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**Title:** Comparing aversions to outcome inequality and social risk in health and income: an empirical analysis using hypothetical scenarios with losses

**Short title:** Outcome-inequality & social-risk aversions in health & income

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**Abstract**

Evaluation of future social welfare may not only depend on the aggregate of individual prospects, but also on how the prospects are distributed across individuals. The latter in turn would depend on how people perceive inequality and risk at the collective level (or "social risk"). This paper examines distributional preferences regarding inequality in outcomes and social risk for health and income, in the context of losses. Specifically, four kinds of aversions are compared: outcome-inequality aversion in health, outcome-inequality aversion in income, social-risk aversion in health, and social-risk aversion in income. Face-to-face interviews of a representative general public sample in Spain are undertaken using hypothetical scenarios involving losses in health or income across otherwise equal groups. Aversion parameters are compared assuming Social Welfare Functions with constant relative or constant absolute aversion. We find that outcome-inequality aversion and social-risk aversion within either domain are not the same, and that neither aversion is the same across the two domains: there are statistically significant differences, with outcome-inequality aversion in income the strongest, followed by social-risk aversion in income and social-risk aversion in health (although not significantly different under constant absolute aversion), and outcome-inequality aversion in health coming last.

**Key words**: aversion to outcome inequality, aversion to social risk, distributional preferences, health and income, social welfare.

**JEL:** I14, D63

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This article has the approval of the Ethical Committee for Research of the University of La Laguna (Spain). The corresponding approval letter has been uploaded in the submission process.

**Comparing aversions to outcome inequality and social risk in health and income: an empirical analysis using hypothetical scenarios with losses**

ABSTRACT

Evaluation of future social welfare may not only depend on the aggregate of individual prospects, but also on how the prospects are distributed across individuals. The latter in turn would depend on how people perceive inequality and risk at the collective level (or "social risk"). This paper examines distributional preferences regarding inequality in outcomes and social risk for health and income, in the context of losses. Specifically, four kinds of aversions are compared: outcome-inequality aversion in health, outcome-inequality aversion in income, social-risk aversion in health, and social-risk aversion in income. Face-to-face interviews of a representative general public sample in Spain are undertaken using hypothetical scenarios involving losses in health or income across otherwise equal groups. Aversion parameters are compared assuming Social Welfare Functions with constant relative or constant absolute aversion. We find that outcome-inequality aversion and social-risk aversion within either domain are not the same, and that neither aversion is the same across the two domains: there are statistically significant differences, with outcome-inequality aversion in income the strongest, followed by social-risk aversion in income and social-risk aversion in health (although not significantly different under constant absolute aversion), and outcome-inequality aversion in health coming last.

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## 1. INTRODUCTION

Evaluation of future social welfare may not only depend on the aggregate of individual prospects, but also on how the prospects are distributed across individuals. The latter in turn would depend on how inequality and risk at the collective level are judged. This paper compares how people perceive inequality in outcomes and risk at the collective level using examples in health and income in the context of losses.

Let us start with examples where policy makers are faced with the prospect of a certain harm and insufficient resources to protect the entire relevant population fully. They have two alternatives: either to protect a random part of the population fully so that some people will be helped but not others (which would entail an inequality in outcomes), or to endeavour to protect everybody but depending on the State of the world fail to protect anybody (which would entail a collective risk for the whole society, or "social risk"; Fleurbaey, 2018). For example, suppose there is a new emerging disease (that needs not be fatal). The existing prevention is fully effective but is pricey and the policy maker cannot afford this for the entire population. One alternative is to give this prevention to randomly selected individuals: regardless of who receives the prevention, some people are protected while others are not, leading to unequal outcomes. The other alternative is to protect the entire population with another less pricey new and untested prevention: if this turns out to be ineffective, the whole community would be unprotected, which would entail a social risk. In another example, suppose there is a densely populated city with a river flowing through it, and climate change makes inevitable some rising water levels and associated inconvenience. One alternative is for policy makers to protect one side of the river with high barriers, but they cannot afford barriers to protect both sides: they can locate the high barriers along one bank randomly chosen to protect one side of the city but not the other, resulting in an outcome inequality. Alternatively, they can build a dam upstream to protect both parts of the city, but this may not be completed in time exposing both parts of the city unprotected, which would entail a social risk. While there is a literature on the theory and the measurement of inequality aversion that addresses trade-offs between inequality and efficiency, to the best of our knowledge, the literature on social risks is limited.

More formally, a given future prospect can be judged in two distinct approaches (for example, Adler and Sanchirico, 2006; Flerubaey, 2018). The first approach considers the *expected values of outcomes* across individuals (the ex-ante approach), while the second approach considers the *actual outcomes* across individuals under different states of the world (the ex-post approach). Table 1 illustrates two equal-size groups of otherwise similar people and two equally likely States of the world.

[TABLE 1]

In the Baseline Scenario (B) each individual in the two Groups loses two units of good for certain, so there is no ex-ante or ex-post inequality and no social risk. In the Inequality Scenario (I), depending on the State (which is at random), those in one Group lose four units of good and those in the other Group lose nothing. Thus, individuals in the two Groups have the same expected outcome (lose two units), and there is no ex-ante inequality. Furthermore, whichever happens, there is ex-post inequality in outcomes across the Groups, but total loss is always four units so there is no social risk. In the Risk Scenario (R), in State 1 both Groups lose four units, while in State 2 neither Group loses anything. Again, individuals in each Group have the same expected outcome (lose two units) so there is no ex-ante inequality. In addition, there is no ex-post outcome inequality across the Groups, while there is a social risk. Social welfare orderings based on the ex-ante approach have been criticised for not distinguishing between I and R (Diamond, 1967; Broome, 1982; Fleurbaey, 2018). On the other hand, the ex-post approach may rank these scenarios differently: for example, these ranks suggest a tension between social-risk aversion and outcome-inequality aversion. In fact, social-risk aversion implies tolerating some level of inequality in outcomes (Fleurbaey, 2018). While we expect people to be averse to outcome inequality and social risk, we have no strong hypotheses on people being more averse to outcome inequality than social risk or vice versa. In the empirical literature, scenarios similar to I and R have been used by Keller and Sarin (1988) to examine how a sample of university students perceived equity of the allocation of risks amongst miners trapped in two separate mines, and by Kroll and Davidovitz (2003) to examine how a sample of 8-year old children perceived different rules for allocating prizes amongst them. Both studies found that respondents preferred R over I, implying a stronger aversion to outcome inequality than to social risk.

