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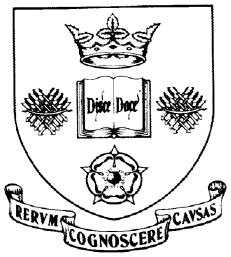

Ignacio Abásolo
Aki Tsuchiya

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Department of Economics
University of Sheffield
9 Mappin Street
Sheffield
S1 4DT
United Kingdom
www.shef.ac.uk/economics

INEQUALITY AND RISK AVERSION IN HEALTH AND INCOME: AN EMPIRICAL ANALYSIS USING HYPOTHETICAL SCENARIOS WITH LOSSES.

Ignacio Abásolo[1], Aki Tsuchiya[2]

ABSTRACT

Four kinds of distributional preferences are explored: inequality aversion in health, inequality aversion in income, risk aversion in health, and risk aversion in income. Face to face interviews of a representative sample of the general public are undertaken using hypothetical scenarios involving losses in either health or income. Whilst in health risk aversion is stronger than inequality aversion, in the income context we cannot reject that attitudes to inequality aversion and risk aversion are the same. When we compare across contexts we find that inequality aversion and risk aversion are both stronger in income than they each are in health.

JEL codes: I14, D63, D71

Key words: inequality, risk, aversion, health, income

[1] Departamento de Economía de las Instituciones, Estadística Económica y Econometría, Facultad de Ciencias Económicas y Empresariales. Universidad de La Laguna, Campus de Guajara. 38071 La Laguna. Tenerife. Spain. <iabasolo@ull.es>

[2] Department of Economics and School of Health and Related Research, University of Sheffield, Sheffield, United Kingdom. <a.tsuchiya@sheffield.ac.uk>

INTRODUCTION

Individual utility contributes to social welfare. However, social welfare depends not only upon the aggregate of individual utilities (concern for *efficiency*), but arguably also upon how the total is distributed across the individuals (concern for *equality*). While some policies may increase utilities and reduce inequalities in them at the same time, others will only improve one at the cost of the other. This leads to the need to quantify the efficiency-equality trade-off, or the level of inequality aversion, that is relevant in public policy decisions. One way in which to address this issue is to explore the trade-off supported by members of the public. Our study explores inequality aversion and other preferences held by members of the public through a face to face interview survey. In doing so, there are four things to note: the distribuendum; the relationship between inequality and risk; the relationship between individual utility and social welfare; and the survey methodology. Each is addressed below.

First, the level of inequality aversion people hold may depend on the distribuendum, i.e. the thing that is distributed unequally. If utility is defined as a function of individual consumption, then individual utility can be (indirectly) expressed as a function of income, given prices. On the other hand, there are fundamental aspects of human wellbeing that do not have an obvious market or price. Health is one such example. While health may affect the individual's employability and thus their income, the most simplistic indirect utility function fails to capture the direct effect of health on individual utility. This may lead to a multi-dimensional notion of welfare (Atkinson, Bourguignon, 1982). Arguably, health and income are two fundamental elements of human wellbeing across which we might expect people to be inequality averse.

Williams (1997) argued for a social welfare function that is inequality averse in lifetime health prospects of different population groups, and empirical studies have shown that the general public support this (see for example Abásolo and Tsuchiya, 2004; 2012; Dolan and Tsuchiya, 2005). However, would people have different levels of aversion to *health* inequality and *income* inequality? For instance, Tobin (1970) has 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. More recently, Anand (2002) has argued that aversion to health inequality should be higher than aversion to income inequality. He argues 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. (Also see Hausman, 2007.)

Second, a simple *inequality* averse social welfare function involves diminishing marginal social welfare, and therefore is indistinguishable from a *risk* averse social welfare function. In the real world, since both inequality aversion and risk aversion form the basis for similar policies regarding social security and welfare transfers, they may be seen as the same thing. However, the two have different conceptual bases. Suppose there are three prospects of equal expected value, affecting two individuals, *i* and *j*:

X. With certainty, individual *i* gains one unit of good and individual *j* gains nothing;

Y. Randomly, either *i* or *j* gains one unit of good and the other gains nothing;

Z. Randomly, either both individuals gain one unit of good each; or both individuals gain nothing.

Of these three, the first two have their origins in the classic example given by Diamond (1967) and subsequently re-visited by Broome (1982), where a point they made was that a social welfare function based on expected utility theory is indifferent between X and Y, while inequality aversion places Y above X. Echazu and Nocetti (2012) devised a social welfare function (in terms of health) that distinguishes between X and Y. Its aggregation is inequality averse in individual health, while individual health is captured in terms of certainty equivalents reflecting individual risk attitudes, so that individual risk aversion and societal inequality aversion are incorporated separately. Their social welfare function places Y above X, because inequality aversion makes X less attractive. However, this means separating out the two concerns: inequality aversion belongs to the aggregate level, and risk aversion belongs to the individual level. While it may be appropriate to confine inequality aversion to the aggregate level, it is not obvious why risk aversion should be restricted to the individual level.

The addition of prospect Z above allows a contrast between inequality and risk at the aggregate level. While an inequality averse and risk neutral social welfare function will place Z above Y, a risk averse and inequality neutral social welfare function will place Y above Z. Similar scenarios have been used by Keller and Sarin (1988) to examine how a sample of university students perceived equity of the allocation of risks within an imaginary island community. In their terminology, “ex ante equity” ranks Y above X, while “ex post equity” ranks Z above Y. The two latter scenarios also correspond to the “individual game” and the “common game”, respectively, used by Kroll and Davidovitz (2003), to examine whether young children are inequality averse or risk averse when

they are asked to choose for themselves between two different systems of allocating outcomes. In both studies, respondents preferred to Z over Y.

