IZA Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 17439

An Unconsidered Leave? Inequality Aversion and the Brexit Referendum

Joan Costa-Font
Frank Cowell

NOVEMBER 2024

I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 17439

An Unconsidered Leave? Inequality Aversion and the Brexit Referendum

Joan Costa-Font
London School of Economics and IZA

Frank Cowell
London School of Economics and IZA

NOVEMBER 2024

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

An Unconsidered Leave? Inequality Aversion and the Brexit Referendum

This paper examines a behavioural explanation for the Brexit referendum result, the role of an individual's inequality aversion (IA). We study whether the referendum result was an "unconsidered Leave" partially driven by people's low aversion to inequality. We use a representative sample of the UK population fielded in 2017, and analyse the extent to which lottery-based individual IA estimates predict their Brexit vote. We consider alternative potential drivers of IA in both income and health domains; these include risk aversion, locus of control, alongside socio-economic and demographic characteristics. A greater aversion to income inequality predicts a lower probability of voting for Leave, even when controlling for risk aversion and other drivers of the Brexit vote. This effect is only true among men, for whom an increase in income IA by one standard deviation decreases their likelihood of voting for leaving the EU by 5% on average. Had there been a greater IA, the overall referendum result might have been different. However, the effect of health inequality aversion is not significantly different from zero.

JEL Classification: H1, I18

Keywords: Brexit, inequality aversion, income inequality aversion, health inequality aversion, imaginary grandchild, risk aversion, locus of control

Corresponding author:
Joan Costa-Font
Department of Health Policy
London School of Economics and Political Science
Houghton Street, WC2A 2AE
United Kingdom

E-mail: j.costa-font@lse.ac.uk

1 Background

On 23 June 2016, the UK electorate voted to exit the European Union (EU). Support for the Leave option in the Brexit referendum was influenced by a complex interplay of various determinants, including socio-economic factors, cultural identity, and perceptions of sovereignty and immigration (Clarke et al., 2017; Goodwin and Heath, 2016; Hobolt, 2016; Scully et al., 2016). Socio-economic status played a significant role, with individuals from lower-income households being more likely to vote for leaving the EU (Brexit). Economic grievances, such as perceptions of declining living standards, job insecurity, and austerity measures, contributed to a sense of disillusionment with the EU, which also fuelled support for Brexit among economically marginalised communities (Goodwin and Heath, 2016). Cultural identity played a significant role, with nationalist values and sovereignty narratives ("taking back control") emerging as important determinants. Those who identified strongly as British and expressed anti-immigrant sentiments were more likely to support Brexit. Cultural concerns such as fears of cultural dilution and loss of national identity intertwined with economic anxieties to reinforce negative narratives of EU membership (Hobolt, 2016).

Other individual-specific characteristics also played a role in the Brexit referendum, including cohort-specific differences in attitudes towards the EU. These differences were shaped by a variety of factors, such as divergent perspectives on issues such as immigration, economic opportunities, and national identity. Younger voters, who were less likely to turn out to vote in the referendum, were more likely to have grown up in a more interconnected Europe and benefited from opportunities such as studying or working abroad or interacting with similar individuals across the continent. They may have viewed EU membership as essential for maintaining economic prosperity and cultural openness (Clarke et al., 2017). In contrast, older voters, who might have experienced a different era characterised by national sovereignty and greater control over immigration, were more inclined to support Brexit as a means of reclaiming sovereignty and addressing concerns over immigration (Scully et al., 2016). The age divide in voting patterns underscored broader generational tensions and highlighted the varying perspectives on the UK's relationship with the EU among different age cohorts. Becker et al. (2017) find that demography and local economic structure are the strongest predictors of voting behaviour. They find that older age, lower educational attainment, and a higher preponderance in manufacturing, construction and finance employment are associated with a higher Vote-Leave share in an area. The combination of austerity and immigration became more closely linked with support for leaving the EU when they interact with fundamental demographic variables: the association is stronger in a region where voters are older, have lower education, lower income, and higher unemployment.[1] Nouvellet (2017) shows that an upper limit on the voting age could have changed the referendum outcome. These results reflect an electoral re-alignment, where the class cleavage based on economic fundamentals starts to be dominated or even replaced by age and education cleavages (Cutts et al., 2020). In contrast, Park and Kim (2018) found that pro-Brexit voting was still influenced by economic interests which in turn drove emotional attitudes toward European integration. However, the underlying behavioural motivations underpinning these explanations are still not fully explained.

We still know little about the role of behavioural drivers, such as risk aversion and inequality aversion, that might have led to "jumping from the cliff edge" to initiate Brexit.[2] Our research contributes to the literature by studying how inequality aversion, alongside other behavioural constructs like risk aversion and locus of control, drive Brexit opinions. Risk attitudes are relevant because cost-benefit calculations from Brexit involved a large degree of uncertainty. Evidence suggests that risk-tolerant voters were more likely to support leaving the EU, viewing Brexit as a calculated risk worth taking for the potential benefits of regaining sovereignty, controlling immigration, and forging new trade agreements (Clarke et al., 2017). These voters were more inclined to prioritise long-term considerations of national autonomy and self-determination over short-term economic uncertainties associated with leaving the EU. Conversely, those with lower risk tolerance tended to support remaining in the EU, perceiving Brexit as a potentially destabilising and unpredictable event that could lead to economic disruptions, trade barriers, and reduced international

[1] Similarly, Alabrese et al. (2019a) found that voting for leaving the EU is associated with older age, white ethnicity, low educational attainment, infrequent use of smartphones and the internet, receiving benefits, adverse health and low life satisfaction. The correlations at the individual level are the strongest among strongly pro-Leave or strongly pro-Remain regions.

[2] The exception is Carreras (2019) claiming that prospect theory, and specifically the loss frame that individual associate with EU membership explains their Brexit referendum vote.

influence (Goodwin and Heath, 2016).

This paper examines the influence of inequality aversion controlling for risk preferences. The role of inequality follows from Pastor and Veronesi (2021) who explain the rise of populism as resulting from exposure to high inequality, high financial development, and trade deficits. To restore support for globalisation (in this case the reverse of the Brexit result), they suggested that either inequality should be kept in check, or voters' inequality aversion ought to decline. We will also consider the mediating effect of gender, which has been shown to explain differences in social risk-taking (Friedl et al., 2020).[3] Women were slightly more likely to support remaining in the EU, citing concerns over the potential economic consequences of leaving and the importance of EU membership for issues such as workers' rights and gender equality (Clarke et al., 2017). However, it is unclear whether less inequality-averse women compare to less inequality-averse men. On the other hand, Scully et al. (2016) argues that gender differences in attitudes towards Brexit were more attributable to other factors, with women from economically disadvantaged backgrounds more likely to support Brexit. While gender did not emerge as a primary determinant of voting behaviour in the Brexit referendum, it interacted with other demographic factors to shape individual attitudes towards EU membership.

Our evidence comes from a representative survey that collected information about individuals' inequality aversion in both income and health domains in 2017, months after the Brexit referendum (hence limiting recollection bias). We estimate inequality aversion using a lottery-based approach, introducing an "imaginary grandchild" to imitate a "veil of ignorance" condition that abstracts inequality preferences from personal circumstances. In the survey, we also recorded individuals' decisions to leave the European Union alongside a long list of demographics and socio-economic controls, risk preferences and locus of control. We show that a stronger aversion to inequality predicts a lower probability of voting for Leave, with heterogeneous effects across genders, and when financial and health risk aversion are controlled for. An increase in income IA by one standard deviation decreases the likelihood of voting for leaving the EU by 5% on average among men. However, for women, the effect of

[3] Booth et al. (2014) finds female participants more risk averse than male participants, using students from the University of Essex as a sample. But as Friedl et al. (2020) points out, the effect of gender on risk tolerance is culture-specific.

income and health IA is indistinguishable from zero. This conclusion is robust under alternative empirical methods and specifications.

In the rest of the paper, section 2 describes the theoretical framework behind our elicitation technique; section 3 describes the survey questions, and how the IA parameters are calculated from the responses; section 4 describes our empirical strategy. Section 5 presents descriptive results and the effect of IA on voting behaviours in the Brexit referendum, along with a series of robustness checks. Section 6 concludes.

2 Conceptualisation of IA

Using the model developed by Carlsson et al. (2005), individual utility is given by $u(y, \Phi, \gamma)$, where y is income and Φ is an inequality index. Here, γ is a parameter of individual inequality aversion which can be interpreted as an elasticity, reflecting the percentage in income for a 1% increase in inequality that holds utility constant. $\gamma = 0$ corresponds to the case where utility is independent of the income distribution per se, and $\gamma = 1$ implies that a 1% increase in own income gives as much utility as a 1% decrease in the inequality measure; $\gamma < 0$ reflects inequality-prone preferences whereas $\gamma > 1$ implies that a 1% decrease in the inequality gives more utility than a 1% increase in own income. The utility function is assumed to take the form:

$$u = h(y \cdot \Phi^{-\gamma}).$$

If we adopt the coefficient of variation as the inequality index Φ, then this equation can be written as the following, where μ is mean income and σ is the standard deviation of income of the society:

$$u = h\left(y\left(\frac{\mu_y}{\sigma_y}\right)^{\gamma}\right).$$

If societies A and B are regarded as equivalent, then:

$$y_A \Phi_A^{-\gamma} = y_B \Phi_B^{-\gamma}.$$

This gives the equation for determining the value of γ:

$$\gamma = \frac{\ln(\frac{y_A}{y_B})}{\ln(\frac{\Phi_A}{\Phi_B})}.$$

This model rests on the following assumptions (Bergolo et al., 2022).