Such distributional preferences may depend on the distribuendum, i.e. the thing that is being distributed. Arguably, health and income are the two most fundamental elements of human wellbeing across which we might expect people to be inequality/risk averse, but given their different natures, the extent of the aversion might be different (Atkinson, 2011). For example, regarding inequality aversion, Tobin (1970) discussed "specific egalitarianism", under which inequality in certain basic necessities (such as health) should be lower than the inequality in general ability to pay (i.e. income), implying a higher inequality aversion for health than income. Anand (2002) has argued that aversion to health inequality should be higher than aversion to income inequality. He claims that first, health is a special good, with intrinsic value; and second, while there may be situations where income inequality is acceptable (e.g. increase in overall size of the pie may enable trickle down effects), there are no parallel examples for health. Similar arguments may apply to social risk, so that social-risk aversion for health might be

expected to be stronger than social-risk aversion for income, for example, because health (or being alive) is fundamental to people's wellbeing. In the empirical literature, Leibler et al. (2009) examined inequality aversion across income and health, treating these as a matter of "framing", and, in fact found that support for Pigou-Dalton transfer is stronger under the income framing than health framing, indicating a stronger aversion to income inequality than to health inequality. In line with the above studies, we will consider income and health as separate domains (notwithstanding the likely correlation between both).

In exploring distributional preferences for outcome inequality and social risk, the focus of this paper is social welfare, and not individual utility. While social welfare orderings can reflect attitudes to outcome inequality and social risk, selfish individual utility functions can only reflect attitudes to individual risk, and not inequality per se or social risk. However, individuals may (and usually do) have an additional meta-level detached preference over distributions per se, and these 'societal' or 'citizens' preferences, which we interpret as the basis of the social welfare ordering, are those preferences we are interested in.

'Societal' or 'citizens' preferences are not revealed through market transactions, leaving researchers with the direct questioning of individuals through lab-based experiments and questionnaire-based surveys to obtain stated or expressed preferences. The exercises are typically either 'real' and involve relatively modest amounts of actual monetary payments but are likely to elicit personal rather than societal preferences, or unincentivised and use scenarios with large monetary sums or mortality but the outcomes are completely hypothetical (see Amiel and Cowell, 1999 and Gaertner and Schokkaert, 2012). Furthermore, a number of stated preference studies examining empirical support to elicit different degrees of aversion have relied on student samples (for inequality aversion, for example, Amiel and Cowell, 1999; Bolton and Ockenfels, 2006; Engelmann and Strobel, 2004), which represent a relatively small, young, and privileged portion of the wider public and are arguably unsuited for studies eliciting normative judgements.

Against this background, this paper will contrast people's distributional preferences in the following:

- outcome inequality versus social risk, in health;
- outcome inequality versus social risk, in income;
- outcome inequality, in health versus income; and
- social risk, in health versus income.

Each of these corresponds to a null hypothesis, that people's societal level distributional preferences are no different across the corresponding pairs.

Some of the individual components have been researched empirically, but not all (in particular, empirical research on social risk in any domain), and not within one single survey, with general public respondents. These will be pursued using face-to-face, unincentivised interviews where hypothetical questions examining peoples' meta-level, or social, preferences are asked. Our results indicate that in the health context social-risk aversion is stronger than outcome-inequality aversion, whilst the reverse applies in the income context. Across the domains, outcome-inequality aversion is stronger in income than in health; likewise, social-risk aversion is stronger in income than in health (although not significantly different under constant absolute aversion).

## 2. METHODS

Face-to-face interviews of individuals aged 18 or older with age sex quotas were undertaken by Opinometre S.L. (a Spanish commercial survey company) in and around Madrid and Barcelona in Spain in July 2012. Interviews were undertaken in the respondent's home.

### *2.1 The questions*

Our survey has four questions: one for outcome-inequality aversion in health (IH), one for social-risk aversion in health (RH), one for outcome-inequality aversion in income (IY) and one for social-risk aversion in income (RY), where each question compares an alternative (A) that involves inequality or risk with a baseline (B) without inequality or risk (see Appendix A). None of the questions involve ex-ante inequality. Each question asks the respondent to imagine a hypothetical community of 1000 individuals across 250 households of four people each (which were set arbitrarily), facing the prospect of a loss measured in weeks, affecting random people in the community over the next year. In the two health questions (IH and RH), the loss is for individuals to become seriously ill for two or more weeks, and in the two income questions (IY and RY) the loss is for households to lose two or more weeks' income. In each of the four questions, respondents are then presented with four pairwise choice tasks made up of alternatives A and B. Alternative B corresponds to the baseline B Scenario in Table 1 and is fixed throughout at all 1000 people facing a two-week loss for certain. It involves no outcome inequality, or social risk. Alternative A corresponds to I or R Scenarios in Table 1 and consists of (an expected) 500 people experiencing: a three, four, five, or six-week loss, in this order, while the remaining 500 suffer no loss. In the inequality questions (IH and IY) the number, 500 of randomly chosen individuals, that experiences the loss is for certain, and therefore – for a decision maker there is outcome inequality but no social risk. In the risk questions

(RH and RY) the expected number, 500, arises from a 50% chance that all 1000 will experience the loss, and a 50% chance that none will experience the loss – and therefore there is social risk but no outcome inequality.