Carlsson et al. (2005) examined whether people's aversion to inequality could be explained entirely by their risk attitude. They asked a student sample to make choices on behalf of their grandchildren, across two different questions. The first question asked them to choose between lotteries of different income levels for the grandchild, where the overall level of inequality was fixed. In the second question, the choice was between societies with different distributions, but the grandchild's income was fixed, so the question was risk-free. Choices are explained in terms of individual utility functions specified to satisfy both constant relative risk aversion and constant inequality aversion elasticity. Most respondents were found to be inequality averse, independently from their level of risk aversion.

Third, the focus of our study is the social welfare function, and not the individual utility function. Let us assume individual utility is a function of own consumption, and social welfare is a function of utility levels of composite individuals. While social welfare functions can reflect attitudes to uncertainty and inequality, individual utility functions can only reflect attitudes to uncertainty, and not inequality per se. This is the case so long as distribution at the societal level is not part of the individual's own consumption bundle. Thus, in the above example with the three prospects, an individual choosing strictly for him or herself will have no preference between the latter two (Y and Z). Whilst a risk averse individual utility can be consistent with inequality aversion at the aggregate level because a more egalitarian distribution also reduces individual's risk, this is not the focus of our study. Furthermore, individual utility may be relaxed to include relative income and position, and/or externalities such as altruism (which may be why the respondents in Kroll and Davidovitz, 2003, preferred Z over Y in making

choices for themselves); but while these are affected by the distribution across society, ultimately, they are based on how the distribution looks like from the individual's perspective. However, individuals may (and usually do) have an additional meta-level detached preference over distributions per se, and these 'societal' preferences, which we interpret as the basis of the social welfare function, may indeed be inequality (and risk) averse. And it is these that we aim to examine.

Fourth, such preferences are not revealed through market transactions, leaving two methods of exploration. One is the direct questioning of individuals through computer-based experiments or questionnaire-based surveys to obtain stated or expressed preferences. The obvious challenge associated with this is the validity of the results. The exercises are typically either 'real' and involve actual monetary payments but the amounts are (by practical necessity) relatively modest, or unincentivised and deal with large monetary sums or potential mortality but the outcomes are (again, by practical necessity) completely hypothetical (for a detailed discussion, see Amiel and Cowell, 1999; Gaertner and Schokkaert, 2012). Furthermore, while a number of stated preference studies have examined empirical support for inequality aversion, most have relied on student samples (see for example, Amiel and Cowell, 1999; Bolton and Ockenfels, 2002; Engelmann and Strobel, 2004; Amiel et al, 2012). University students only represent a relatively small, young, and privileged portion of the wider public; while they may be better suited to more cognitive exercises they are arguably less ideal for topics involving normative judgements (see for example Abásolo and Tsuchiya, 2008, on the effect of age).

As an alternative method, Schwarze and Härpfer (2007) used a large scale general population survey to model variations in self-reported subjective well-being (or life satisfaction) by variation in real income inequality. They argue that "life satisfaction

not only measures individual utility, but also reflects aspects of social utility" (p.237). Ferrer-i-Carbonell and Ramos (2010) use this approach to examine whether the negative impact of local income inequality on self-reported life satisfaction can be explained by individual risk aversion measured by self-reported preparedness to take risks. They do this by using life satisfaction as a proxy for inequality aversion once a whole host of individual and household characteristics are controlled for, and demonstrate that this and risk aversion are two related but separate preferences. However, the approach relies crucially on the assumption that once variation in satisfaction with one's own life is modelled in terms of individual and household variables, the residual can be interpreted to reflect inequality aversion held by the individual.

Overall, there are four economic issues addressed in this paper: inequality aversion in health, inequality aversion in income, risk aversion in health and risk aversion in income. Some of the individual components have been researched, but not all, and not within one single survey, with general public respondents. These will be pursued using face to face interviews of members of the general public where hypothetical questions examining peoples' meta-preferences are asked. In the below, section I outlines the design of the questions and the method of analysis, section II reports the results, section III discusses the findings, and section IV concludes.

I. METHODS

Design of questions

The study empirically examines inequality and risk aversion held by members of the public across health and income, using scenarios that correspond to Z and Y above, and

contrasting each with another scenario that involves no uncertainty or risk. In doing so, several factors need to be considered: how to represent health and income; whether to deal with gains or losses; and how to scale the degree of gain/loss across health and income. Each is addressed in turn.

The previous literature examining inequality aversion in health referred to above have used inequalities in life expectancy at birth, a measure of *individual lifetime health*. Thus, a natural extension of this would be to contrast it with inequality in *individual lifetime income*, and then to expand into the context of risk. However, there are two complications. The first complication concerns the unit of analysis: while health in the first instance primarily affects individuals, income affects households. For example, transferability of health is limited so that although it is the case that ill health can invoke caring externalities within the family, unless the condition is contagious, one family member becoming ill need not make the rest of the family also ill; or, a healthy family member cannot transfer their health to an ill member. On the other hand, money is substantially more transferable than health so that one family member losing their job typically has immediate financial implications for the rest of the family; equally, income from another member of the family can make up for reduction in income caused by the job loss. A related issue concerns measurement: while it is possible to measure household income, it is not possible to measure household health. These suggest that the natural measure of health is at the individual level, whilst the natural measure of income is at the household level. Therefore, individual health and household income are used as the units of analysis in this study.

The second complication concerns the timeframe: lifetime health and lifetime income typically have a positive correlation, and the causality can go in either direction. Chronic poverty is likely to have adverse effects on health, and serious illness can have

employability implications and affect income. If it is not credible to survey respondents that lifetime health and lifetime income are independent of each other, then this will make it difficult to isolate them. One way to minimise this problem is to consider changes in health and income over a limited duration of time, which is what is done in this study.

A further decision was made in this study to use scenarios in losses rather than gains. This involved two considerations. First, while it is straightforward to present scenarios in which households experience a significant increase in income for a fixed duration, it is less practical to build scenarios in which individuals experience a significant increase in health for a fixed duration, because most people are already reasonably healthy. Introducing some artificially lowered level of baseline health and baseline income to start with would accommodate gains, but this would mean an additional layer of complexity to the scenarios. Second, respondents may find loss scenarios more credible, where income and health are simply lost for a fixed period, compared to gain scenarios, where respondents may want to know how they are generated and/or why they cannot be sustained.