First, inequality affects individual utility only in the consequential sense: people care about the level of societal inequality but not the mechanisms generating inequality. However, our paper tests whether the perception of the importance of luck versus effort in personal success affects inequality aversion.

Second, the model captures non-self-centred inequality aversion, in which individuals like or dislike inequality depending on the parameters of the outcome distribution, but not how their income compares to that of others (self-centred inequality aversion). This motivates an elicitation approach that abstracts from personal circumstances, as explained earlier.

Third, preferences assume a form where inequality aversion remains invariant under equal proportionate changes in Φ_A and Φ_B.

3 Data and IA Measurement

We designed and conducted a survey experiment in 2017 collecting information on behavioural parameters, socio-economic characteristics, a voter's recent recollection of their Brexit vote, as well as different measures of inequality aversion in the income and health domain (Costa-Font and Cowell, 2024).

3.1 The Survey

The survey questions were piloted before the actual survey, and designed in conjunction with a survey research organisation. The survey was carried out online, and the sample is nationally representative of Britain and its different nations. The sample size is 2049 persons. The fieldwork took place between 29th September and 1st October 2017. The questionnaire was carried out following a warm-up remark, "We are interested in understanding your views on the distribution of income and health" after each participant stated their consent to participate. 51 percent of survey participants were women, 38 percent were under 35, 21 percent were over 65, 23 percent were between 35 and 55 and about 15 percent were between 55 and 64. The survey was balanced in terms of socio-economic status with about one quarter in each of the four categories of socio-economic status considered, and respondents were from all regions in Britain, including 12.6 from London, 8.7 percent from Scotland, and 11.8 from the North West and 5.6 percent from Wales among other areas. About 44 percent were in full-time employment, 44 percent were out of employment or retired and 12 percent were working part-time. However, with the exception of London, the survey is not representative of regions in Britain, only of their nations. Our analysis will place some attention to two of the Remain strongholds we can identify, namely Scotland and London.

3.2 Lottery-based elicitation on income IA

The IA was elicited using the respondent's choice of (hypothetical) societal scenarios and such estimates were then used to estimate the implied confidence intervals of IA parameters, and regression analysis was employed to study the behavioural determinants of IA. The elicitation instrument mimics the veil-of-ignorance condition where individuals were asked to choose a hypothetical society for their grandchildren in the domain of income and health.

We requested participants to identify what kind of world they would consider for their (imaginary) grandchild to live in, without knowing ex-ante the status of their grandchild in the income and health hierarchies. Respondents were asked to choose between two scenarios A and B which differ in terms of the range of incomes in society (incomes are in £ per year; in every other respect, A and B are the same). Scenario A's income ranges from £20,000 to £100,000, with an average of £60,000.

To obtain greater benefit from the survey, we (quasi) rationalise the specific numbers presented in scenario B in each case (scenario A remains unchanged). So, scenario B would be randomly chosen from the following four versions:

- B1 (As above) Incomes range from £30,000 to £70,000 with an average of £50,000
- B2 Incomes range from £40,000 to £80,000 with an average of £60,000

- B3 Incomes range from £20,000 to £50,000 with an average of £35,000
- B4 Incomes range from £30,000 to £100,000 with an average of £65,000.

In addition to the above questions, the 2017 survey includes the following second-round questions:

- If B1 is shown but participants responded A then replace B1 by: Incomes range from £10,000 to £120,000 with an average of £65,000
- If B1 shown and participants responded B1 then replace B1 by: Incomes range from £40,000 to £60,000 with an average of £50,000
- If B2 shown but responded A then replace B1 by: Incomes range from £10,000 to £120,000 with an average of £65,000
- If B2 shown and responded B2 then replace B1 by: Incomes range from £30,000 to £70,000 with an average of £50,000
- If B3 shown but responded A then replace B1 by: Incomes range from £10,000 to £120,000 with an average of £65,000
- If B3 shown and responded B3 then replace B1 by: Incomes range from £25,000 to £55,000 with an average of £40,000
- If B4 shown but responded A then replace B1 by: Incomes range from £10,000 to £120,000 with an average of £65,000
- If B4 shown and responded B4 then replace B1 by. Incomes range from £40,000 to £90,000 with an average of £65,000

3.3 Lottery-based elicitation on health IA

The questions are framed similarly to those above. We ask respondents to choose their (imaginary) grandchild between two scenarios A and B which differ in terms of the range of life expectancy in society (life expectancy is measured at birth; in every other respect A and B are the same). Again there are four possible answers: "A/B is better", "A and B are equally good", and "cannot say".

Scenario A: Life expectancy is between 40 and 80, with an average of 60. Scenario B was randomly chosen from the following four versions:

- B1: (As above) Life expectancy is between 60 and 70, with an average of 65
- B2: Life expectancy is between 30 and 90 with an average of 60
- B3: Life expectancy is between 45 and 75 with an average of 60
- B4: Life expectancy is between 50 and 85 with an average of $67\frac{1}{2}$.

In addition to the above question, the 2017 survey includes the following new questions:

- If B1 shown but responded A then replace B1 by: Healthy Life expectancy is between 30 and 90, with an average of 60
- If B1 shown and responded B1 then replace B1 by: Healthy Life expectancy is between 65 and 71, with an average of 68
- If B2 shown but responded A then replace B1 by: Healthy Life expectancy is between 30 and 90, with an average of 60
- If B2 shown and responded B2 then replace B1 by: Healthy Life expectancy is between 46 and 70, with an average of 58
- If B3 shown but responded A then replace B1 by: Healthy Life expectancy is between 30 and 90, with an average of 60
- If B3 shown and responded B3 then replace B1 by: Healthy Life expectancy is between 50 and 70, with an average of 60
- If B4 shown but responded A then replace B1 by: Healthy Life expectancy is between 30 and 90, with an average of 60
- If B4 shown and responded B4 then replace B1 by: Healthy Life expectancy is between 56 and 80, with an average of 68

3.4 Computation of IA parameters

Responses to the lottery-based questions are used to calculate IA parameters. Assuming uniform distributions, we can calculate the mean, standard deviation and coefficient of variation of each income and healthy life expectancy distribution. For example, if a society's income is uniformly distributed over $[a, b]$, then $\mu = \frac{a+b}{2}$, $\sigma^2 = \frac{(b-a)^2}{12}$, and $\Phi = \frac{\sigma}{\mu}$. Although a Pareto distribution might be considered a more appropriate depiction of income distributions in reality, it is reasonable to assume that participants intuitively assess their imaginary grandchild's (uncertain) position in the hypothetical societies using a uniform distribution. We also assume that behind the veil of ignorance, expected income or health is equal to the mean of their respective distributions.

When presented with two versions of an imaginary society to choose from, respondents could state that they are indifferent between the two choices, and then γ can directly be calculated using the model in 3.1. If respondents expressed a strict preference, then we can infer the range of their IA parameters. To illustrate with an example: suppose a respondent is given the choice between two societies, where in society A the coefficient of variation $\Phi_A = 0.3$, and the individual's monthly income $y_A = £24,000$, while in the more equal society B $\Phi_B = 0.2$ and $y_B = £20,000$. A respondent who is indifferent between A and B has an IA parameter of $\gamma = 0.45$. A respondent who prefers the more equal society B has $\gamma > 0.45$, and a strict preference for society A gives $\gamma < 0.45$. A rule of thumb here is that the greater a person's γ, the more IA there is. In Appendix B, Table 3 to 5 summarise the lotteries as well as the indifference-level γ values that individuals face.

The follow-up questions can further narrow down the possible range of IA parameters for each individual. This also makes it possible to identify inconsistencies from the follow-up questions.[4] We omit observations that contain inconsistent responses over the two rounds of elicitation. We further test for whether the missing values are random in section 5.5.