The instructions explain that all the losses happen at random throughout the year, on different weeks so that there is no single week in a year when a substantial proportion of the community suffers the losses at once, and the weeks of loss are non-consecutive. There are no other reasons that cause health or income loss. The health question states people will recover fully from the health loss. To ensure that the alternatives differ only in the parameters of interest the instructions indicate that costs of alternatives A and B remain constant. Appendix B outlines the key design considerations regarding the constituents of the scenarios, the initial distribution of health and income, the use of loss scenarios as opposed to gains, and the size and the measurability of the losses.

For each of the four pairwise choice tasks, respondents are asked to indicate whether they would choose A, choose B, or that A and B are equally good. A typical respondent, unless extremely averse, is expected to choose A on the first-choice task and shift to selecting B at some stage during the following tasks as A becomes increasingly less attractive. Once the respondent chooses B (or, if the respondent chooses B at the first pair), the subsequent choice tasks are not asked, so as to minimise noise and imprecision. Inequality or risk neutrality is achieved by being indifferent on the second pairwise choice task, where the expected/average losses in the two alternatives are the same. An even number of choice tasks was chosen so that the neutral pair does not appear in the middle of the sequence of tasks.

The questionnaires have two versions both covering the same questions: in one version, the four questions are asked in the order IH-RH-IY-RY (health-first); whilst in the other version the order is IY-RY-IH-RH (income-first). By pooling the analysis across the two versions, potential biases arising from the ordering of the topics can be cancelled out. In both versions, the inequality questions (in health or in income) are asked before the corresponding risk questions, because the latter are more complex.

In addition, the survey includes a fifth question, also asked to all respondents, the income equivalent health question (YEH, see Appendix A). Its aim is to allow the identification of a conversion rate from the weeks of ill-health to the equivalent number of weeks of income loss for each respondent. This question uses a visual aid similar to the previous questions and asks respondents to indicate across six pairwise choice tasks whether they chose A, or B, or they were equally good. This time, alternative A is fixed at all 1000 individuals (across 250 households) experiencing serious illness for one week *and* six weeks' income loss. Alternative B has a fixed level of five weeks of serious illness for the same 1000 individuals, combined with five, four, three, two, one, or zero

weeks of income loss for everybody. As in the previous questions, the instructions indicate that costs of A and B remain constant.

The survey also includes information on demographic, socio-economic and other relevant characteristics of the respondents.

*2.2 Method of analysis*

We test the hypotheses across three analyses. In the first, we group the responses to the four aversion questions into ordinal categories ranked by the degree of aversion and compare these across pairs of questions (e.g. IH and RH) with non-parametric tests.

In the second and third analyses, we fit the data to a social welfare function (SWF) and compare the aversion parameters across pairs of questions parametrically. The second analysis uses a SWF specification that assumes constant relative aversion (or scale invariance), which means that if the good (income or health) of all parties changed by the same proportional amount (e.g. everybody's income increases by 30%), this will leave the level of inequality across them unchanged (Atkinson, 1970). Let us consider question IY, for example. While alternative A of the second choice task involves half the population losing four weeks' income, alternative A of the third choice task involves five weeks' income lost. If respondents perceive this difference in proportional terms (i.e. A in the third task involves a 25% more loss), then this constant relative aversion is appropriate. Similarly, for risk aversion, consider RY. Alternative A of the second and third choice tasks have a 50% chance that everybody loses four or five weeks' income, respectively. If respondents perceive this difference as 25% more loss in the third choice task compared to the second, then the constant relative aversion is appropriate.

If, however (for both outcome-inequality and social-risk aversions), respondents perceive the difference in terms of absolute units (i.e. one more week's income loss), then another assumption, constant absolute aversion, would be more appropriate. To accommodate this, the third analysis, again, fits the data to a SWF, but this time using a specification that assumes constant absolute aversion (or translation invariance). This means that if the good of all parties changed by the same absolute amount (e.g. everybody's income increases by $3000), this will leave the level of inequality across them unchanged (Kolm, 1976).

The two specifications are used to see whether the test results are reliant on one or the other assumption (constant relative vs constant absolute aversion), rather than to test which of the two assumptions better fit the data. In addition, note that by using SWFs the aim is to conduct parametric tests, rather than to discuss the specific values

of the aversion parameters. Figure 1 illustrates what is compared against what: (a) is for the first and second analyses and (b) is for the third analysis.

[FIGURE 1]

*2.2.1 The first analysis assuming ordinal categories of aversion*

In the first analysis, responses are grouped into nine different aversion categories depending on the allocation of the switch from alternative A to alternative B (see columns 1-3, Table 2), from the most inequality/risk averse in category 1 to the most inequality/risk seeking in category 9, via neutrality in category 4 (corresponding to indifference at the second choice task). Note that two of the hypotheses require comparisons across the domains (IH and IY; and RH and RY) but becoming seriously ill for several weeks is not directly comparable with losing income for the same number of weeks. Nevertheless, since the relative size of the losses are the same across all questions (e.g. the loss in alternative A in the third choice task always lasts five weeks, or 150% longer than in alternative B), this means that cross-domain comparisons can be made by assuming that differences in magnitudes of inequality/risk depend on proportional differences. This is equivalent to assuming constant relative aversion mentioned above. Constant relative aversion will allow us to say that since the magnitude of inequality/risk associated with a given choice task is proportionately the same across all four questions, IH and IY and RH and RY can be meaningfully compared (see Figure 1(a)).