These considerations have led to the decision to measure health in terms of serious illness affecting individuals for a limited duration, and to measure income in terms of lost household income for a limited duration. Thus, there are four questions used in this paper:

- Inequality aversion in individual Health (IH)
- Risk aversion in individual Health (RH)
- Inequality aversion in household Income (IY), and
- Risk aversion in household Income (RY).

The inequality questions use scenarios that are similar to Z above and contrast them with a reference scenario with no inequality (or risk); the risk questions use scenarios that are similar to Y above and contrast them with the same reference scenario. Note that the Z-type scenarios and the Y-type scenarios are not compared to each other directly. All of the scenarios involve losses over specified numbers of weeks: e.g. seriously ill for two weeks; or losing two weeks' income. The four questions are designed so that they are as similar as possible, allowing any differences observed to be attributed to the parameters of interest.

All the questionnaires use the perspective of a policy maker. In other words, the survey aims to explore the parameters of a social welfare function that the respondents would support, rather than the parameters of their own individual utility function. The questionnaire survey is helped by a visual representation of various scenarios, where respondents choose one scenario over the other, or choose indifference between the two. Each scenario depicts the health, or income, of two population groups. There are four null hypotheses, namely, that people have societal level preferences with no differences between the following:

- inequality aversion and risk aversion regarding losses in health (IH vs RH)
- inequality aversion and risk aversion regarding losses in income (IY vs RY)
- inequality aversion regarding losses in health and losses in income (IH vs IY)
- risk aversion regarding losses in health and losses in income (RH vs RY)

In each question, the respondent is asked to imagine a hypothetical community of 1000 individuals across 250 households of four people each, facing the prospect of a loss for certain, affecting 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 weeks,

and in the two income questions (IY and RY) the loss is for households to lose two weeks' income. In all the questions, respondents are then presented with four pairwise scenarios each made up of alternatives A and B, where alternative A varies across the pairs. Outcome of alternative B is the baseline and involves no inequality or risk; throughout, it is always fixed at all 1000 people (across 250 households) facing a two-week loss for certain. Alternative A varies across the four pairs in the same manner across all four questions and consists of (an expected) 500 people experiencing: a three, four, five, or six-week loss, in this order, while those unaffected suffer no loss. In the inequality questions (IH and IY) the number, 500, that experiences the loss is for certain. 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.

For each of the four scenario pairs, respondents are asked to indicate whether they would choose A, choose B, or that A and B are equivalent. Inequality or risk neutrality is achieved by being indifferent on the second scenario pair, where the loss in alternative A is for four weeks. An even number of scenario pairs was chosen so that the neutral pair does not appear in the middle of the sequence of pairs. A typical respondent is expected to choose A on the first scenario pair, and shift to selecting B at some stage during the following scenario pairs. Once the respondent chooses B (or, if the respondent chooses B at the first pair), the subsequent scenarios are not asked, so as to minimise noise and imprecision.

Table 1 summarises the design, and the IH question with the visual aid, and the visual aid for the RY question are reproduced in the Appendix. (The complete set is available on request.)

<Table 1 here>

The questionnaires have two versions both covering the same four questions: in one version 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 and regarded more difficult. Any potential bias introduced by this ordering is not explored within this study.

The survey also includes information on demographic, socio-economic and other relevant characteristics of the respondents (such as whether they have health care insurance).

Method of analysis

To explore the four null hypotheses, responses are grouped into six categories regarding relative aversion to inequality or risk, captured by the stage at which a respondent switches from alternative A to B (Table 2). The first and last categories are for those who never switch between A and B. The fourth is for (inequality or risk) neutral preferences. The remaining categories collapse those who switch from A to B directly or via the indifference option. The stronger the aversion to inequality or risk, the earlier will be the switch from A to B. Assuming scale independence for inequality aversion and constant relative risk aversion, these aversion categories are directly comparable across the four questions. The distributions of responses are illustrated using a stacked bar chart and cross tabulation.

<Table 2 here>

The four hypotheses (i.e. IH vs RH; IY vs RY, etc) are examined in two ways. First, a chi-squared test for homogeneity (Rohatgi, 1976) is used to compare the proportions in each of the six response categories across the pairs of questions. However, this test does not take into account the ordinal nature of the six categories, and does not necessarily allow the interpretation regarding the strength of aversion involved. Second, building on the ordinal nature of the six categories, a cumulative function is drawn for each question, so that stronger the aversion across respondents, the lower will be the position of the cumulative curve for that question. If the cumulative curves do not intersect, the aversion representing the lower curve would dominate the aversion of the upper curve. The Wilcoxon sign rank test (Wilcoxon, 1945) is used to compare across the cumulative functions of the four pairs of questions.

Furthermore, to examine how individuals respond *across* the four questions, they are classified into different "profiles" depending on their response: S for inequality/risk seeking (i.e. categories 1, 2, and 3 above), N for inequality/risk neutral (category 4), and A for inequality/risk averse (categories 5 and 6). Each respondent is assigned a four-digit profile across the four questions: IH, RH, IY, RH. So for example, AANS will mean the preferences observed were inequality averse in health; risk averse in health; inequality neutral in income; and risk seeking in income. The prevalence of different profiles will be discussed. This exercise does not rely on the assumption of scale independence (in inequality aversion) or constant relative risk aversion.

II. RESULTS

A face to face interview survey of 422 individuals over the age of 18 years was undertaken by a commercial survey company in and around Madrid and Barcelona in Spain in July 2012. Interviews were undertaken in the respondent's home by trained interviewers. Recruitment followed set quotas for age and sex, and as a result the achieved sample is representative in these variables: 48.6% of the respondents were male, with average age of 45.8 (SD 17.0); and 51.4% female, with average age of 46.7 (SD 17.1).