3.5 Behavioural Parameters

In addition to measures of inequality aversion measures, the survey is unique in that it allows for control of relevant behavioural parameters that conceptually can affect individuals' inequality aversions such as risk attitudes (Carlsson et al., 2005). In addition, we have added to our estimates the measure of locus of control, a behavioural

[4]For example, if a person strictly prefers income scenario A to B3, but then says that they prefer A to the replaced B3 in the second round, then we label their response as inconsistent, as the first response suggests a parameter range smaller than 1.22, whereas the second suggests a range larger than 0.70, i.e., the two responses are contradictory. Around 10% of respondents give inconsistent responses.

parameter collected in other studies (Costa-Font and Cowell, 2024). For both parameters, we distinguished two domains the financial or income domains which are our primary focus, and in some specifications, we consider the health domain, as health or more specifically attracting more funds for the NHS was part of the Brexit narrative. Risk preferences were measured using a scale that carries from "very willing to take risks" to "very unwilling to take risks" after the following questions: "Are you generally a person who is willing to take risks in making financial decisions or do you try to avoid taking financial risks? ". The same question and format are used when eliciting risk perceptions in the health domain just that we refer to health risks (e.g., smoking, binge drinking, etc). Similarly, locus of control is elicited using a question with a similar format where individuals state from 1 to 10 whether they agreed or disagreed with the question "I have little control over my financial condition" or "I have little control over my health".

3.6 Gender, Age and Socio-economic controls

Finally, we have included some controls in some specifications that are relevant such as age and gender. This is because individuals' attitudes to leaving the European Union differ across age, and so with the individual's experience of living during different eras in Britain. Similarly, gender is important as a research document that perceptions of gender discrimination play a role, and more specifically men are more likely to vote against the status quo (Green and Shorrocks, 2023). In the Brexit referendum, both regional and individual data suggest that men are more likely to vote for leaving the EU (Alabrese et al., 2019b). However, gender effect might be driven by other covariates included in the analysis such as income and education, as well as inequality perceptions. Hence, gender effects might well exhibit other effects when we control for such covariates as we do in this paper as we explain next. Kuhn et al. (2016) found that women are significantly more eurosceptic across several European countries, and one study documented that women in Britain were more eurosceptic than men (Clements, 2009). However, some studies find no effect of gender (Curtice, 2017), and hence it is an empirical question whether the role of gender once other effects are taken into consideration. Finally, we consider individuals' education captures their ability and knowledge about political phenomena which have been found to influence the voting decision (Hakhverdian et al., 2013), and their socioeconomic positions are hypothesised to have influenced individuals' decision to vote in the referendum.

4 Empirical Strategy

We analyse respondents' Brexit voting choice in the light of information about inequality aversion, as well as behavioural, socio-economic and demographic variables. The behavioural variables are financial risk aversion, health risk aversion, financial locus of control, and health locus of control. Because behavioural variables are highly correlated we will use one of them that the literature has identified as explaining inequality aversion in the income domain, namely financial risk aversion. The socio-economic variables include income, education, and employment status. The main demographic variables include age, gender, and region. Our baseline results are estimated from the following linear probability model via ordinary least squares (OLS):

$$Leave_i = \beta_1 \gamma_{income,i} + \beta_2 \gamma_{health,i} + X'_{b,i}\beta_3 + X'_{se,i}\beta_4 + X'_{d,i}\beta_5 + \varepsilon_i \tag{1}$$

where $Leave_i$ is a dummy variable that takes 1 if voter i voted for Leave, and 0 if they voted for Remain. $X_{b,i}$, $X_{se,i}$, and $X_{d,i}$ are the behavioural, socio-economic and demographic controls respectively.

The linear probability model (1) has limitations. First, the marginal effects of independent variables are constant. Second, predicted values may lie outside $[0, 1]$, which obstructs a probability-based interpretation of the dependent variable. So, we also use the following probit model:

$$\begin{aligned} Pr(Leave_i = 1|X) &= Pr(Leave_i > 0|X) \\ &= Pr(\beta_1 \gamma_{income,i} + \beta_2 \gamma_{health,i} + X'_{b,i}\beta_3 + X'_{se,i}\beta_4 + X'_{d,i}\beta_5 + \varepsilon_i > 0|X) \\ &= Pr(\varepsilon_i > -(\beta_1 \gamma_{income,i} + \beta_2 \gamma_{health,i} + X'_{b,i}\beta_3 + X'_{se,i}\beta_4 + X'_{d,i}\beta_5)|X) \\ &= \Phi(\beta_1 \gamma_{income,i} + \beta_2 \gamma_{health,i} + X'_{b,i}\beta_3 + X'_{se,i}\beta_4 + X'_{d,i}\beta_5) \end{aligned} \tag{2}$$

where $Leave_i$ is the latent variable, $\varepsilon_i \overset{\text{iid}}{\sim} N(0,1)$, and $\Phi(\cdot)$ is the CDF of the standard normal distribution. Equation (2) allows for a probability interpretation, with varying marginal effects. Given that inequality aversion is continuous we will interpret our estimates on the effect of IA on the probability of voting Leave in units of its standard deviation. As we will see, this probit model gives comparable results to the linear probability model.

5 Results

5.1 Income and Health IA Estimates

Figure 1 presents the raw as well as predicted IA estimates.[5] We present both grouped interval estimates and point estimates (which are the average of the two boundary values of the corresponding interval estimates).

Both income and health IA estimates reveal similar bimodal distributions. The two most common categories for the income and health IA estimates are $\gamma > 1.5$ and $\gamma < -1.5$. For income IA, the point estimates $\gamma = 5.18$ and $\gamma = -4.83$ are the modal responses. As for health IA, $\gamma = 4.73$ and $\gamma = -5$ are the modal point estimates. This bimodality is consistent with the findings of Hurley et al. (2020).[6]

As for the predicted lottery estimates, both income and health inequality aversion conform more closely to a bell-shaped distribution. In addition, the distribution for health IA shifts rightward with a lower spread compared to the 2016 survey results under only one round of elicitation (Costa-Font and Cowell, 2024). This suggests that individuals have a less precise view of their inequality aversion in the health domain, and when they reconsider, they tend to reveal higher estimates on average. Furthermore, the peak for the income IA predictions is higher than for the health IA predictions.

Overall, the raw lottery estimates conform to a bimodal distribution, composed of a large share of extreme answers. The distribution of predicted answers, by contrast,

[5] We use interval regression to obtain predicted values of income and health γ parameters, with risk aversion, locus of control, plus socio-economic and demographic characteristics as predictors.

[6] That respondents are either very averse or not at all averse to health inequality, with only a small proportion of people having moderate level of IA.

is closer to bell-shaped; this can then be used to meet the specific condition of ordinary least squares regression. In either case, aversion to income inequality tends to be higher than health inequality. The advantage of predicted estimates is both driven by the use of statistical inference and that they are provided in a standard distribution, hence easier to interpret and show, as well as less affected by individual specific jumps, mistakes and noise.

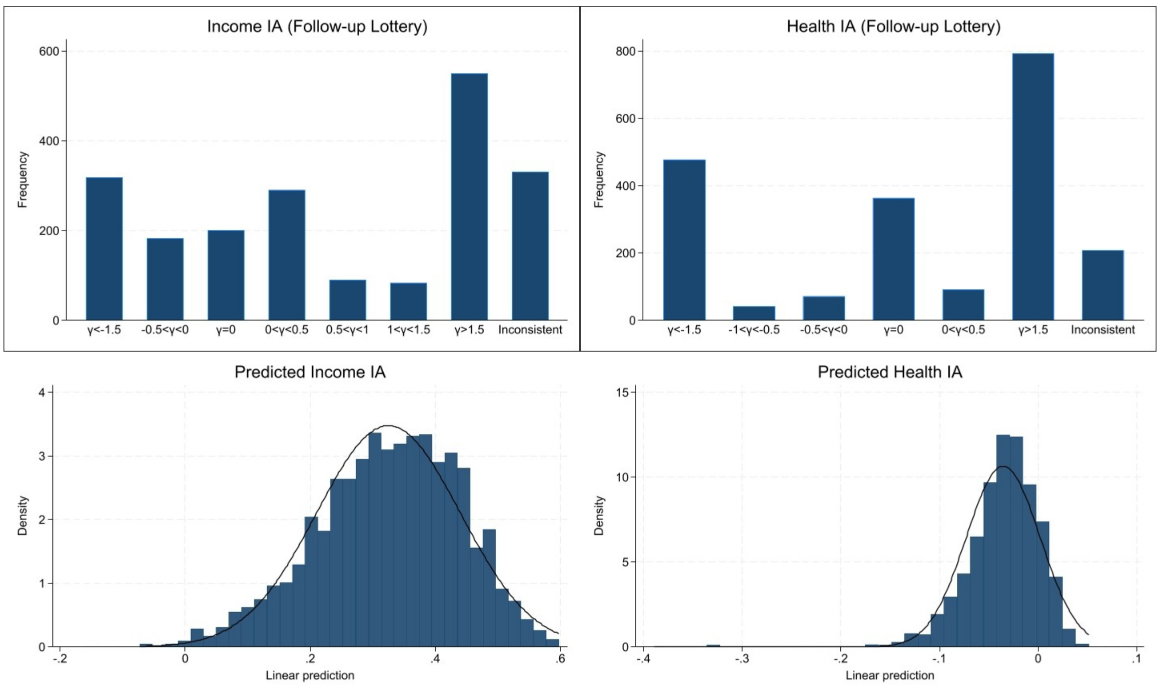

Figure 1: Income IA Estimates

5.2 IA by Groups

Beyond the overall distributions of our IA estimates, we compare their sample moments across domains and groups. Tables 1 below and 7 in Appendix B present summary statistics of the income and health IA estimates. We observe that the sample mean of income IA is greater than that of health IA, although the difference is not significant at 5% level. The greater aversion to income IA is attributable to the fact that the modal response in the positive ranges for income IA bears higher magnitudes than the positive modal response for health IA. This is in line with Tobin (1970)'s original hypothesis that IA is domain-specific, as well as subsequent findings from e.g., Leibler et al. (2009), Abásolo and Tsuchiya (2020) and Hurley et al. (2020) that health IA is lower than income IA.