[TABLE 2]

Building on the ordinal nature of these nine aversion categories, a cumulative function is drawn for each question. The Wilcoxon non-parametric sign-rank test is used to compare across the cumulative functions of the four questions (Wilcoxon, 1945).

*2.2.2 The second analysis assuming cardinal levels of aversion and constant relative aversion*

In the second analysis, we assign a cardinal aversion level for each individual for each of the four aversion questions, by fitting the data to a specific SWF. Here, we use a SWF with constant relative aversion. A description of the SWF used and the assignment of aversion parameters for each of the nine response patterns are outlined in Appendix C1. The results are reported in the fourth column of Table 2. To test our four-null hypothesis statistically, data from each pair of relevant questions (e.g., IH and RH) are jointly treated as a panel dataset and regression models are run using a set of covariates and a question dummy representing the difference between the relevant aversion parameters (e.g., the difference between aversion to health inequality and aversion to health risk parameters). Regarding the dependent variable (the aversion parameter), the actual observations are made up of

three different kinds: point data (when a respondent is indifferent at a given scenario pair, e.g. category-2 of Table 2), interval data (when a respondent either switches from A to B, e.g. category-3, or prefers B throughout, i.e. category-1) or left-censored data (when a respondent chooses A throughout, i.e. category-9). This means that it is not always possible to observe a specific aversion point value for each individual. Therefore, we have run interval regression models that accommodate this type of data (Cameron and Trivedi, 2009). Regarding the independent variables, alongside the question dummy the covariates included are gender, age, education level and employment status (Amiel and Cowell, 2002); in addition, health, attitudes to public goods, and respondent's comprehension (interviewer-reported) are also assumed to explain the different aversions to risk and inequality (see Appendix D, Table D1 for the definition of these variables). Random-effects estimations with bootstrapped standard errors are used to account for the repeated observations. The sign and significance of the question dummy allow a parametric test of each of the four null hypotheses: see Figure 1(a).

*2.2.3 The third analysis assuming cardinal levels of aversion and constant absolute aversion*

The third analysis assumes constant absolute aversion (or translation independence). A description of the SWF specified and the assignment of aversion parameters for each of the nine response patterns are outlined in Appendix C2 and results are reported in the fifth column of Table 2. Similarly to the case with constant relative aversion, to test the four hypotheses under constant absolute aversion, interval regression models are run for each of the four combinations of questions by treating the data jointly across the relevant pairs of questions as panel data and including a question dummy that measures the difference between the relevant aversion parameters alongside the same set of covariates used in the second analysis. However, assuming constant absolute aversion means that cross-domain comparisons (e.g. IH and IY) cannot be made. This is because the difference between a 5-week loss in health and a 4-week loss in health (one more week of health loss) is not the same in absolute magnitude as the difference between a 5-week loss in income and a 4-week loss in income (one more week of income loss). To overcome this problem, the income-equivalent health question (YEH) explained above is used to convert the numbers of weeks of health loss into the equivalent numbers of weeks of income loss in the inequality question (IHE) and the risk question (RHE) at the individual respondent level. For details, see Appendix C2. See Figure 1(b), where the health-to-income conversion is represented by broken arrows.

## 3. RESULTS

The sample consists of 422 individuals and is representative in age and sex: 52.5% of the respondents were female and average age was 45.2 (SD=17.7). (See Appendix D, Table D1 for details.) Of the sample, eight respondents

were excluded (resulting in 414 valid cases). The two versions of the questionnaire (health-first, n=205; and income-first, n=209) did not significantly affect the IH, RH and RY results (chi-square tests: p=0.536; p=0.243; and p=0.762, respectively) but did affect the IY results (p=0.017) so that those with the health question first showed a stronger aversion to income inequalities than those with the income question first. All subsequent analyses pool across the two versions, and therefore are not affected by this.

Regarding the first, ordinal analysis, the stacked bar chart in Figure 2 summarises the results across the nine relative aversion categories. In IH, just under half (45.9%) are outcome-inequality seeking while a similar proportion (43.7%) are outcome-inequality averse. In the remaining three questions, the majority are averse. The location and width of category 4 for neutrality differs across the questions. The median respondent for each question demonstrates neutral preference for IH, and averse in RY, IY and RH.

[FIGURE 2]

Figure 3 illustrates the cumulative distributions of each relevant question pair. Wilcoxon sign-rank tests show that in the health domain social-risk aversion (RH) is stronger than outcome-inequality aversion (IH) ($p<0.01$); but in the income domain, outcome-inequality aversion (IY) is stronger than social-risk aversion (RY), although there is only marginally significant difference (p=0.046).

[FIGURE 3]

Furthermore, across contexts, outcome-inequality aversion and social-risk aversion are both stronger in income (IY and RY) than in health (IH and RH) ($p<0.01$ in both cases).

Regarding the second analysis, cardinal analysis with constant relative aversion, the first row of Table 3 shows the estimates of the coefficients of the corresponding dummies for the four pairs of aversion parameters (IH and RH; IY and RY; IH and IY; RH and RY). The question named first in the labels were used as the baseline so that, for example, the positive and significant coefficient reported in the first row, first column (+4.011***) indicates that, controlling for the covariates, the aversion parameter for social risk in health (RH) is significantly larger than the aversion parameter for outcome inequality in health (IH), ($p<0.01$). (Full results are available in Appendix E, Tables E1 and E2.)

