonstrate little relationship to the preference parameters, but this may be because total savings is highly correlated with other factors, such as age and income. There is, however, a strong positive correlation between higher loss aversion and having a rainy-day fund, suggesting that loss aversion might be a significant determinant of precautionary saving.

Our final profiling characteristics are religion and religiosity: for both these questions there are relatively few responses. Results for these variables are not driven by non-Christian religions, since the total number of Jews, Moslems, Hindus and Sikhs is only 3% of the sample. Non-religious people and Roman Catholics have higher values of α (indicating lower risk aversion in the gain domain) than all other religious affiliations and respondents who report themselves to be religious are significantly more risk averse than those who report themselves as being non-religious. However, there are no significant differences in the loss domain.

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.

Both of these studies estimate parameters separately for each individual respondent and then report the median of the individual estimates. Table 4 presents these median estimates alongside our estimates for the pooled sub-sample of our respondents who are graduate students. 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.

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)[a]	7.08 (2.86, 14.97)[b]
Tversky & Kahneman (1992, p.311)	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 the disutility of a loss of 1,000 with the utility of a gain of 1,000 (see Equation (6)). [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).

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 $\alpha = \beta$ 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 for our students and this, together with their finding that β is significantly greater than unity, could reflect the small-sample bias in the estimator they used (see Appendix A1.2).

Since Abdellaoui et al. (2008, pp.253-4) use a normalisation constant of €1,000, we report $\Lambda(1000)$ for the three studies (ignoring the small differences arising from the use of different currencies). The relative loss aversion coefficient for our group of students (7.08) is much higher than for the other groups, largely because our students 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 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 section 3.1, we presented correlations between the LA parameters and various profiling characteristics. In this section, we report multivariate correlations.

Table 5 reports NLS estimates of two separate multivariate regressions for α and β which includes the profiling characteristics as explanatory variables. The estimates can be interpreted as partial correlations between the 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 or the footnote to Table 5). Alongside the parameter estimates, we present the result of hypotheses tests for there being no correlation, i.e., the parameters on the deviations for a given characteristic equalling zero: these tests correspond to the equality tests of the parameters in Table 3. In this section, we concentrate on the differences between the simple correlations and the multivariate correlations.

For example, holding other characteristics constant the difference in α between men and women is reported in the second row as –0.005 and this is statistically insignificant (so there is no * in the adjacent column). We can compare this to the unconditional estimates in Table 3, where the difference in α between men and women is 0.673 – 0.700 = –0.027, statistically significant at the 5% level (hence the * in Table 3). In fact, the *p*-value for the equality test rises from 0.013 to 0.642. This is consistent with the argument in Filippin and Crosetto (2016) and Nelson (2017) that different responses from men and women are due to confounding factors rather than inherent gender differences.

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

Characteristic / category	Category dummy	α		β	
	Constant	0.713		0.820	
Gender	Female	-0.005		0.009	
Age	25-34	-0.042		-0.054	
	35-44	-0.020		-0.104	
	45-54	-0.054	**	-0.091	+
	55-64	-0.083		-0.080	
	65 & over	-0.074		-0.084	
Marital status	Single	0.024		-0.029	
	Widowed, separated or divorced	-0.001		-0.018	
No of children	One or more children	0.033	*	-0.035	+
	No answer re children	0.023		-0.073	
Health status	Average	0.009		-0.031	
	Worse than average	0.024		-0.025	
Personality 1	Type B (laid back)	-0.048	***	0.011	
Personality 2	Pessimist	-0.011		0.026	
Emotional state during test	Neutral	0.001		0.035	
	Relaxed	0.040	**	0.015	
	Not sure	0.034		-0.076	
Completed education	17-19	-0.020		0.015	
	20 & over	0.016	+	0.050	+
	Other / NA	-0.022		0.058	
Social class	B	-0.023		0.069	
	C1	0.012		0.045	
	C2	-0.009	+	0.047	+
	D	-0.027		0.042	
	E	-0.044		0.078	
	Not available	-0.006		0.041	
Employment type	Part-time*	-0.018		-0.040	+
Management responsibility	Senior manager	0.019		-0.023	
	Middle manager	0.024		-0.074	
	Junior manager	-0.007		0.043	**
	None	0.001		0.020	
	Other / NA	0.010		-0.004	
Employment sector	Private sector	0.020		-0.008	
	Public corporation	0.013		0.022	
	Public sector	-0.014		0.047	
	Charity sector	-0.012		0.061	
	Other / NA	0.011		0.004	
Job security	Insecure	0.001		-0.031	
	No answer	-0.053		-0.013	
Personal gross income	£15,000-£29,999	0.003		-0.023	
	£30,000-£49,999	0.047	*	-0.026	
	£50,000 or more	0.075		-0.044	
	No answer	0.015		-0.016	
Home ownership	Mortgage	-0.004		-0.039	
	Rent	0.005		-0.072	+
	No answer / don't know	0.029		-0.044	
Savings	£1,000 - £9,999	0.024	*	0.003	