We also group the point estimates by age and gender, presenting the confidence intervals in Appendix A Figure 3. The estimates of the different instruments differ slightly in the number of observations: typically the simpler the exercise the less likely are there to be missing values. Indeed, estimates for the trade-off elicitation methods exhibit a higher number of observations than lottery estimates. However, given that such differences may be driven by missing values, we then examine separately the drivers of such missing observations, and specifically the extent to which any characteristics of the sample drove the effect. We did not identify any significant difference; taking the missing values to be random supports the use of the maximum number of observations possible in order to maximise the sample. This will be further discussed in section 5.5.

The 2017 survey shows a 'hump shape' of IA estimates by age. Young and old people in the sample are on average less averse to income and health inequality than middle-aged respondents – see also Abásolo and Tsuchiya (2008). People aged 18-24 have health and income IA of 0.3 to 0.4, while people aged 45-54 have inequality aversion of as high as 1.3, indicating that they are willing to reduce inequality by 10% at the cost of a 13% reduction in total outcomes. While our estimates are on average greater than Bergolo et al. (2022)'s baseline IA estimates of 0.2 for university students, we show that the younger population are much less averse to income and health inequalities than the middle-aged group. Within age and gender groups, income IA is on average greater than health IA, except for the 25-34 age group and female respondents in 2017.

Regarding regional differences, Figure 5 in Appendix A shows that northern regions tend to be more averse to health inequality than the midlands, with Scotland as the most averse, followed by the East of England and London being the least averse to health inequality. Meanwhile, a similar pattern is observed in the case of income inequality aversion: northern and southern regions are on average more averse to income inequality than the midlands. It is also noticeable that London has the highest average income IA despite being the least averse to health inequality, and the North East has the lowest income IA despite being the most averse to health inequality. Table 8 in Appendix B summarises the sample moments of our income and health IA estimates by region in greater detail.

Table 1: IA Estimates by Gender

	N	Mean	Std.Dev.	Std.Err.
Male				
Income γ	839	.9336293	3.577615	.123513
Health γ	868	.6758929	4.10505	.1393345
Female				
Income γ	879	.7570933	3.421583	.1154071
Health γ	973	.9347379	3.994226	.128049
Total				
Income γ	1718	.8433062	3.498745	.0844113
Health γ	1841	.8126969	4.047817	.0943396

Note: this table groups by gender the IA estimates from the lottery and trade-off methods. The number of valid responses, sample mean, and standard error are presented for each gender group.

5.3 Brexit Referendum Voting

Of the 2049 respondents in total, 918 participants voted Leave, 865 participants voted Stay, and the other 266 either did not participate or preferred not to disclose this information. The proportion of Leave votes, Remain votes, and non-participation reflect the actual referendum results closely. Later we deleted the non-informative 266 responses and re-coded the values of "0" as voting Remain and "1" as voting Leave.[7]

We summarise respondents' vote decisions in the Brexit referendum by region in Figure 2. The proportion of Leave and Remain votes in each region is in line with aggregate data as summarised in Table 6 in Appendix B.[8] In the third column

[7]This enables us to interpret the dependent variable in the subsequent probit regressions as the probability of voting Leave. In the robustness check section, we will recover the non-informative responses via imputation.

[8]The aggregate data was obtained from the Electoral Commission available hereand here.

we included imputed results. We observe that after imputation the voting patterns become even closer to reality overall.[9]

Scotland, Wales and London are the regions that voted for Remain (i.e. average smaller than 0.5). East England, North West and South East are regions that most strongly supported Leave. The regional differences in Brexit voting and inequality aversion partially match each other. Regions that support Leave are at the same time usually more averse to income inequality (London and Wales are the two exceptions), and also less averse to health inequality (Scotland is the exception here).

Figure 4 in Appendix A shows that older voters are more likely to support leaving the EU than younger voters. Nearly 60% of those aged 55 or above voted Leave, whereas only slightly more than 20% of the youngest group of voters did so. This difference is significant at 5% level. As we shall see in the subsequent sections, age is consistently a strong predictor of voting behaviour in the Brexit referendum. Male voters on average voted more for Leave than did female voters.

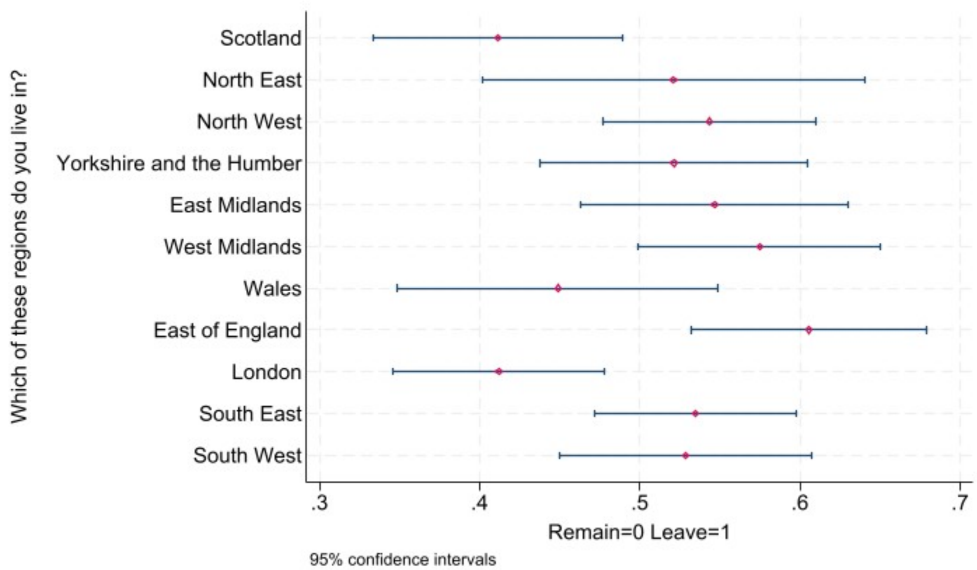

Figure 2: Brexit Voting Behaviour: Summary

[9]The imputation technique will be further explained in the robustness checks section.

5.4 The Relation Between IA and Brexit Voting Behaviour

Table 2 presents our baseline results on the contribution of IA to the Brexit referendum result. Column (1) implements the identification strategy in section 4, controlling for age, gender, region, income and education.[10] Consistent with the existing literature, age turns out to be a statistically significant predictor of Brexit voting behaviour: older voters are more likely to support Brexit. Ceteris paribus, being 10 years older is estimated to increase the chance of voting for Leave by more than 3.1 percentage points on average. As for gender differences, females are around 4.4 percentage points less likely to support Leave than male voters, although this effect is only significant at a 10% level. As for inequality aversion, our variable of interest, we observe that greater income and health IA are associated with a lower likelihood of voting for Leave.

In columns (2)-(5), we interact income and health IA (separately and then together) with gender. In all specifications, the effect of income IA is larger for the male baseline group. The magnitude of the coefficient increases from 0.006 to around 0.016 in column (2), and remains at 0.014 in column (5) where we include both domains of IA and control for financial risk aversion. This suggests that the omission of gender heterogeneity masks the effect of IA. We can interpret the size of the coefficient as follows: when a male voter's aversion to income inequality increases by one standard deviation, their likelihood of voting for Leave decreases by 5.0 p.p.s on average, holding the other variables constant.[11] The difference in the effect of IA is significant at 5% level across genders, resulting in a much weaker effect for females than for male voters. The magnitude of the sum of the coefficients on income IA and the gender interaction term is not distinguishable from zero, as the joint test of significance returns a p-value of 0.4.[12] This result supports the intuition that leaving the EU is involved with uncertainties in the income domain and the possibility of worsening income inequality, hence voters who dislike inequality are deterred from leaving the EU. The effect remains significant when we include financial risk aversion, a potential confounder that affects both inequality aversion and Brexit voting

[10] See Appendix C for a summary of the coding of the variables.

[11] The standard deviation of income IA for female voters is 3.58, which gives $3.578 * 0.014 \approx 0.050$

[12] The effect of health IA after the inclusion of interaction terms is usually smaller than that without the interaction term. But in both cases, it is insignificantly different from zero.

behaviours.