Across all the question pairs, most respondents chose either alternative A or B, and few indicated indifference. Across the four questions, four different respondents chose indifference in two consecutive scenarios pairs. Given their ambiguity, these four cases were excluded from the baseline analysis, leaving a total of 418 respondents who each provided valid responses to all four questions. According to the chi-squared tests for homogeneity, the two different versions of the questionnaire (health first and income first) did not significantly affect the results of IH, RH and RY ($p=0.536$; $p=0.243$; and $p=0.762$ respectively) but did affect the results of IY ($p= 0.017$) in such a way that those who were given the health version first showed a stronger aversion to income inequalities than those who were given the income version first. All subsequence analyses pool across the two versions, and therefore are not affected by this.

The distribution of the responses at each pair is reported in the Appendix. The stacked bar chart in Figure 1 summarises the results across the six relative aversion categories. In IH, just under half (45%) are inequality seeking while a similar proportion (43%) are inequality averse. In the remaining three questions, the majority are averse. As can be seen, 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 RI, IY and RH. More specifically, prevalence of neutrality ranges from the

6.7% for risk questions (both RH and RI) to 9.3% for IY and the highest at 11.0% for IH.

<Figure 1 here>

Table 3 cross-tabulates the frequencies for each relevant pair of questions. The analysis of the first hypothesis (IH vs RH) is illustrated in panel (a), where 44.5% of the respondents are in one of the shaded diagonal cells, and thus fall in the same relative aversion category for inequality and risk in the health context; 32.8% of the respondents appear on the upper right half of the panel, and so are more risk averse than inequality averse; the remaining 22.7% are located in the lower left half, and are more inequality averse than risk averse. Note that 14 respondents are in the most inequality seeking category (1 for IH) *and* in the most risk averse category (6 for RH). At the opposite end, two respondents are in the most inequality averse category (6 for IH) *and* the most risk seeking category (1 for RH).

<Table 3 here>

Regarding the second hypothesis for income (IY vs RY), the picture in panel (b) is different: 49.8% of respondents are in the same relative aversion category for inequality and risk. The rest are split roughly evenly so that 28.5% are more inequality averse than risk averse; and 21.8% are more risk averse than inequality averse. Eight respondents are in the most inequality averse category (6 for IY) *and* the most risk seeking category (1 for RY). The same number of respondents is at the opposite extreme (1 for IY and 6 for RY).

Regarding the third hypothesis (IH vs IY), panel (c) shows that 44.7% of respondents are in the same aversion categories for income inequality and health inequality; the

majority of these (40.7% of the total) are more averse to income inequality than to health inequality; while 14.6% are more averse to health inequality than to income inequality. Three respondents are in the most inequality averse category for health (6 for IH) *and* in the most inequality seeking category for income (1 for IY), while a much larger number, 20, are in the opposite corner.

Regarding the fourth hypothesis (RH vs RY), panel (d) shows that the majority of respondents (58.9%) are in the same risk aversion category for health and income; 15.6% are more risk averse in health than in income; and the reverse applies for 25.6%. Four respondents are in the most risk averse category for health (6 for RH) *and* the most risk seeking category for income (1 for RY), while 13 respondents have the opposite combination.

In total, there are 72 instances where an individual is in category 1 for one question and category 6 for the other. These instances are attributable to 45 individuals, who, in terms of background characteristics, are not statistically significantly different from the overall sample (results not shown).

Regarding the four hypotheses, firstly, the chi-squared test for homogeneity tests the equality of proportions across pairs of questions in the cross-tables (i.e. it compares the relative frequencies down the seventh column "ALL" against those along the seventh row "ALL" of each table). Of the four hypotheses, the first three result in statistically significantly different proportions, although they cannot provide an interpretation on the strength of preferences. The fourth hypothesis (RH vs RY) is not significant.

Secondly, the Wilcoxon sign rank test examines the equality of each relevant pair of distributions and is based on the cumulative distributions illustrated in Figure 2. Of the four hypotheses, the first, the third, and the fourth are significant, while the second (IY

vs RY) is not. This test allows the interpretation in terms of strength of preferences. Thus, in the health context risk aversion is stronger than inequality aversion; but in the income context, there is no significant difference. Furthermore, across the contexts, aversion to inequality and aversion to risk are both stronger in income than in health.

<Figure 2 here>

Finally, with relation to the four excluded cases involving indifference in two consecutive scenarios pairs, sensitivity analyses have been conducted by putting them back in. The first sensitivity analysis takes the first indifference as the real preference and replaces the second with a preference for B; the second sensitivity analysis replaces the first indifference with a preference for A and takes the second indifference as the real preference. All the statistical tests are robust and unaffected by the inclusion or otherwise of these respondents.

Table 4 shows the individuals' inequality/risk aversion profiles throughout the four health and income questions; these groups are ordered from the most prevalent to the least, and the table presents the 13 most frequent profiles which account for just over 80% of respondents. Of the total, 39.9% of respondents gave similar responses across all four questions (AAAA, SSSS, or NNNN). The mode of the distribution is given by profile AAAA (i.e. inequality averse and risk averse in both contexts), which covers 25.8% of respondents. This group is followed by the profile SSSS (i.e. inequality seeking and risk seeking in both contexts), with 12.2% of respondents. Less than 1.9% gave neutral preferences across all of the questions (NNNN).

<Table 4 here>

If we look at those individuals who have a mix of attitudes across health and income, we find several patterns. For example, 9.0% of the respondents have the same preferences *within* but different *across* health and income. In order of prevalence, the different profiles are SSAA (6.7% of the total), AASS (1.2%), SSNN (<0.7%) and the rest (NNSS, NNAA, AANN) account for another 0.7%. Therefore, those individuals with different preferences across health and income tend to be more averse in income than in health. Those who have the same preferences *within* but different across inequality and risk make up 11.0% of the total, comprising SASA (4.8%), ASAS (3.1%), and others (NSNS, NANA and ANAN: 3.1%). So, individuals who have different preferences across inequality and risk tend to be more averse to risk than to inequalities.