Characteristic / category	Category dummy	α		β	
	£10,000 - £49,999	-0.001		-0.006	
	£50,000 and above	0.052		0.005	
	No answer	-0.005		0.013	
Ease of saving	Not easy	0.007		0.028	
Rainy day fund	No	0.032	*	-0.039	+
Financial knowledge	Medium	0.015		-0.029	*
	High	0.046		0.041	
Region	North West	-0.013		0.013	
	Yorkshire and the Humber	-0.006		0.005	
	East Midlands	-0.004		0.056	
	West Midlands	0.033		0.054	
	East of England	-0.011		0.048	
	London	0.011		0.015	
	South East	-0.014		0.030	
	South West	0.002		0.053	
	Wales	-0.015		-0.044	
	Scotland	0.009		-0.005	
	Northern Ireland	-0.008		0.011	
Newspaper	Sun / Star	-0.017		0.022	
	Mirror / Record	0.026		0.028	
	Guardian / Independent	-0.041	**	0.073	
	FT / Times / Telegraph	0.049		0.017	
	Other paper	0.003		0.043	
	No Paper	-0.017		0.055	
Political party	Labour	-0.017		-0.008	
	Liberal Democrat	-0.054		0.039	
	SNP or Plaid Cymru	0.039	+	-0.022	
	Other party	-0.030		0.001	
	No party	-0.013		-0.040	
	Don't know / NA	-0.018		0.009	
Religion	Ch of England	-0.010		0.010	
	Roman Catholic	0.002		0.027	
	Protestant	-0.042		0.035	
	Other	-0.037		0.022	
	NA	0.009		-0.001	
Religiosity	Not religious	0.033		0.040	
	Don't know / NA	-0.010		0.047	

Note: The table presents the results of two separate regressions for 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 and β for the reference individual and the other coefficients show positive or negative deviations from this. For each category we test for equality across categories, which in this specification is the null hypothesis that all of the deviations are zero: the test p-value is summarised by *** < 0.001, ** < 0.01, * < 0.05, + < 0.1. 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.

The statistically significant effects of marital status, employment status and religion/religiosity in Table 3 cease to be statistically significant when we control for other variables. The relationship between risk aversion in the gain domain and financial knowledge ceases to be statistically significant, but it remains so in the loss domain. Conversely, while the unconditional effect of savings on risk aversion in the gain domain was only marginally significant ($p = 0.098$), in the conditional specification it is statistically significant ($p = 0.026$).[9]

However, the most striking result is that statistically significant relationships between many profiling characteristics and preferences are the same in both the univariate and multivariate analysis: number of children, personality type 1 (competitive v laid back), social class (although this is marginally significant in the multivariate analysis); income, existence of a rainy-day fund, newspaper readership and political party remain statistically significant.

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 ($\gamma = 0.0316$ and $\lambda = 2.960$) 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

[9] Precise information on all of the *p*-values is reported in Appendix Table A6.

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 Tversky-Kahneman (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 $\Lambda(x)$), 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 curvature of the value function is greater in the loss domain than in the gain domain – see Figure 1.