This finding differs from Pastor and Veronesi (2021)'s perspective that aversion to growing income inequality leads to anti-globalisation sentiments. However, Pastor and Veronesi (2021) use proxies (such as personal income) instead of direct measurements of income inequality aversion. They assumed that higher income is associated with a lower aversion to income inequality. Consequently, their conclusion traces back to lower personal income leads to higher support for anti-globalisation initiatives, in this case, support for exiting the EU. This conclusion becomes consistent with our discussion on the coefficient of the income control variable. The problem with Pastor and Veronesi (2021)'s conclusion regarding IA lies in the assumption that higher income is a good proxy for lower-income IA.

	(1)	(2)	(3)	(4)	(5)
	Leave=1	Leave=1	Leave=1	Leave=1	Leave=1
Income IA	-0.00583	-0.0155***		-0.0153***	-0.0143***
	(0.00374)	(0.00504)		(0.00534)	(0.00529)
[1em] Health IA	-0.00337		-0.00567	-0.00271	-0.00188
	(0.00318)		(0.00429)	(0.00454)	(0.00451)
[1em] Age	0.00313***	0.00301***	0.00327***	0.00319***	0.00373***
	(0.000812)	(0.000788)	(0.000753)	(0.000810)	(0.000830)
[1em] Female	-0.0441*	-0.0560**	-0.0547**	-0.0604**	-0.0429
	(0.0260)	(0.0258)	(0.0248)	(0.0271)	(0.0279)
[1em] Scotland	-0.107**	-0.102**	-0.129***	-0.109**	-0.112**
	(0.0461)	(0.0452)	(0.0432)	(0.0461)	(0.0460)
[1em] Income	-0.00990**	-0.00997**	-0.0109**	-0.00939**	-0.0109**
	(0.00459)	(0.00447)	(0.00433)	(0.00459)	(0.00457)
[1em] Education	-0.105***	-0.105***	-0.106***	-0.105***	-0.110***
	(0.0191)	(0.0185)	(0.0180)	(0.0191)	(0.0190)
[1em] Income IA x Female		0.0170**		0.0189**	0.0185**
		(0.00717)		(0.00744)	(0.00741)
[1em] Health IA x Female			0.00356	-0.000508	-0.000756
			(0.00596)	(0.00635)	(0.00633)
[1em] Financial Risk					0.0161***
					(0.00561)
[1em] Constant	0.622***	0.631***	0.623***	0.626***	0.540***
	(0.0623)	(0.0603)	(0.0587)	(0.0626)	(0.0700)
N	1421	1504	1619	1421	1421

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: The Effect of IA on Brexit Voting Behaviour - Baseline

5.5 Robustness checks

In Appendix B, Tables 9 and 10, we check the assumption that the missing responses to the IA elicitation questions (due to inconsistencies) are as good as random, by comparing observable characteristics of the two groups. We find that the 434 observations who inconsistently responded to the income and/or health IA questions have similar socio-economic and behavioural characteristics as to the consistent respondents. The difference in characteristics across groups are mostly within two standard errors. Respondents who reportedly voted in the referendum, however, are on average older and male dominant than respondents who did not vote or preferred not to reveal their decision. This is addressed by adding age and gender as controls in the imputation equations and the empirical specifications.

In Table 11 we conduct a series of robustness checks on the relation between IA and voting behaviour in Brexit. Column (1) controls for health risk aversion, and locus of control (LOC) in the health and financial domains in addition to the empirical specification in Table 2 column (5). Consistent with the sign and magnitude from the baseline results, we find that higher income IA predicts a lower probability of voting Leave for male voters. The effect is not significantly different from zero for female voters. Furthermore, lower aversion to financial risk (where the variable is coded as 1 is very unwilling to take risks and 10 is very willing to take risks as in Appendix C) predicts a greater propensity to vote Leave. The difference in probability is as high as 13.3 percentage points between the most and least averse individuals. This suggests that risk aversion and inequality aversion both affect Brexit voting behaviour via separate channels.[13]

Column (2) uses a regional dummy that takes the value one if the respondent is from London or Scotland, and zero otherwise, and we obtain similar results. In columns (3) and (4), imputed values are used for irrational responses and those who did not vote in the referendum or prefer not to say. Here we use a chained imputation technique to fill in missing entries for multiple variables. The approach assumes that

[13]There are additional demographic variables included in the survey, such as the respondent's marital status and how many children they have. Adding these variables do not change the direction, magnitude and significance of the coefficients of interest. Since these variables are highly correlated with age, education, etc., for the sake of simplicity we do not present results from these specifications.

the missing data are missing at random, which enables unbiased estimation from observed values. The chained equation process regresses a variable with missing values on other covariates chosen, and use the predicted values to fill in the missing entries.[14] Our imputation equation has income IA, health IA and Brexit choice as the dependent variables to be filled in. We use risk aversion, locus of control, age, gender, income, and education as predictors. Applying this method restores the sample size back to 2049.[15] Here, income IA remains a significant negative predictor for male voters, although the magnitude of effect has become weaker, and the difference in effect across genders is also smaller. Aversion to both financial and health risks dissuades individuals from voting Leave. The effects of demographic controls are similar to those in the baseline results. Column (4) uses the probit model, which returns an average marginal effect of -0.010 for the row income IA. This suggests that the omission of inconsistent individuals and non-participation in the referendum biases the effect slightly downward. A more conservative conclusion is: that when a male voter's aversion to income inequality increases by one standard deviation, the likelihood of voting for Leave decreases by 3.6% on average, holding the other variables constant. Still, had there been a modest difference in IA been realised, the referendum result could have been different.

6 Conclusion

This paper has examined a specific behavioural explanation for Brexit voting, the role of inequality aversion. Inequality aversion is associated with the voting behaviour of individuals who are sensitive to the inequality resulting from different political alternatives at stake. We examined whether the Brexit vote was driven by a form of collective self-interest, where individuals who are less sensitive to inequality (as in the "unconsidered Leave" hypothesis) were more likely to vote to stop belonging to a larger size polities such as the European Union. That is, we estimate whether the collective choice of leaving the European family was partly explained by an individual

[14] A detailed description of the imputation method can be found in Azur et al. (2011) and at https://www.stata.com/manuals/mimiimputechained.pdf .

[15] 5 observations are omitted by the probit model due to perfect prediction by the dummy variable that takes value one (in 5 entries) when survey respondent says "don't know" when asked their level of education.

insensitivity to inequality. Consistently with the "unconsidered Leave" hypothesis, we find that income inequality aversion explains the Brexit vote, even after controlling for risk aversion. However, no effect is found for health inequality aversion, even though health and the National Health Service (NHS) were particularly salient in the Brexit referendum debates.

While estimates suggest that a higher aversion to income inequality predicts a lower probability of voting for Leave, the effect was heterogeneous by gender. Among men, an increase in income IA by one standard deviation decreases their likelihood of voting for leaving the EU by 5% on average. However, we find that this effect is indistinguishable from zero among women. This result suggest that attention needs to be paid to changes in people's sensitivity to inequality, as not placing adequate weight on others' financial status in society can give rise to situations like those produced by Brexit. Furthermore, the effect of IA on Brexit voting is independent of the effect of other behavioural and socio-economic determinants of IA, such as risk aversion, locus of control, education and income. Our finding is robust to alternative measurement strategies and sub-samples. Overall, the estimates suggest that higher income inequality aversion among women would have reduced the support for Brexit to an extent to make a difference in the final result.