III. DISCUSSION

In this study we find evidence suggesting that preferences regarding inequality and risk aversion are not the same *within* the health or the income context, nor across the two contexts. Inequality/risk averse preferences have the greatest support followed by inequality/risk seeking preferences, with inequality/risk neutral preferences coming last. The median respondents in each of the four questions analysed in this paper are: inequality neutral regarding health; risk averse in health; inequality averse in income; and risk averse in income.

Based on the test for homogeneity using the relative aversion categories ranging from 1 (maximum inequality/risk seeking) to 6 (maximum inequality/risk aversion), three comparisons (IH vs RH; IY vs RY; IH vs IY) result in significantly different distributions across the pairs of questions. However, when the cumulative distributions

are compared building on the ordinal nature of the six categories, a different set of three comparisons (IH vs RH; IH vs IY; RH vs RY) emerge with significant results. Thus, the first (IH vs RH) and the third (IH vs IY) null hypotheses are robustly rejected: in the context of health, risk aversion is stronger than inequality aversion; and across contexts, inequality aversion is stronger for income than for health. Regarding the second hypothesis (IY vs RY), while the distributions across the six categories are different, as can be seen in Figure 2 the cumulative functions intersect, and thus are not statistically significantly different from each other. With respect to the fourth hypothesis (RH vs RY), the opposite is the case: while the distributions across the six categories are similar, risk aversion in income is consistently stronger than risk aversion in health (the RY curve is always lower than the RH curve in Figure 2), which the sign rank test has captured. Across these two tests, the Wilcoxon sign rank test should be given more weight than the homogeneity test, because the latter does not account for the ordered nature of the six categories. Therefore, we interpret the results here to mean that while the fourth hypothesis may be rejected, the second cannot.

Out of the possible 24 different profiles representing different patterns of preferences across the four questions, there are four of them that cover more than half the respondents. Firstly, the two most prevalent profiles, which account for almost half of the respondents, are those who are averse across all four questions, or seeking throughout; on the other hand, a neutral preference throughout is a much less prevalent profile. Secondly, people who have different preferences across health and income tend to be more averse in income than in health, whilst individuals who have different preferences across inequality and risk tend to be more averse to risk than to inequalities.

As was noted above, when people were asked in a previous study by Keller and Sarin (1988) to choose on behalf of others between two health scenarios of equal expected

value, where one scenario (Y) involved ex post inequality but no uncertainty in total gains, and the other scenario (Z) involved no ex post inequality but an uncertainty in total gains, respondents preferred Z over Y. If so, we may expect a stronger aversion to inequality than to risk. However, the results here disagree. In health, they suggest weaker aversion to inequality than to risk (and in income, no stronger aversion to inequality than to risk). One possibility is framing. As in Keller and Sarin, where respondents are faced with Y and Z directly, the ex post inequality element may be more prominent than the uncertainty in total gains (and especially so, if the difference is between life and death as in their study). On the other hand, in this study, respondents compared Y against a reference (with no uncertainty and no inequality); and then compared Z against the same reference. This presentation may have helped respondents to pick up the key features of each scenario.

Another finding to note is the stronger inequality (and risk) aversion in income than in health, disagreeing with Anand (2002). However, it should also be noted that this paper does not test directly whether Anand's argument has empirical support. Firstly, while Anand does not distinguish between gains and losses, our survey was entirely framed in terms of losses. Secondly, while Anand's argument refers to mortality and permanent disability, the measure of health used in our study was temporal illness. Thirdly, the interviews were conducted in June and July 2012, and it is possible that the on-going crisis affecting the Spanish economy may have led individuals to become relatively more sensitive to financial losses than to health losses; however, we cannot test for this as we have no qualitative information on the motivation behind the responses.

These results should be interpreted with care and we discuss six points. First, in this study we decided to consider scenarios in losses rather than gains, both for practical reasons regarding the comparison between the health and income contexts, and also to

enhance the credibility of the questions presented to respondents. However, there is evidence that suggests people feel losses more intensively than gains of the same value (Tversky and Kahneman 1991). If that is the case, our results may have overestimated the levels of aversion; whether this may have affected the health and income contexts differently is something that is not known.

Second, on the other hand, with respect to previous studies that compared inequalities in lifetime health, our study has considered losses at a relatively small scale, mainly in order to make the losses in the health and the income contexts as independent as possible. 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. If so, discrepancy observed between the questions may be underrepresented. However, it is unlikely that the differences observed were exaggerated because of the use of losses over short periods under six weeks.

Third, in the questions used, the losses in health happen to individuals while the losses in income happen to individuals clustered in households. Although the questions were designed so that the number of individuals affected is always matched between the health and the income questions, and the income questions stated that all households consist of four individuals, this complete correlation between the context (health vs income) and the parties in the scenarios (individuals vs households) may have had an effect on the responses. The extent of possible bias introduced by this cannot be examined in this study.

Fourth, regarding the comparison of inequality and risk aversion between the health and the income contexts, the four questions have been designed as similar as possible, so that differences observed in answers can be attributed to the parameters of interest. In

particular, the relative size of the losses are controlled so that the reference (alternative B) involves two units of loss for certain, while the alternative scenarios range from three to six units of (expected) loss, allowing the direct comparison of the distribution of responses across the questions, without involving an exchange rate between serious ill health and income. However, this assumes that social welfare satisfies scale independence and constant relative risk aversion, which is not tested within the study.

Fifth, the questionnaire deliberately had an even number of pairs of scenarios, so that the inequality/risk neutral (or indeed any) scenario did not appear in the middle. Given this, it is relevant to note that the overwhelming majority of the indifference answers in any of the questions appear in category 4, corresponding to the "neutral" pair. This scenario structure could have biased the results in favour of inequality/risk seeking options, as there were two "seeking" pairs and one "aversion" pair around the "neutral" option. However, there is no reason to think that this potential bias had different effects across the four questions.