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 slightly 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.

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 which is 2.41. 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 convex in the loss domain. This clearly emphasises the problem in generalising from studies of students to the population as a whole.

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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Quantifying Loss Aversion:
Evidence from a UK Population Survey

David Blake, Edmund Cannon, and Douglas Wright

Material for online publication only

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

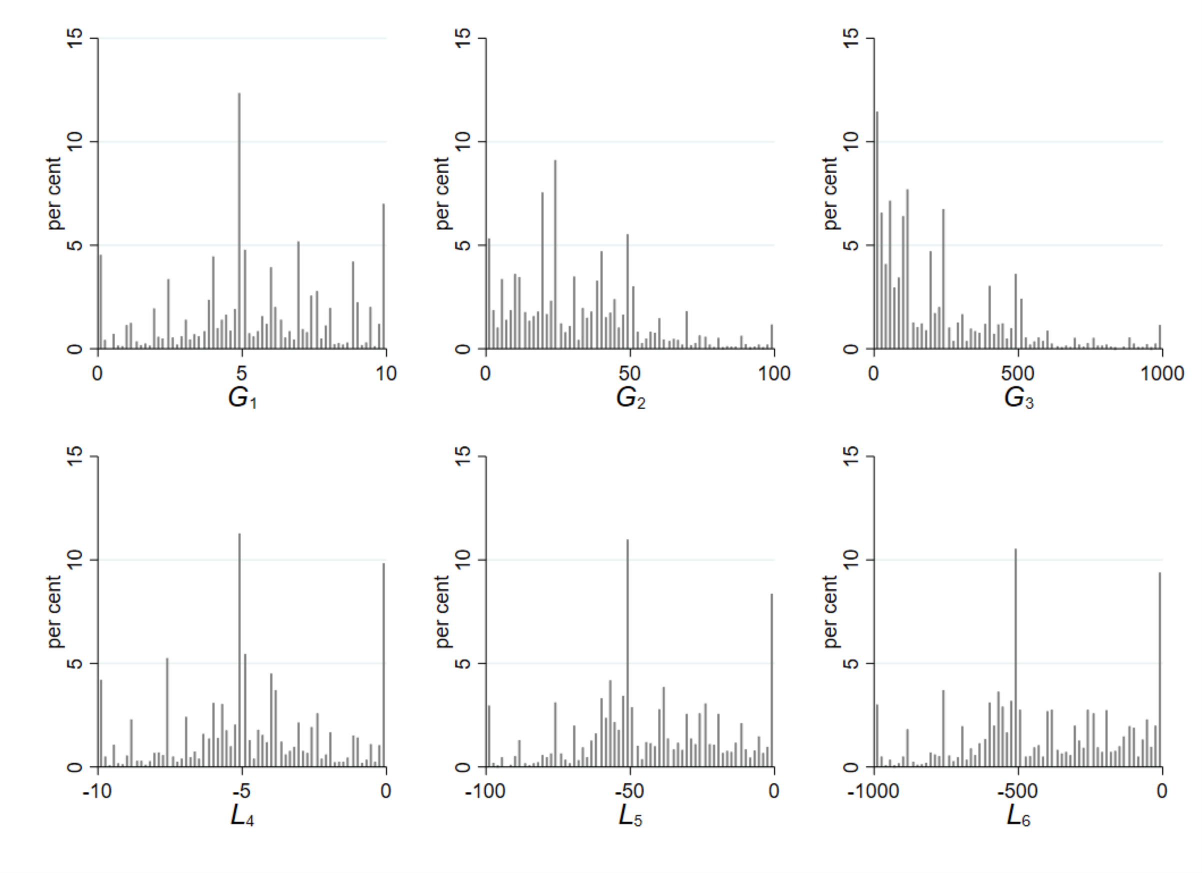


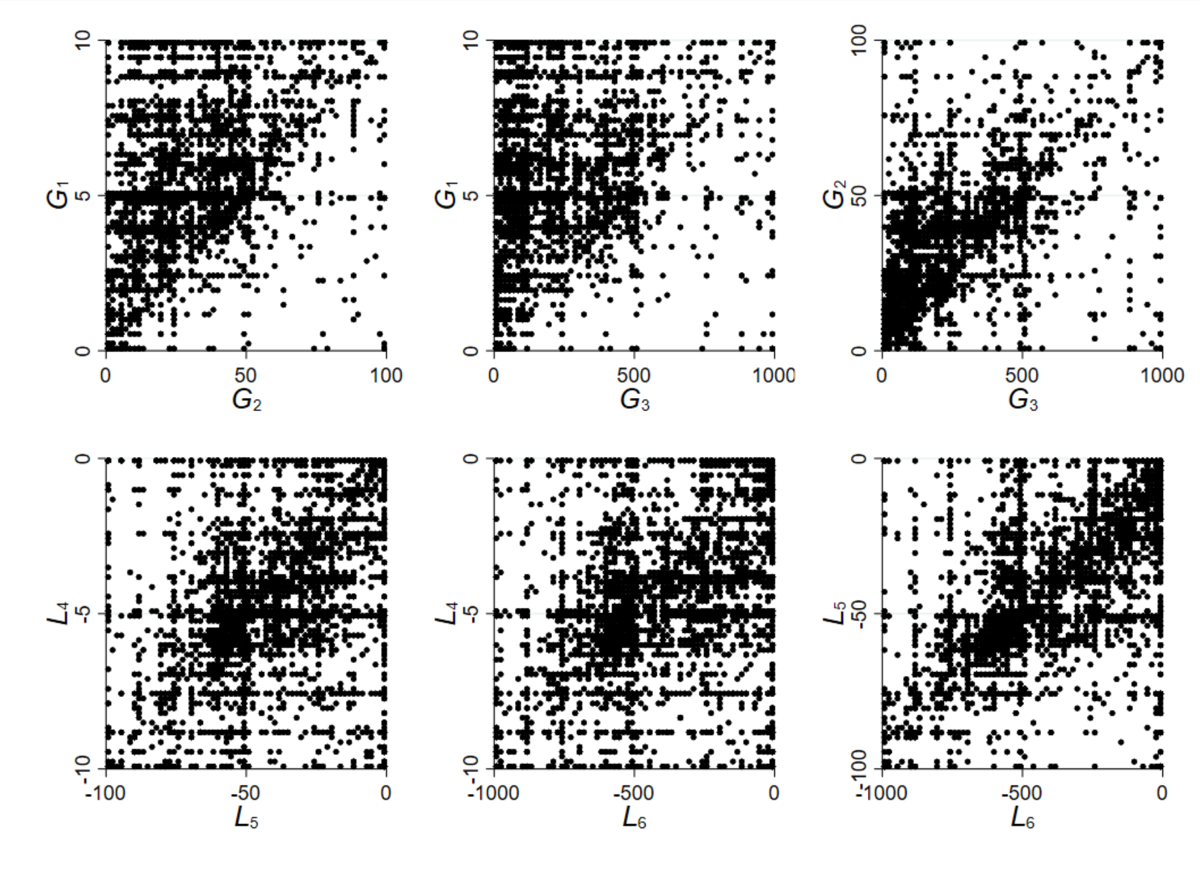
Table A1: Summary statistics for the distribution of the certainty equivalent scores for the three gain and three loss risky prospects

	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 results – see Appendix 3.

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:

$$g_i \equiv \frac{G_i}{10^i} \quad i = 1,2,3$$
$$l_i \equiv \frac{L_i}{10^{i-3}} \quad i = 4,5,6 \qquad (A1)$$
$$m_i \equiv \frac{M_i}{10^{i-6}} \quad i = 7,8,9$$

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 shall 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 explained 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 for a set of individual respondants $r \in R$ minimises:

$$\sum_{\substack{i=1,2,3 \\ r \in R}} \left\{g_i - 0.5^{1/\alpha}\right\}^2 \qquad (A2)$$

resulting in closed-form solutions for the parameter estimates of:

$$\hat{\alpha} = \frac{\ln 0.5}{\ln(n^{-1}\sum g_i)} = \frac{\ln 0.5}{\ln \bar{g}} \qquad (A3)$$