Appendix A List of Figures

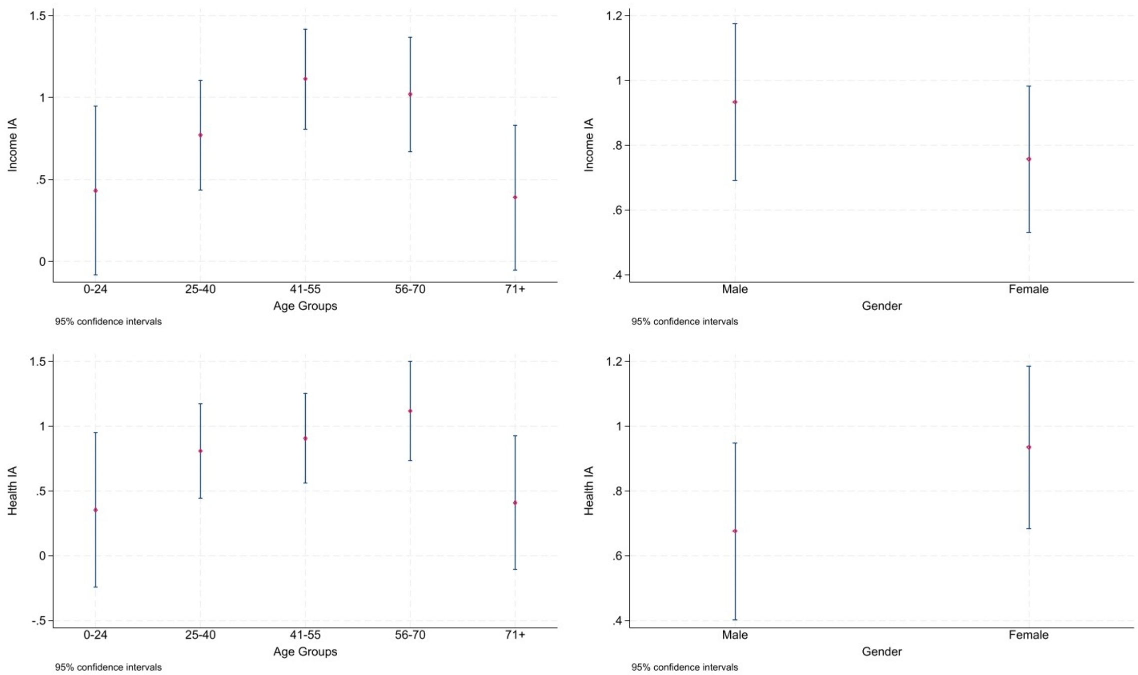

Figure 3: Follow-up Lottery IA by Groups

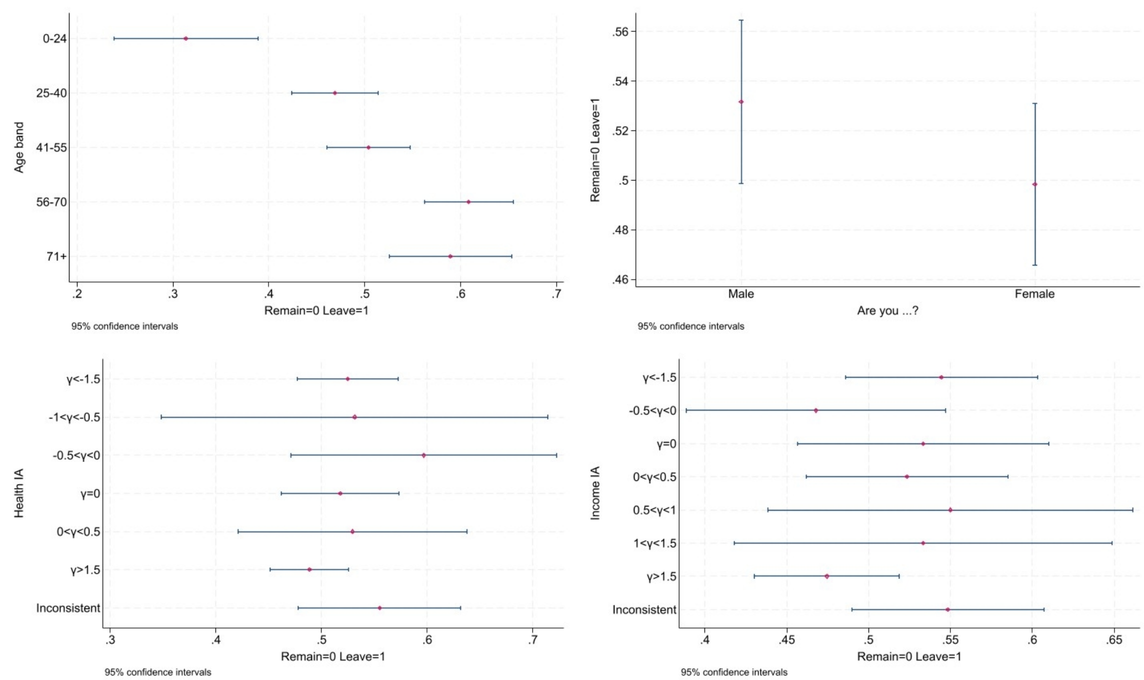

Figure 4: Brexit Voting Behaviour by Groups

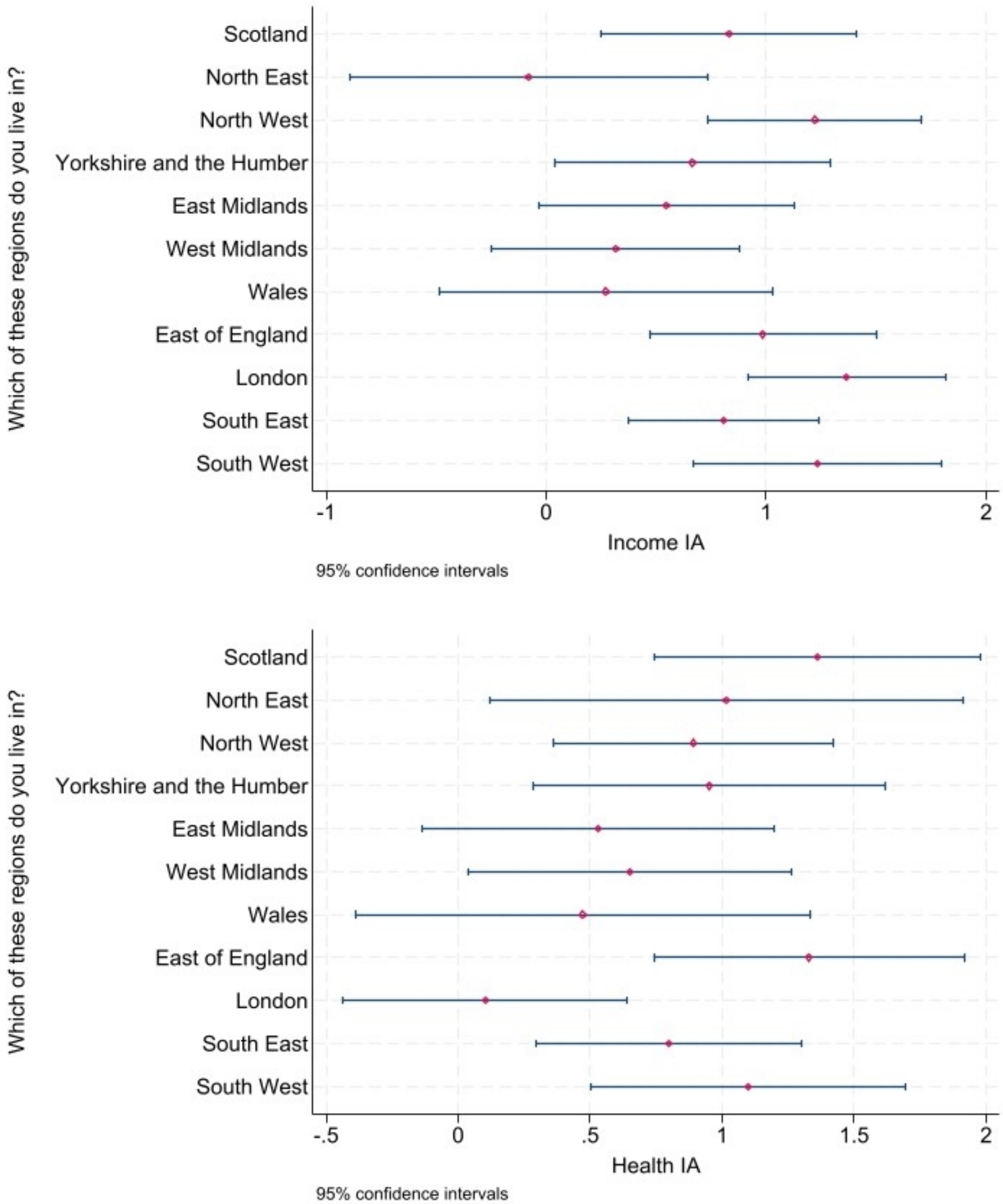

Figure 5: IA by Region

Appendix B List of Tables

	Income				Health					
	Min	Mean	Max.	γ	Min	Mean	Max	γ	No.	Frequency
Lottery A	20,000	60,000	100,000		40	60	80			
Lottery B1	30,000	50,000	70,000	0.36	60	65	70	-0.05	501	0.24
Lottery B2	40,000	60,000	80,000	0.00	30	60	90	0.00	513	0.25
Lottery B3	20,000	35,000	50,000	1.22	45	60	75	0.00	519	0.25
Lottery B4	30,000	65,000	100,000	-0.37	50	67.5	85	-0.54	516	0.25
									2,049	1.00

Table 3: Imaginary Grandchild Scenarios (2017)

	Min.	Mean	Max.	γ	No.	Frequency
Lottery A	20,000	60,000	100,000			
**If chose A in original lottery*						
Lottery B	10,000	65,000	120,000	0.34	588	0.45
**If chose B(#) in original lottery*						
Lottery B1	40,000	50,000	60,000	0.15	140	0.11
Lottery B2	30,000	50,000	70,000	0.36	233	0.18
Lottery B3	25,000	40,000	55,000	0.70	80	0.06
Lottery B4	40,000	65,000	90,000	-0.15	253	0.20
					1,294	1.00

Table 4: Imaginary Grandchild Follow-up Scenarios–Income (2017)

	Min	Mean	Max	γ	No.	Frequency
Lottery A	40	60	80			
**If chose A in original lottery*						
Lottery B	30	60	90	0.00	571	0.38
**If chose B(#) in original lottery*						
Lottery B1	65	68	71	-0.06	304	0.20
Lottery B2	46	58	70	0.07	112	0.07
Lottery B3	50	60	70	0.00	98	0.07
Lottery B4	56	68	80	-0.20	415	0.28
					1,500	1.00

Table 5: Imaginary Grandchild Follow-up Scenarios–Health (2017)

Note: Tables 3 to 5 list the boundary values for each round of elicitation question in the imaginary-grandchild approach, for survey years 2016 and 2017 in the income and health domains.