Similarly, the second row of Table 3 is for the third analysis, with constant absolute aversion. However, as was noted above, these aversion parameters are not comparable across domains, and the income-equivalent health question (YEH) elicited the income-equivalent conversion to allow cross-domain comparison (i.e., IH(E) and IY; RH(E) and RY). Regarding the frequencies for the response patterns to the YEH question, the modal preference

was to select alternative A throughout (27%), followed by AABBBB (23%) corresponding to a week of ill-health being converted into a range from 1/2 to 3/4 weeks' income loss, while the median preference was AAABBB corresponding to a range of 3/4 to one week's income loss. On average, individuals found that a week of income loss is equivalent to 0.938 weeks of health loss (see appendix D3).

Across the second and third analyses, seven of the eight coefficient estimates in Table 3 are statistically significant and all the signs across the matching relative and absolute aversion coefficients were the same. In addition, all the models had significant likelihoods and were estimated using bootstrapped standard errors (replications based on clusters in individuals) with 400 draws (see Appendix E, Tables E1 and E2). When constant relative aversion was assumed, all four null hypotheses were rejected; when constant absolute aversion was assumed, the first three were rejected. More specifically, within the health domain social-risk aversion was statistically significantly stronger than outcome-inequality aversion, but within the income domain outcome-inequality aversion was significantly stronger than social-risk aversion (the same pattern was observed for constant relative aversion and constant absolute aversion). Across domains, whilst aversion was significantly stronger for income than for (income-equivalent) health for constant relative inequality, constant absolute inequality, and constant relative risk aversion, the same pattern was not significant for constant absolute risk aversion. As a consistency check regarding the income-equivalent converters, the fifth column of Table 3 shows the result of the comparison IHE and RHE, which is consistent (equal sign and significance, although much smaller in magnitude) with IH and RH under constant absolute aversion. Furthermore, these results of the cardinal analysis are consistent with the corresponding results obtained in the ordinal analysis.

[TABLE 3]

## 4. DISCUSSION

In this study, we surveyed a mostly representative (but overeducated) sample of the Spanish general public and found evidence suggesting that outcome-inequality aversion and social-risk aversion *within* either domain are not the same, and that neither aversion is the same *across* the two domains. Keller and Sarin (1988) found that when asked to choose on behalf of others between two health prospects of equal expected value, where one scenario involved no social risk but outcome inequality (as in our I-scenario in Table 1), and the other prospect involved social risk but no outcome inequality (as in the R-scenario), respondents preferred the latter over the former. Thus, we may expect a stronger aversion to inequality than to risk. However, our findings suggest weaker aversion to outcome inequality than to social risk in health (though in income we found stronger aversion to outcome

inequality than to social risk). One possibility is framing. As in Keller and Sarin (1988), where respondents are faced with I- and R-scenarios directly, the outcome inequality element may be more prominent than the risk in total losses (and especially so, if the difference is between life and death as in their study). On the other hand, our study compared I-scenarios against a baseline (B-scenario with no risk or inequality); and then compared R against the same baseline. This presentation may have helped respondents to pick up the key features of each scenario. This final point could also be made of Kroll and Davidovitz (2003). However, this study asked 8-year old children to express a preference over how to allocate candy bars amongst themselves, so there are other factors that make the results not directly comparable.

Our results indicate that, in the income context, inequality aversion is stronger than risk aversion. Indeed, a non-negligible proportion of preferences are "risk seeking" (and similarly for health). These preferences could be explained by the "reflection effect" (Kahneman and Tversky 1979), where people give less weight to certain losses (our baseline alternative B) relative to uncertain losses (our alternative A), contributing therefore to a lower risk aversion. Results in the health context are different, however: health inequality aversion is weaker than health risk aversion, and much weaker than income inequality aversion. We may speculate as to why this may be. For example, people may have been more sensitive to income inequalities due to the economic crisis that was taking place in 2012. Moreover, the different perceived determinants of health and income might have had an effect. To understand the *reasons* for the different distributive preferences would likely require qualitative investigations.

The highly abstract and stylised nature of the scenarios was necessary to ensure that health and income were separated and to minimise additional interpretations that respondents bring to the exercises. However, this inevitably has made the scenarios unrealistic. These results should be interpreted with care and, here, we discuss seven points.

First, in this study we considered scenarios in losses rather than gains. Evidence suggests people feel losses more intensely than gains of the same value (Tversky and Kahneman, 1991). If so, gain-based scenarios may have resulted in data supporting weaker aversions, although we do not know whether these may have affected the four aversions differently.

Second, the data were collected through scenarios in losses, but social welfare was modelled in terms of final *levels* of the distribuendum (e.g. 49 weeks in full health), instead of *changes* in their levels (e.g. three weeks of health loss). Given the data, this modelling choice does not matter for constant absolute aversion, but constant relative aversion could be affected. The results of modelling social welfare assuming constant relative aversion

in terms of changes are similar to those reported here (details available on request). Whether these may have affected health and income domains differently is not known.

Third, regarding previous studies that compared inequalities in lifetime health, our study considered losses at a relatively small scale. This may have resulted in the failure to detect aversion in inequality and/or risk which would have been picked up if larger losses were used. On the other hand, compared to incentivised studies that measure (personal) risk aversion in income, our study considered losses at a relatively large scale (up to around 12% of annual income). The analysis fitted the data to SWF specifications that assume constant (relative or absolute) aversion, without testing these assumptions. It is possible that they do not hold empirically (for example, the calibration problem, Rabin and Thaler, 2001). However, the contribution of this study is in demonstrating the significant differences across the four kinds of aversion when keeping everything else fixed, rather than the levels of aversion parameters themselves.

Fourth, there may be issues related to what is understood by "severe ill-health". In the questionnaire design it was decided against naming some particular illness such as the flu to avoid conditioning responses in one or other direction. While the heterogeneity in how people interpreted "severe ill-health" may have affected the answers in non-random ways, as long as respondents had the same health problem in mind throughout the relevant exercises, this should not affect the paired analyses.