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

$$plim[\hat{\alpha}] = plim\left[\frac{\ln 0.5}{\ln(\bar{g})}\right] = \frac{\ln 0.5}{\ln(plim[\bar{g}])} = \frac{\ln 0.5}{\ln(\mathbb{E}[g])} = \frac{\ln 0.5}{\ln(0.5^{1/\alpha})} = \alpha \qquad (A4)$$

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

In principle, we could estimate the preference parameter α_r for each respondant, 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:

$$\frac{d\hat{\alpha}}{d\bar{g}} = \frac{\ln 2}{\bar{g}(\ln \bar{g})^2} > 0; \quad \frac{d^2\hat{\alpha}}{d\bar{g}^2} = \frac{-\ln 2}{(\bar{g}\ln \bar{g})^2}\left\{1 + \frac{2}{\ln \bar{g}}\right\} \gtrless 0 \qquad (A5)$$

so $\hat{\alpha}$ is a concave function in the relevant range if $\bar{g} < exp(-2) \approx 0.13$ and convex otherwise. Furthermore, the function is extremely convex as $\bar{g} \to 1$ 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 $\bar{g}$ 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_i, 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
$Pr[\hat{\alpha} > 1]$	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
$Pr[\hat{\beta} > 1]$	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 Equation (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, l and m 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_i $(i = 7,8,9)$, 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)):

$$g_i^{\alpha} - \lambda m_{i+6}^{\beta} = 0 \Rightarrow m_{i+6} = g_i^{\alpha/\beta} \lambda^{-1/\beta} \qquad (A6)$$

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

$$\sum_{\substack{i=1,2,3 \\ r \in R}} \left\{ m_{i+6} - g_i^{\hat{\alpha}/\hat{\beta}} \lambda^{-1/\hat{\beta}} \right\}^2 \qquad (A7)$$

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:

$$\sum_{\substack{i=1,2,3 \\ r \in [18-24]}} \left\{ g_i - 0.5^{1/\alpha^{[18-24]}} \right\}^2 \qquad (A8)$$

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 $\hat{\lambda}^{[18-24]}$ is found by minimising:

$$\sum_{\substack{i=1,2,3 \\ r\in[18-24]}} \left\{m_{i+6} - g_i^{\hat{\alpha}^{[18-24]}/\hat{\beta}^{[18-24]}} \lambda^{-1/\hat{\beta}^{[18-24]}}\right\}^2 \qquad (A9)$$

To estimate the standard error of $\hat{\lambda}^{[18-24]}$, 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 $\hat{\alpha}^{[18-24]}$, $\hat{\beta}^{[18-24]}$ and $\hat{\lambda}^{[18-24]}$. 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 A4.

A1.3 Hypothesis testing

In this section, we explain how the hypothesis tests in Table A5 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 to test whether they are equal. This is easiest to do by choosing a transformed set of parameters $\alpha^{[18-24]}$ and $\Delta^{[25-34]}, \Delta^{[35-44]}, \Delta^{[45-54]}, \Delta^{[55-64]}, \Delta^{[65+]}$ to minimise:

$$\sum_{i=1,2,3} \left\{g_i - 0.5^{1/\left(\alpha^{[18-24]}+\Delta^{[25-34]}d_i^{[25-34]}+\Delta^{[35-44]}d_i^{[35-44]}+\cdots+\Delta^{[65+]}d_i^{[65+]}\right)}\right\}^2 \qquad (A10)$$

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

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

However, our boot-strapping procedure only allows us to test the more restrictive null hypothesis. Under the more 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: Full sample estimation results for three measures of relative loss aversion

Appendix 2 presents some additional estimates to those shown in the main text. Table A4 shows the full set of results for all 25 profiling characteristics and for three measures of relative loss aversion. Table 3 in the main text presented the summary results for $\Lambda(500)$ only.