Region	Actual	Survey	Imputation
South East	0.518	0.535	0.529
London	0.401	0.412	0.420
North West	0.537	0.543	0.503
East	0.565	0.606	0.593
South West	0.526	0.529	0.526
West Midlands	0.593	0.575	0.576
Yorkshire and the Humber	0.577	0.521	0.507
Scotland	0.380	0.411	0.412
East Midlands	0.588	0.547	0.558
Wales	0.525	0.449	0.470
North East	0.580	0.521	0.557

Table 6: Share of Leave (vs Remain) votes

Table 7: IA Estimates by Age

	N	Mean	Std.Dev.	Std.Err.
18 to 24				
Income γ	183	.4329508	3.520239	.2602235
Health IA	189	.3542328	4.170266	.3033422
25 to 34				
Income γ	272	.5238236	3.671455	.2226147
Health IA	284	.7976056	4.191372	.2487122
35 to 44				
Income γ	356	.9369382	3.616706	.191685
Health IA	375	.5223867	4.045003	.2088831
45 to 54				
Income γ	308	1.329302	3.354908	.1911636
Health IA	331	1.270091	3.952955	.2172741
55 to 64				
Income γ	267	1.046592	3.479674	.2129526
Health IA	297	1.315354	3.97141	.2304446
65 to 74				
Income γ	199	.6035427	3.485976	.2471143
Health IA	210	.5828095	4.021208	.2774897
75 plus				
Income γ	133	.6358647	3.041781	.2637559
Health IA	155	.4732903	3.89658	.3129808
Total				
Income γ	1718	.8433062	3.498745	.0844113
Health IA	1841	.8126969	4.047817	.0943396

Note: this table groups by age the IA estimates from the lottery and trade-off methods. The number of valid responses, sample mean, and standard error are presented for each age group.

	N	Mean	Std.Dev.	Std.Err.
Scotland				
Income γ	149	.8310067	3.585596	.2937435
Health γ	160	1.361125	3.956626	.3127988
North East				
Income γ	71	-.08	3.433944	.4075342
Health γ	76	1.014868	3.922289	.4499175
North West				
Income γ	206	1.222816	3.536387	.2463917
Health γ	218	.8916514	3.982558	.2697329
Yorkshire and the Humber				
Income γ	139	.6648921	3.739051	.3171422
Health γ	146	.950137	4.075632	.3373017
East Midlands				
Income γ	138	.5478261	3.449677	.293656
Health γ	149	.5299664	4.113385	.3369817
West Midlands				
Income γ	159	.3172642	3.603216	.2857536
Health γ	171	.6497369	4.050539	.3097525
Wales				
Income γ	88	.2714773	3.575204	.3811181
Health γ	97	.4723196	4.281641	.4347347
East of England				
Income γ	159	.9858491	3.283607	.260407
Health γ	175	1.329343	3.944663	.2981885
London				
Income γ	227	1.366211	3.437209	.2281356
Health γ	241	.1032158	4.247848	.2736279
South East				
Income γ	238	.8064076	3.371082	.2185148
Health γ	245	.7990816	4.004073	.2558108
South West				
Income γ	144	1.233333	3.416604	.284717
Health γ	163	1.098129	3.838625	.3006643
Total				
Income γ	1718	.8433062	3.498745	.0844113
Health γ	1841	.8126969	4.047817	.0943396

Table 8: IA Estimates by Region

Note: this table groups by regions the IA estimates from the lottery and trade-off methods. The number of valid responses, sample mean, and standard error are presented for each of the 11 regions.

	N	Mean	Std.Dev.	Std.Err.
Participants with consistent response				
Age	1615	47.78204	16.83875	.4190093
Gender	1615	.5188854	.499798	.0124368
Income	1615	6.113932	3.853822	.0958971
Education	1615	1.763467	.9378601	.0233374
Health	1615	2.976471	1.06804	.0265767
Scotland=1	1615	.0897833	.2859596	.0071157
Health Risk	1615	4.300929	2.572824	.0640212
Financial Risk	1615	4.112693	2.479593	.0617013
Health Risk	1615	4.300929	2.572824	.0640212
Financial LOC	1615	4.079876	2.722923	.0677562
Health LOC	1615	3.994427	2.521402	.0627416
Leave=1	1615	1.682353	.7066892	.017585
Participants with inconsistent response				
Age	434	47.59677	17.57915	.8438261
Gender	434	.5322581	.4995342	.0239784
Income	434	6.493088	4.369874	.2097606
Education	434	1.965438	1.333943	.0640313
Health	434	3.14977	1.130375	.0542597
Scotland=1	434	.0829493	.2761239	.0132544
Health Risk	434	4.135945	2.643122	.1268739
Financial Risk	434	3.988479	2.537908	.1218235
Health Risk	434	4.135945	2.643122	.1268739
Financial LOC	434	4.126728	2.695488	.1293876
Health LOC	434	4.069124	2.570002	.123364
Leave=1	434	1.762673	.8303639	.0398587
Total				
Age	2049	47.7428	16.99407	.3754279
Gender	2049	.5217179	.49965	.0110381
Income	2049	6.194241	3.970638	.0877181
Education	2049	1.806247	1.037406	.0229181
Health	2049	3.013177	1.083579	.0239381
Scotland=1	2049	.0883358	.2838519	.0062708
Health Risk	2049	4.265983	2.5881	.0571755
Financial Risk	2049	4.086384	2.491951	.0550514
Health Risk	2049	4.265983	2.5881	.0571755
Financial LOC	2049	4.0898	2.716547	.0600131
Health LOC	2049	4.010249	2.531326	.0559213
Leave=1	2049	1.699366	.7351423	.0162405

Table 9: Check for Randomness of Missing Data in IA elicitation

	N	Mean	Std.Dev.	Std.Err.
Participants who voted in Remain or Leave				
Age	1783	49.04936	16.75562	.3968119
Gender	1783	.5042064	.5001226	.0118441
Income	1783	6.21032	3.882977	.0919579
Education	1783	1.785754	.9721596	.023023
Health	1783	2.999439	1.070731	.0253574
Scotland=1	1783	.0886147	.2842665	.0067321
Health Risk	1783	4.287156	2.558954	.060602
Financial Risk	1783	4.103758	2.497114	.0591375
Health Risk	1783	4.287156	2.558954	.060602
Financial LOC	1783	4.046551	2.713513	.0642623
Health LOC	1783	4.003365	2.53881	.0601249
Participants who did not vote or prefer not to say				
Age	266	38.98496	15.98536	.9801255
Gender	266	.6390977	.4811675	.0295023
Income	266	6.086466	4.521233	.2772146
Education	266	1.943609	1.392912	.0854049
Health	266	3.105263	1.164008	.0713699
Scotland=1	266	.0864662	.281581	.0172648
Health Risk	266	4.12406	2.776523	.1702395
Financial Risk	266	3.969925	2.458531	.1507422
Health Risk	266	4.12406	2.776523	.1702395
Financial LOC	266	4.379699	2.72421	.1670321
Health LOC	266	4.056391	2.484787	.1523521
Total				
Age	2049	47.7428	16.99407	.3754279
Gender	2049	.5217179	.49965	.0110381
Income	2049	6.194241	3.970638	.0877181
Education	2049	1.806247	1.037406	.0229181
Health	2049	3.013177	1.083579	.0239381
Scotland=1	2049	.0883358	.2838519	.0062708
Health Risk	2049	4.265983	2.5881	.0571755
Financial Risk	2049	4.086384	2.491951	.0550514
Health Risk	2049	4.265983	2.5881	.0571755
Financial LOC	2049	4.0898	2.716547	.0600131
Health LOC	2049	4.010249	2.531326	.0559213