Fifth, we have assumed that health and income are independent and additive. While this is unlikely to hold globally, since the numbers of weeks of loss used in the income-equivalent question are in a similar range to those used in the four main questions, the assumption can be a reasonable local approximation (note that the Spanish cash benefit programme means that health loss is less likely to lead to income loss compared to other countries where this does not exist). The same assumption also means that the questions deal with "pure" inequalities, not health inequalities caused by (or correlated with) income inequalities; and vice versa. Lay members of the public may have theories about the relationship between health and income inequalities, and whether the respondents kept health and income separate is an interesting issue that cannot be tested in this study. The relatively small scale of the loss in health makes the independence assumption less problematic than larger scale losses (e.g. premature death). However, at the same time, this may have diluted the special, fundamental status of health as a dimension of wellbeing.

Sixth, the sequence in which the pairwise choice tasks are presented may have a few implications. Once a respondent starting from alternative A switched to choosing B, the subsequent scenario pairs were not asked.

While this was to avoid the interview becoming too repetitive, it does mean that there is no opportunity to check whether the responses are rational (viz. do not switch back from B to A in the next pair). Furthermore, this practice may have induced the respondent to switch to B earlier simply to move on. However, if such a bias was present, it is likely to affect the latter questions than the earlier ones and picked up through the comparison of the two questionnaire versions (health-first and income-first). One final potential bias has the opposite effect: titration questions may result in respondents delaying the switching point compared to the same set of scenario pairs being presented in a random order. Nevertheless, if all four questions were affected similarly, then it should not affect our results.

Finally, the question on the income-equivalent converter was designed to elicit a social conversion rate between severe illness and income loss. It was motivated by the concern that people may contrast the difference between alternatives A and B in the four main questions in terms of the number of weeks, rather than relative proportions of weeks. The answers on this question was bi-modally distributed and significantly associated with the respondent needing the interviewer's help (interviewer-assessed, for the whole interview), suggesting that it was possibly the most difficult of all the questions asked. Regarding the two SWF specifications, the survey does not provide any information towards choosing between the two (or any other) specifications. Furthermore, in practice, both approaches have resulted in similar findings. Nevertheless, qualitative work to explore how respondents process these questions would be of interest.

Evaluation of future prospects at the social level may be subject to the distributional preferences that people hold. Using stylised scenarios designed to contrast outcome-inequality aversion and social-risk aversion using loss-based scenarios in the health and income domains, we have shown that our respondents have different distributional preferences across these. While this study is largely exploratory and methodologically-driven, with little immediate policy implications, if the results are found to hold beyond this study, it would suggest that in contexts where whole communities are exposed to the same joint risk (such as those brought on by climate change, emerging diseases, or global economic shocks), policy evaluation should take into account the tension between inequality aversion and social-risk aversion, and that when the distribution of prospects is considered separately for different domains (e.g. income or health), policy evaluation should not automatically use aversion parameters elicited for another domain.

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**TABLES**

**TABLE 1:** THE BASELINE, THE INEQUALITY AND THE RISK SCENARIOS ACROSS TWO GRUOPS

| | **Group 1** | **Group 2** |
|---|---|---|
| **The Baseline Scenario [B]** | | |
| **State 1** | -2 | -2 |
| **State 2** | -2 | -2 |
| **The Inequality Scenario [I]** | | |
| **State 1** | -4 | 0 |
| **State 2** | 0 | -4 |
| **The Risk Scenario [R]** | | |
| **State 1** | -4 | -4 |
| **State 2** | 0 | 0 |

NB. The two groups are of equal size and consist of otherwise similar individuals. The two states of the world 1 and 2 are equally likely.

**TABLE 2:** THE NINE RESPONSE PATTERNS AND CORRESPONDING AVERSION PARAMETERS

| Aversion category† | Response pattern | Type of preference | Constant relative aversion parameter ‡ | Constant absolute aversion parameter‡ |
|---|---|---|---|---|
| 1 | B B B B | B at the first scenario pair | $24.171 < r_R < 182.100$ | $0.481 < r_A < 6.931$ |
| 2 | = B B B | Indifferent at the first scenario pair, and B at the second | $r_R = 24.171$ | $r_A = 0.481$ |
| 3 | A B B B | A at the first scenario pair, and B at the second | $0 < r_R < 24.171$ | $0 < r_A < 0.481$ |
| 4 | A = B B | A at the first scenario pair, indifferent at the second and B at the third | $r_R = 0$ | $r_A = 0$ |
| 5 | A A B B | A at the first two scenario pairs, and B at the third | $-8.177 < r_R < 0$ | $-0.164 < r_A < 0$ |
| 6 | A A = B | A at the first two scenario pairs, indifferent at the third, and B at the fourth | $r_R = -8.177$ | $r_A = -0.164$ |
| 7 | A A A B | A at the first three scenario pairs, and B at the last | $-11.909 < r_R < -8.177$ | $-0.241 < r_A < -0.164$ |
| 8 | A A A = | A at the first three scenario pairs, and indifferent at the last | $r_R = -11.909$ | $r_A = -0.241$ |
| 9 | A A A A | A throughout the four scenario pairs | $r_R < -11.909$ | $r_A < -0.241$ |

† The relative aversion categories range from 1 (maximum aversion) to 9 (maximum seeking), with 4 for neutrality.
‡ The aversion parameters are based on the social welfare functions. See Appendices C1 and C2 for specifics.