Sixth, the questionnaire has two versions, both covering the same four questions: in one version health questions are asked first, whilst in the other version the income questions are asked first. The two versions did not significantly affect the results of IH, RH and RY but results of IY were affected. The pooled analysis corrects for biases arising from the ordering of the topics.

On the other hand, the sequence in which the scenarios are presented may have a few implications. Once a respondent starting from alternative A switched to choosing B, the subsequent scenarios 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 (if the respondent was intending to switch back from B to A in the next pair,

there is no opportunity to observe this). 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 later questions than the earlier ones, and picked up through the comparison of the two questionnaire versions. 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. However, if all four questions were affected similarly, then it should not affect the results of this paper.

IV. CONCLUSION

This paper has compared across four kinds of aversion in societal preferences: inequality aversion in health, inequality aversion in income, risk aversion in health, and risk aversion in income. They were explored through face to face interviews of members of the general public using hypothetical scenarios involving losses in either health or income. In general, whilst in health there is a stronger risk aversion than inequality aversion, we cannot say the same in the income context, where attitudes to inequality aversion and risk aversion are similar. In addition, inequality aversion and risk aversion are both stronger in income than they each are in health.

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REFERENCES

ABÁSOLO, I. and TSUCHIYA, A. (2004). Exploring social welfare functions and violation of monotonicity, an example from inequalities in health, *Journal of Health Economics*, 23, 313-329.

ABÁSOLO, I. and TSUCHIYA, A. (2008). Understanding preferences for egalitarian policies in health, are age and sex determinants? *Applied Economics*, 40, 2451-2461.

ABÁSOLO, I. and TSUCHIYA, A. (forthcoming) Is more health always better?, exploring public preferences that violate monotonicity, *Theory and Decision*.

AMIEL, Y. and COWELL, F.A. (1994). Income inequality and social welfare, in J. Creedy (Ed.) *Taxation, poverty and income distribution*, 193-219. Edward Elgar.

AMIEL, Y. and COWELL, F.A. (1999). *Thinking about Inequality*, Cambridge University Press

AMIEL, Y., CREEDY, J. and HURN, S. (1999). Measuring attitudes towards inequality, *Scand. Journal of Economics*, 101 (1), 83-96.

AMIEL, Y., COWELL, F.A. and GAERTNER, W. (2012). Distributional orderings, an approach with seven flavors, *Theory and Decision*, 73(3), 381-399.

ANAND, S. (2002). The concern for equity in health. *Journal of Epidemiology and Community Health*, 56, 485-87.

ATKINSON, A.B. and BOURGUIGNON, F. (1982). The comparison of multi-dimensioned distributions of economic status. *Review of Economic Studies*, XLIX, 183-201.

BOLTON, G. and OCKENFELS, A. (2002). The behavioural trade-off between efficiency and equity when majority rules, Max Planck Institute of Economics, Strategic Interaction Group Discussion Paper.

BROOME, J. (1982). Equity in risk bearing. Operations Research 30(2), 412-414.

CARLSSON, F., DARUVALA, D., and JOHANSSON-STENMAN, O. (2005). Are people inequality averse or just risk averse?, *Economica*, 72, 375-396.

CHAMBERS, CH. (2009). Inequality aversion and risk aversion. *Social Science Working Paper* 1300, California Institute of Technology.

DIAMOND, P.A. (1967). Cardinal welfare, individualistic ethics and interpersonal comparisons of utility, comment. *Journal of Political Economy*, 75,765-766

DOLAN, P. and TSUCHIYA, A. (2005). Health priorities and public preferences, the relative importance of past health experience and future health prospects, *Journal of Health Economics*, 24, 703-714.

ECHAZU, L. and NOCETTI. D. (2012). Priority setting in health care, Disentangling risk aversion from inequality aversion, *Health Economics*, forthcoming

ENGELMANN, D. and STROBEL, M. (2004). Inequality Aversion, Efficiency, and Maximin Preferences in Simple Distribution Experiments, *The American Economic Review*, 94(4), 857-869.

FERRER-I-CARBONELL, A. and RAMOS, X. (2010). *Inequality Aversion and Risk Attitudes*, IZA DP 4703 [http,//ferrer.iae-csic.org/Ineq&Risk-IZAdp4703.pdf] accessed 6 Sep 2012

GAERTNER, W. and SCHOKKAERT, E. (2012). *Empirical Social Choice. Questionnaire, experimental studies on distributive justice*. Cambridge University Press. New York.

HAUSMAN, D. (2007). What's wrong with health inequalities?, *The journal of political phyilosophy*, 15, 1, 46-66.

Keller, L.R. and Sarin, R.K. (1988). Equity in social risk, Some empirical observations. Risk Analysis;8(1),135-146.

Kroll, Y. and Davidovitz, L. (2003). Inequality aversion versus risk aversion, *Economica*, 70,19-29.

ROHATGI, V.K. (1976) An introduction to probability theory and mathematical statistics. John Wiley & Sons, New York .

SCHWARZE, J. and HARPFER, M. (2007). Are People Inequality Averse, and Do They Prefer Redistribution by the State? Evidence from German Longitudinal Data on Life Satisfaction. *Journal of Socio-economics*, 36(2), 233-249

TOBIN, J. (1970). On limiting the domain of inequality, *Journal of Law and Economics*, 13, 263-277

TSUCHIYA, A. and MIYAMOTO, J. (2009). *Social Choice in Health and Health Care (chapter 20)* in Anand, P., Puppe, C., Pattanaik, P. eds, Handbook of Rational and Social Choice, Oxford University Press.

TVERSKY, A. and KAHNEMAN, D. (1991). Loss aversion and riskless choice, a reference dependent model. *Quarterly Journal of Economics*, 106(4), 1039-1061.