Table 10: Check for Randomness of Missing Data in Brexit voting behaviour

	(1)	(2)	(3)	(4)
	Leave=1	Leave=1	Leave=1	Leave=1
Income IA	-0.0143***	-0.0135**	-0.0121***	-0.0269**
	(0.00531)	(0.00532)	(0.00450)	(0.0122)
[1em] Health IA	-0.00199	-0.00264	-0.00379	-0.00645
	(0.00452)	(0.00452)	(0.00391)	(0.0104)
[1em] Income IA x Female	0.0185**	0.0182**	0.0117*	0.0271
	(0.00745)	(0.00746)	(0.00631)	(0.0169)
[1em] Health IA x Female	-0.000595	-0.000737	0.00375	-0.000325
	(0.00635)	(0.00635)	(0.00535)	(0.0143)
[1em] Financial Risk	0.0133**	0.0137**	0.0137***	0.0245*
	(0.00631)	(0.00631)	(0.00516)	(0.0140)
[1em] Health Risk	0.00659	0.00764	0.0125**	0.00539
	(0.00614)	(0.00610)	(0.00493)	(0.0133)
[1em] Financial LOC	0.00286	0.00355	0.00733	0.00951
	(0.00585)	(0.00581)	(0.00493)	(0.0128)
[1em] Health LOC	-0.00366	-0.00408	-0.00732	-0.0136
	(0.00613)	(0.00611)	(0.00517)	(0.0135)
[1em] Age	0.00393***	0.00386***	0.00441***	0.00325*
	(0.000849)	(0.000846)	(0.000692)	(0.00184)
[1em] Female	-0.0409	-0.0358	-0.0421*	-0.0527
	(0.0280)	(0.0279)	(0.0231)	(0.0621)
[1em] Scotland	-0.109**		-0.114***	-0.265***
	(0.0461)		(0.0386)	(0.101)
[1em] Income	-0.0105**	-0.00921*	-0.0138***	-0.0425***
	(0.00472)	(0.00470)	(0.00402)	(0.0106)
[1em] Education	-0.109***	-0.107***	-0.108***	-0.295***
	(0.0191)	(0.0191)	(0.0160)	(0.0428)
[1em] London and Scotland		-0.109***		
		(0.0317)		
[1em] Constant	0.511***	0.508***	0.473***	0.683***
	(0.0785)	(0.0783)	(0.0638)	(0.167)
N	1421	1421	2049	2044

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: The Effect of IA on Brexit Voting Behaviour-Robustness

Appendix C Variable Coding

This section explains in greater detail how we coded the variables in our empirical specifications.

- **Health risk aversion:** Are you generally a person who is willing to take health risks (e.g., smoking, binge drinking, etc) or do you try to avoid taking health risks? Please rate your assessment on the following scale where 1 is very unwilling to take risks and 10 is very willing to take risks.

- **Financial risk aversion:** Are you generally a person who is willing to take risks in making financial decisions or do you try to avoid taking financial risks? Please rate your assessment on the following scale where 1 is very unwilling to take risks and 10 is very willing to take risks.

- **Financial locus of control:** Do you agree or disagree with this statement? "I have little control over my financial condition." Please rate your view on the following scale where 1 is strongly disagree and 10 is strongly agree.

- **Financial locus of control:** Do you agree or disagree with this statement? "I have little control over my health." Please rate your view on the following scale where 1 is strongly disagree and 10 is strongly agree.

- **Brexit:** How did you vote in the Brexit referendum 23rd June 2016?
  - 0: Stay
  - 1: Leave
  - Did not participate: a dummy variable was created that takes value one if respondents belong to this category
  - Prefer not to say: a dummy variable was created that takes value one if respondents belong to this category

- **Gender:**
  - 0: Male
  - 1: Female

- **Household income:**

  1. Up to £7000
  2. £7001-14000
  3. £14001-21000
  4. £21001-28000
  5. £28001-34000
  6. £34001-41000
  7. £41001-48000
  8. £48001-55000
  9. £55001-62000
  10. £62001-69000
  11. £69001-76000
  12. £76001-83000
  13. At least £83001

  – Prefer not to answer: a dummy variable was created that takes value one if respondents belong to this category

- **Education:**[16]

  1. Secondary school, high school, NVQ level
  2. University degree or equivalent
  3. Higher university degree, doctorate, MBA
  4. Still in full time education

  – No formal education: a dummy variable was created that takes value one if respondents belong to this category

[16]**Dummy variables were created for 4-7, which take value one if subject chose those options respectively.**

– Don't know: a dummy variable was created that takes value one if respondents belong to this category

– Prefer not to answer: a dummy variable was created that takes value one if respondents belong to this category

References

Abásolo, I. and Tsuchiya, A. (2008). Understanding preference for egalitarian policies in health: Are age and sex determinants? *Applied Economics*, 40:2451–2461. 5.2

Abásolo, I. and Tsuchiya, A. (2020). Comparing aversions to outcome inequality and social risk in health and income: An empirical analysis using hypothetical scenarios with losses. *Health Economics, 29(1), 85-97.* 5.2

Alabrese, E., Becker, S. O., Fetzer, T., and Novy, D. (2019a). Who voted for brexit? individual and regional data combined. *European Journal of Political Economy 56: 132-150.* 1

Alabrese, E., Becker, S. O., Fetzer, T., and Novy, D. (2019b). Who voted for brexit? individual and regional data combined. *European Journal of Political Economy*, 56:132–150. 3.6

Azur, M. J., Stuart, E. A., Frangakis, C., and Leaf, P. J. (2011). Multiple imputation by chained equations: what is it and how does it work? *International journal of methods in psychiatric research*, 20(1):40–49. 14

Becker, S., Fetzer, T., and Novy, D. (2017). Who voted for brexit? a comprehensive district-level analysis. *Economic Policy 32(92), 601-650.* 1

Bergolo, M., Burdin, G., Burone, S., De Rosa, M., Giaccobasso, M., and Leites, M. (2022). Dissecting inequality-averse preferences. *Journal of Economic Behavior & Organization*, 200:782–802. 2, 5.2

Booth, A., Cardona-Sosa, L., and Nolen, P. (2014). Gender differences in risk aversion: Do single-sex environments affect their development? *Journal of economic behavior & organization*, 99:126–154. 3

Carlsson, F., Daruvala, D., and Johansson-Stenman, O. (2005). Are people inequality-averse, or just risk-averse? *Economica*, 72(287):375–396. 2, 3.5

Carreras, M. (2019). 'what do we have to lose?': Local economic decline, prospect theory, and support for brexit. *Electoral Studies*, 62:102094. 2

Clarke, H., Goodwin, M., and Whiteley, P. (2017). Why britain voted for brexit: An individual-level analysis of the 2016 referendum vote. *Parliamentary Affairs 70.3: 439-464.* 1

Clements, B. (2009). The sociological and psychological influences on public support for the european union in britain, 1983–2005. *British Politics*, 4:47–82. 3.6

Costa-Font, J. and Cowell, F. A. (2024). Specific egalitarianism? inequality aversion across domains. Technical report, IZA Discussion Papers. 3, 3.5, 5.1

Curtice, J. (2017). Why leave won the uk's eu referendum. *J. Common Mkt. Stud.*, 55:19. 3.6

Cutts, D., Goodwin, M., Heath, O., and Surridge, P. (2020). Brexit, the 2019 general election and the realignment of british politics. *The Political quarterly (London. 1930)*, 91(1):7–23. 1

Friedl, A., Pondorfer, A., and Schmidt, U. (2020). Gender differences in social risk taking. *Journal of Economic Psychology*, 77:102182. 1, 3

Goodwin, M. J. and Heath, O. (2016). The 2016 referendum, brexit and the left behind: An aggregate-level analysis of the result. *The Political Quarterly*, 87(3):323–332. 1

Green, J. and Shorrocks, R. (2023). The gender backlash in the vote for brexit. *Political Behavior*, 45(1):347–371. 3.6

Hakhverdian, A., Van Elsas, E., Van der Brug, W., and Kuhn, T. (2013). Euroscepticism and education: A longitudinal study of 12 eu member states, 1973–2010. *European Union Politics*, 14(4):522–541. 3.6

Hobolt, S. B. (2016). The brexit vote: a divided nation, a divided continent. *Journal of European public policy*, 23(9):1259–1277. 1

Hurley, J., Mentzakis, E., and Walli-Attaei, M. (2020). Inequality aversion in income, health, and income-related health. *Journal of health economics, 70, 102276.* 5.1, 5.2

Kuhn, T., Van Elsas, E., Hakhverdian, A., and van der Brug, W. (2016). An ever wider gap in an ever closer union: Rising inequalities and euroscepticism in 12 west european democracies, 1975–2009. *Socio-Economic Review*, 14(1):27–45. 3.6

Leibler, J., Zwack, L., and Levy, J. (2009). Agreement with inequality axioms and perceptions of inequality among environmental justice and risk assessment professionals. *Health, Risk & Society, 11(1), 55-69.* 5.2

Nouvellet, P. (2017). Age matters in the uk's brexit referendum. *Significance 14.4, 30-33.* 1

Park, Y. and Kim, Y. (2018). Explaining the brexit referendum: The role of worker skill level in voter decisions. *The Political Quarterly 89.4: 640-648.* 1

Pastor, L. and Veronesi, P. (2021). Inequality aversion, populism, and the backlash against globalization. *The Journal of Finance, 76(6), 2857-2906.* 1, 5.4

Scully, R., Wyn Jones, R., and Evans, G. (2016). 'brexit': Understanding the socio-political attitudes and motivations underpinning voting intentions in the eu referendum. *British Journal of Politics and International Relations*, 18(3):563–578. 1

Tobin, J. (1970). On limiting the domain of inequality. *Journal of Law and Economics*, 13:263–277. Reprinted in Phelps (1973). 5.2