Table A4: Estimated loss aversion parameters (full sample of respondents, full set of results)

Characteristic	**N**	α **(std. err.)**	β **(std. err.)**	λ **(std. err.)**	**Λ(5) (90% c.i.)**	**Λ(50) (90% c.i.)**	**Λ(500) (90% c.i.)**
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)

Characteristic	**N**	**α (std. err.)**	**β (std. err.)**	**λ (std. err.)**	**Λ(5) (90% c.i.)**	**Λ(50) (90% c.i.)**	**Λ(500) (90% c.i.)**
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)
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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)
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		$p = 0.930$	$p = 0.279$				

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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				
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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							
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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)
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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							
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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)
£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							

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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)
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)

Characteristic	**N**	α **(std. err.)**	β **(std. err.)**	λ **(std. err.)**	**Λ(5) (90% c.i.)**	**Λ(50) (90% c.i.)**	**Λ(500) (90% c.i.)**
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)
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)

Characteristic	**N**	α **(std. err.)**	β **(std. err.)**	λ **(std. err.)**	**Λ(5) (90% c.i.)**	**Λ(50) (90% c.i.)**	**Λ(500) (90% c.i.)**
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)
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)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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)
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 across all characteristics. 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 (6)), where x =5,50,500. 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 3 in the main paper is a shortened version of this table.

Table A5: Multivariate regressions of α and β on the profiling characteristics (full sample)

The following table is a longer version of Table 5 in the main paper, reporting the standard errors for each parameter estimate.

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)
	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)

Characteristic	Category dummy	α	s.e.(α)	β	s.e.(β)
	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)
	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)

Characteristic	Category dummy	α	s.e.(α)	β	s.e.(β)
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.

Table A6: Tests of joint hypotheses from multivariate regressions: p-values

The following table corresponds to Table 5 in the main paper and reports the *p*-values for the hypotheses tests that, conditional on other variable, there is no correlation between α (or β) and the relevant characteristic.

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.

Appendix 3: Reduced sample estimation results for three measures of relative loss aversion

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 A7, we report the full set of results for the reduced sample of 3,359 whose responses fully satisfy satiation. We interpret this as a robustness test of our model.

Table A8 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 A3 and Table A7 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 A3 and Table A7, respectively). The reduced sample typically displays higher loss aversion, although not much higher and the confidence intervals overlap.

Table A7: Estimated loss aversion parameters (reduced sample of respondents, full set of results)

Characteristic	N	α (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 **(std. err.)**	β **(std. err.)**	λ **(std. err.)**	**Λ(5) (90% c.i.)**	**Λ(50) (90% c.i.)**	**Λ(500) (90% c.i.)**
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
£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 (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	$\Lambda(5)$ (90% c.i.)	$\Lambda(50)$ (90% c.i.)	$\Lambda(500)$ (90% c.i.)
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 (std. err.)	β (std. err.)	λ (std. err.)	Λ(5) (90% c.i.)	Λ(50) (90% c.i.)	Λ(500) (90% c.i.)
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 $x = -1$), with standard errors in parentheses. $\mathbf{\Lambda}(x)$ is relative loss aversion comparing a loss of x with a gain of x (see Equation (6)), where x = 5, 50 and 500 and the 90% confidence interval is reported in parentheses. The null hypothesis for the equality test is that the parameters or either α or β 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. We do not test for the equality of λ.

Table A8: Comparison of full sample and reduced sample estimation results

Characteristic	$\alpha^{Reduced} - \alpha^{Full}$ equality test	$\beta^{Reduced} - \beta^{Full}$ equality test	$\Lambda(50)$ full	$\Lambda(50)$ 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	$\Lambda(50)$ full	$\Lambda(50)$ 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	$\alpha^{Reduced} - \alpha^{Full}$ equality test	$\beta^{Reduced} - \beta^{Full}$ equality test	$\Lambda(50)$ full	$\Lambda(50)$ 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	$\alpha^{Reduced} - \alpha^{Full}$ equality test	$\beta^{Reduced} - \beta^{Full}$ 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 (6)) 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.