WAGSTAFF, A. (2002). Inequality aversion, health inequalities and health achievement, *Journal of Health Economics*, 21(4), 627-641

WILCOXON, F. (1945). Individual comparisons by ranking methods. *Biometrics* 1, 80-83

WILLIAMS, A. (1997). Intergenerational equity, an exploration of the 'fair innings' argument, *Health Economics*, 6, 117-132.

TABLES AND FIGURES

TABLE 1: THE LOSSES ASSOCIATED WITH ALTERNATIVE A IN EACH TYPE OF QUESTION

	Health (H)	**Income** (Y)
Inequality (I) (No uncertainty)	**IH**: 500 individuals become seriously ill for X weeks	**IY**: 500 individuals across 125 households loose X weeks' income
Risk (R) (No inequality)	**RH**: 50% chance that all 1000 individuals become seriously ill for X weeks	**RY**: 50% chance that all 1000 individuals loose X weeks' income

1. Alternative B is fixed at 1000 individuals experiencing the loss for two weeks
2. X takes values 3, 4, 5, 6 across four scenario pairs
3. In all questions, X=4 represents neutrality

TABLE 2: DEFINITION OF CATEGORIES ACCORDING TO TYPES OF PREFERENCE

Relative aversion Category	Type of preference
1	A throughout the four scenario pairs
2	A at the first three scenario pairs, and either indifferent or B at the last
3	A at the first two scenario pairs, and either: indifferent at the third and B at the fourth; or B at the third
4	A at the first scenario pair and indifferent at the second and B at the third;
5	Either A or indifferent at the first scenario pair, and B at the second
6	B at the first scenario pair

TABLE 3: RELATIVE AVERSION CATEGORIES REGARDING INEQUALITY/RISK IN HEALTH/INCOME (NUMBER OF INDIVIDUALS IN EACH PAIR)

(a) INEQUALITY-RISK AVERSION IN HEALTH

Aversion to health inequalities	Aversion to health risk 1	2	3	4	5	6	ALL
1	33	2	9	0	4	14	62
2	2	3	9	1	3	4	22
3	4	2	44	6	31	19	106
4	0	5	11	16	10	4	46
5	5	1	15	4	51	21	97
6	2	2	9	1	32	39	85
ALL	46	15	97	28	131	101	418

Test for homogeneity (IH vs RH): chi2(5)=14.9; p=0.011

(b) INEQUALITY- RISK AVERSION IN INCOME

Aversion to income inequalities	Aversion to income risk 1	2	3	4	5	6	ALL
1	18	4	4	1	3	8	38
2	2	2	5	1	2	1	13
3	4	3	30	1	20	10	68
4	0	0	9	18	12	0	39
5	1	1	16	3	57	19	97
6	8	6	18	4	44	83	163
ALL	33	16	82	28	138	121	418

Test for homogeneity (IY vs RY): chi2(5)= 17.1; p=0.004

(c) INEQUALITY AVERSION HEALTH-INCOME

Aversion to health inequalities	Aversion to income inequalities 1	2	3	4	5	6	ALL
1	23	2	6	3	8	20	62
2	3	3	7	1	4	4	22
3	7	3	32	9	21	34	106
4	0	2	5	25	7	7	46
5	2	1	13	1	43	37	97
6	3	2	5	0	14	61	85
ALL	38	13	68	39	97	163	418

Test for homogeneity (IH vs IY): chi2(5)= 41.5; p=0.000

(d) RISK AVERSION HEALTH-INCOME

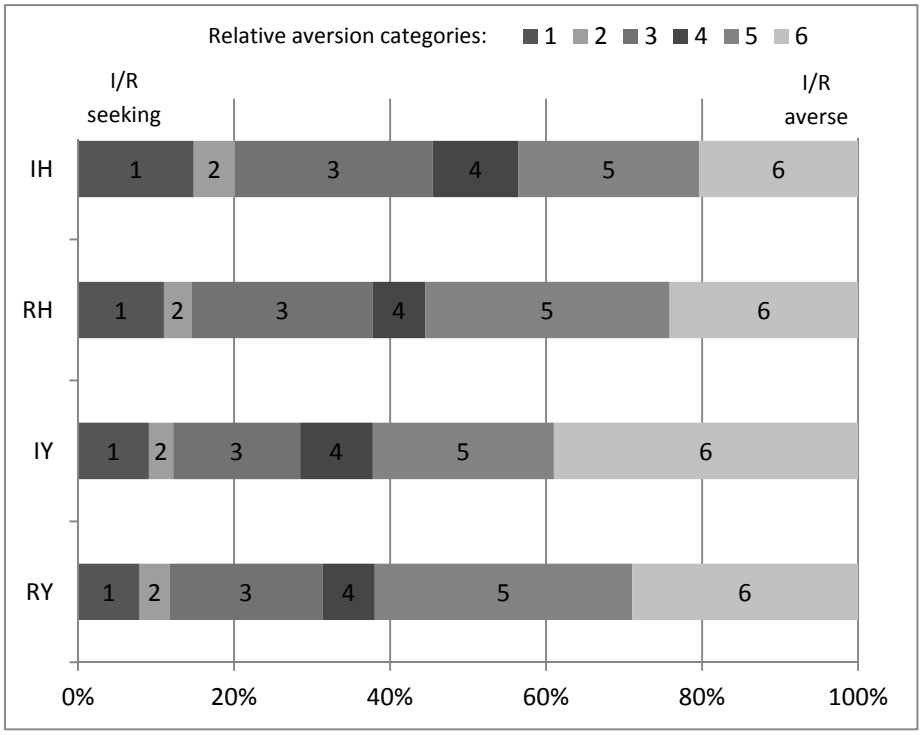
Aversion to health risk	Aversion to income risk 1	2	3	4	5	6	ALL
1	22	2	4	2	3	13	46
2	1	4	6	1	2	1	15
3	3	6	47	2	30	9	97
4	0	0	3	18	6	1	28
5	3	2	13	5	83	25	131
6	4	2	9	0	14	72	101
ALL	33	16	82	28	138	121	418