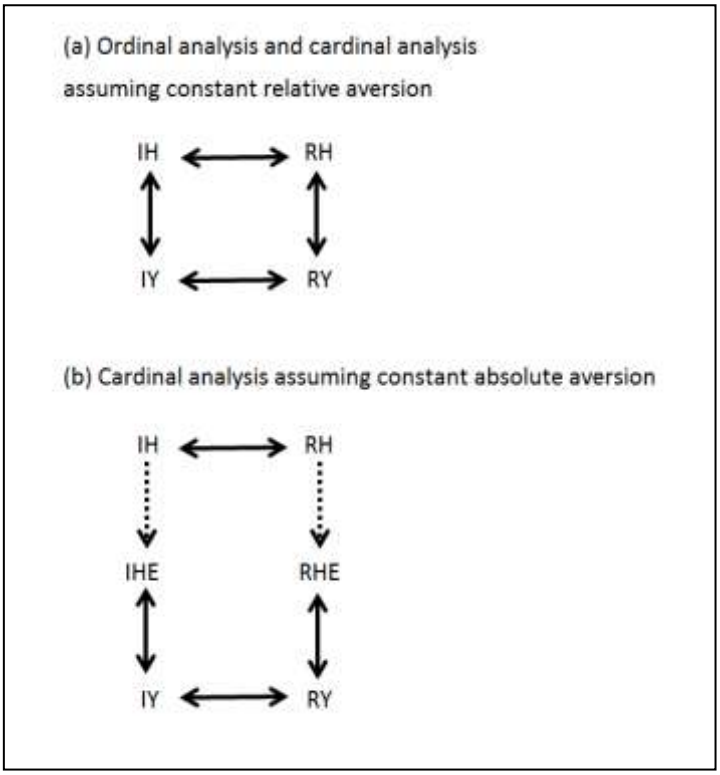
**TABLE 3** RESULTS OF THE RANDOM EFFECTS INTERVAL REGRESSIONS (COEFFICIENT ESTIMATES FOR QUESTION DUMMIES ONLY)

| | IH and RH | IY and RY | IH(E)† and IY | RH(E)‡ and RY | IHE and RHE |
|---|---|---|---|---|---|
| **Constant Relative Aversion** | 4.011(***)<br>Log lik.= -1443.941<br>Wald chi2(14)= 35.40<br>Prob > chi2= 0.0013 | -2.891(**)<br>Log lik.= -1347.837<br>Wald chi2(14)= 30.79<br>Prob > chi2= 0.0059 | 10.012(***)<br>Log lik.= -1456.622<br>Wald chi2(14)= 85.18<br>Prob > chi2=0.0000 | 2.923(***)<br>Log lik.= -1316.780<br>Wald chi2(14)= 37.51<br>Prob > chi2= 0.0006 | n/a |
| **Constant Absolute Aversion** | 0.080(***)<br>Log lik.= -1114.106<br>Wald chi2(14)= 35.31<br>Prob > chi2= 0.0013 | -0.058(**)<br>Log lik.= -1045.602<br>Wald chi2(14)= 30.60<br>Prob > chi2= 0.0063 | 0.242(***)<br>Log lik.= -1347.190<br>Wald chi2(14)= 49.88<br>Prob > chi2=0.0000 | 0.017<br>Log lik.= -1322.535<br>Wald chi2(14)= 31.15<br>Prob > chi2=0.0053 | 0.133(**)<br>Log lik.= -1469.289<br>Wald chi2(14)= 26.00<br>Prob > chi2= 0.0259 |

Controlled for covariates shown in Table A10.
† IH for constant relative aversion; IHE for constant absolute aversion
‡ RH for constant relative aversion; RHE for constant absolute aversion
*** p-value<0.01 ** p-value<0.05; * p-value<0.1