Appendix 4: Different measures of loss aversion

There are a variety of definitions of loss aversion and the consequences of this are discussed in various studies (e.g., Zank, 2010). We discuss this issue in more detail here to show how our study fits into the more general discussion. Suppose that the value function can be written as

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

where α is the parameter (or are the parameters) determining the value function in the gain domain; β is the corresponding parameter (or are the parameters) in the loss domain; and λ is a multiplicative constant. As a concrete example, consider the CRRA utility function:

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

Table A9 presents different definitions of loss aversion loosely based on Table 1 from Abdellaoui, Bleichrodt and Paraschiv (2007).

Table A9: Different definitions of loss aversion

Informal definition of loss aversion	Formal definition of loss aversion; using the example function
The ratio of disutility from losing one unit to utility of gaining one unit, e.g., Tversky and Kahneman (1992). The issue of this is that it is dependent on the unit of measurement.	$\frac{-v(-1)}{v(1)}$ λ
Ratio of disutility from losing x units to utility of gaining x units, e.g., Bleichrodt et al. (2001). The issue with this is that it will depend upon the value of x unless $v^{+} = v^{-}$.	$\frac{-v(-x)}{v(x)}$ $\lambda x^{\beta-\alpha}$
Ratio of marginal disutility from losing x units to marginal utility of gaining x units.	$\frac{v'(-x)}{v'(x)}$ $\frac{\lambda\beta}{\alpha} x^{\beta-\alpha}$

Informal definition of loss aversion	Formal definition of loss aversion; using the example function
The ratio of the marginal disutility of losses to marginal utility of gains at $x = 0$, determining whether there is a "kink" in the value function at the origin, e.g., Köbberling and Wakker (2005).	$\frac{v'_{\uparrow}(0)}{v'_{\downarrow}(0)}$ λ if $\beta = \alpha$, otherwise 0 or undefined;
The ratio of disutility from losing x units to utility of gaining x units, but with an adjustment made for the probability weighting functions, which may be different in the loss and gain space, e.g., Zank (2010).	$\frac{-w^{-}(p)v(-x)}{w^{+}(p)v(x)}$

Most of these definitions result in a measure of loss aversion which depends on x unless $\beta = \alpha$ in which case loss aversion is measured by the parameter λ. The definition proposed by Köbberling and Wakker (2005) has the advantage that it is independent of x but the disadvantage that it may not be defined. The important contribution of Zank (2010) is to propose adjusting the value functions for the probability weighting functions. He suggests that typically we might expect that $w^{-}(p)/w^{+}(p) > 1$ in which case estimates of loss aversion which do not make this adjustment may be under-estimates compared to his definition. However, Abdellaoui et al. (2008) find that $w^{+}(0.5) = 0.46$ and $w^{-}(0.5) = 0.45$, suggesting that the adjustment would make little difference for equal-chance gambles, which are what we are considering in this paper.

An unusual value function is proposed by von Gaudecker et al. (2011), who use a value function taken from Kreps and Porteus (1978):

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

Although based on a CARA (constant absolute risk aversion) specification, this value function has the property that it is concave in x for both gains and losses, whereas all other published papers that we have reviewed are based on value functions which are concave in gains and convex (or linear) in losses. The measure of loss aversion used by von Gaudecker et al. (2011) is that of Köbberling and Wakker (2005).

Appendix 5: National Reader Survey of Social Class

In the United Kingdom, there is a six-fold classification of social class developed by the National Reader Survey but widely used by public and private agencies – see Table A10.

Table A10: Definitions of social class in the UK

Grade	Social class	Chief income earner's occupation	% of population in 2016
A	Upper middle class	Higher managerial roles, administrative or professional	4%
B	Middle middle class	Intermediate managerial roles, administrative or professional	23%
C1	Lower middle class	Supervisory or clerical and junior managerial roles, administrative or professional	28%
C2	Skilled working class	Skilled manual workers	20%
D	Working class	Semi-skilled and unskilled manual workers	15%
E	Non-working	State pensioners, casual and lowest grade workers, unemployed with state benefits only.	10%

Source: Social Grade, http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/