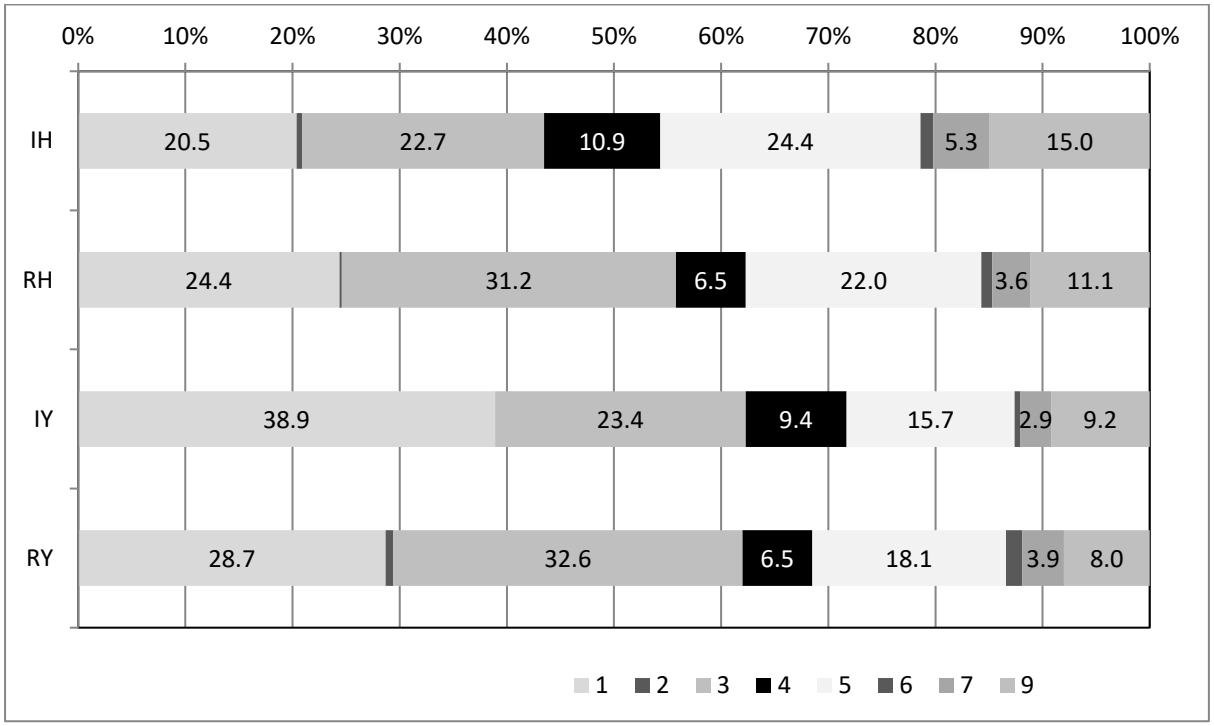
**FIGURES**

**FIGURE 1** A SIMPLE SUMMARY OF THE ANALYSES




NB1. IH: outcome-inequality aversion in health; RH: social risk aversion in health; IY: outcome-inequality aversion in income; RY: social risk aversion in income; IHE: inequality aversion in health converted to income-equivalents; RHE: social risk aversion in health converted to income-equivalents
NB2. The arrows indicate the pairs of questions that are compared against each other.
NB3. The broken lines indicate where numbers of weeks of health loss are converted into equivalent numbers of weeks of income loss using the YEH question.

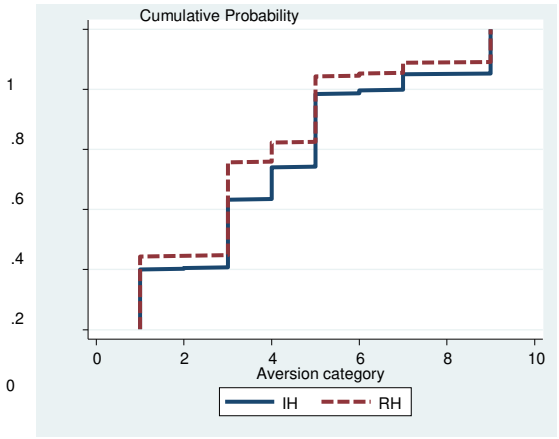
**FIGURE 2** INDIVIDUALS REPORTING DIFFERENT RELATIVE AVERSION CATEGORIES (NUMBER AND PERCENTAGES: N=414)




† The relative aversion categories range from 1 (maximum aversion) to 9 (maximum seeking), with 4 for neutrality. The numbers indicate the percentage of respondents (>2%). Category 8 has no observations. All questions add up to 414 respondents.

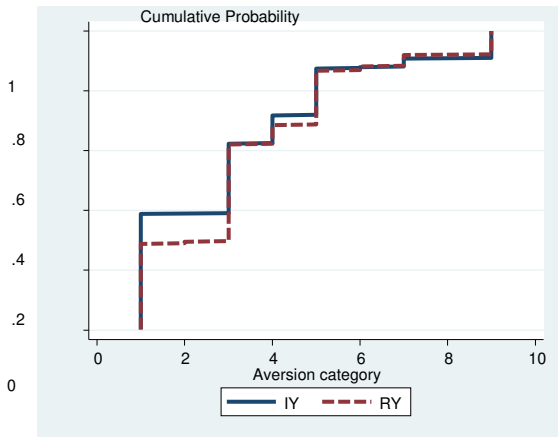
**FIGURE 3** AVERSION LEVEL TO OUTCOME-INEQUALITY/SOCIAL RISK IN HEALTH/INCOME (CUMULATIVE PROBABILITY DISTRIBUTIONS)

**(a) INEQUALITY-SOCIAL RISK AVERSION IN HEALTH**



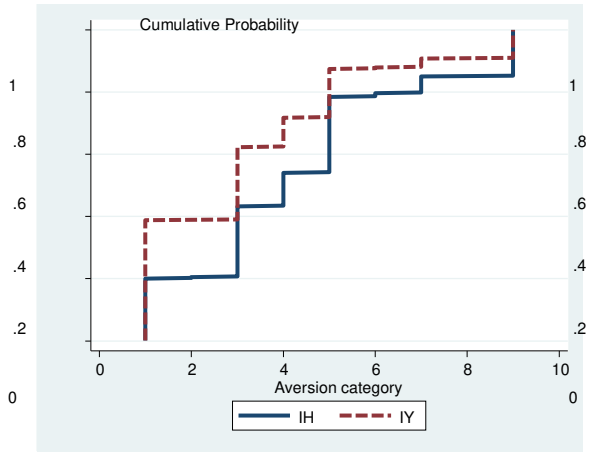

Wilcoxon sign rank test $p < 0.01$

**(b) INEQUALITY- SOCIAL RISK AVERSION IN INCOME**



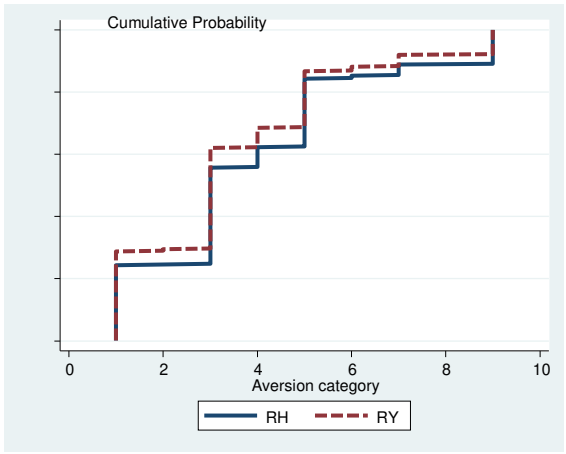

Wilcoxon sign rank test $p = 0.046$

**(c) INEQUALITY AVERSION HEALTH-INCOME**




Wilcoxon sign rank test $p < 0.01$

**(d) SOCIAL RISK AVERSION HEALTH-INCOME**




Wilcoxon sign rank test $p < 0.01$