Test for homogeneity (RH vs RY): chi2(5)=5.4; p=0.368

TABLE 4. PROFILES ACCORDING TO INEQUALITY/RISK AVERSION IN HEALTH AND INCOME (DISTINGUISHING THE 80%MOST FREQUENT CATEGORIES)

INDIVIDUAL PROFILE	Nº	%
AAAA	108	25.8%
SSSS	51	12.2%
SAAA	38	9.1%
SSAA	28	6.7%
SASA	20	4.8%
ASAA	16	3.8%
AASA	15	3.6%
AAAS	14	3.3%
SSAS	13	3.1%
ASAS	13	3.1%
NNNN	8	1.9%
SSSA	7	1.7%
SAAS	7	1.7%
Others	80	19.1%
ALL	418	
(IH -RH - IY - RY)		
A=Averse; S= Seeking; N=Neutral		

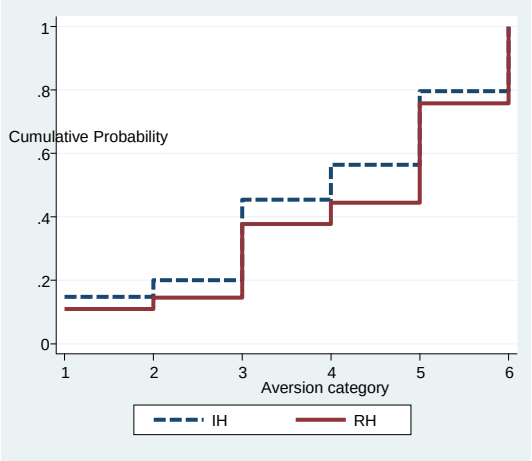
FIGURE 1. INDIVIDUALS REPORTING DIFFERENT RELATIVE AVERSION CATEGORIES (NUMBER AND PERCENTAGES: N=418)



NB: The relative aversion categories range from 1 (maximum seeking) to 6 (maximum aversion), with 4 for neutrality. All questions add up to 418 respondents.

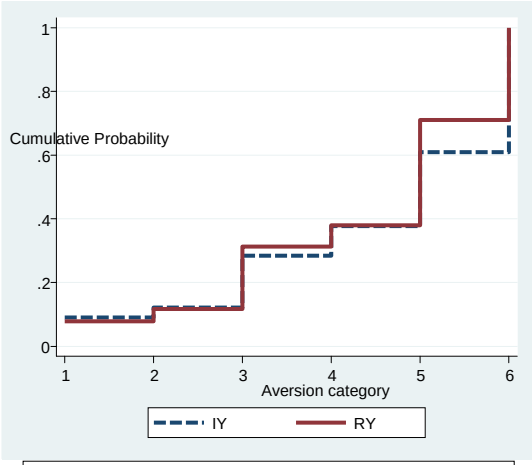
FIGURE 2. AVERSION LEVEL TO INEQUALITY/RISK IN HEALTH/INCOME (CUMULATIVE PROBABILITY DISTRIBUTIONS)

(a) INEQUALITY-RISK AVERSION IN HEALTH



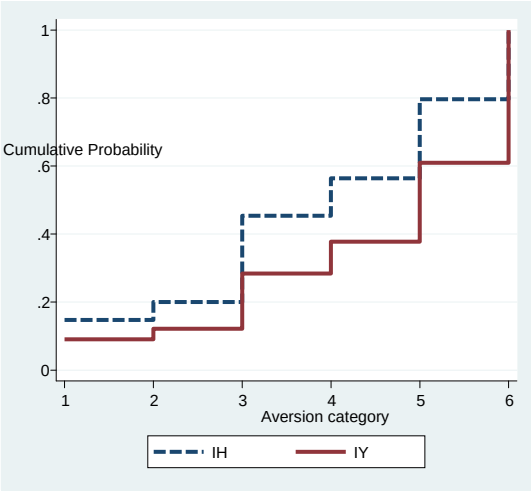
Wilcoxon sign rank test z=-3.289; p=0.001

(b) INEQUALITY- RISK AVERSION IN INCOME



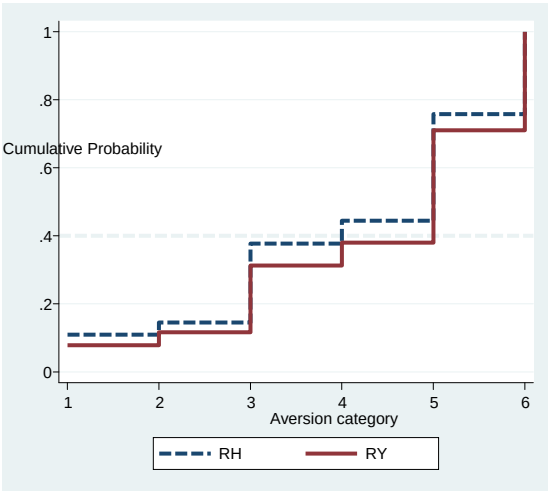
Wilcoxon sign rank test z=1.798; p=0.072

(c) INEQUALITY AVERSION HEALTH-INCOME



Wilcoxon sign rank test z=-7.386; p=0.000

(d) RISK AVERSION HEALTH-INCOME



Wilcoxon sign rank test z=-3.243; p=0.001

APPENDICES

APPENDIX 1: EXAMPLE OF QUESTIONNAIRE WORDING (ORIGINAL IN SPANISH)

Introduction to IH and RH. In the next questions, imagine a community of 1,000 individuals. We are going to talk about the health of this community in the following year: some individuals in the community will be healthy, others will be seriously ill for two weeks, others will be seriously ill for three weeks, others for four weeks, etc. We want you to think how to share those weeks of illness across the individuals of the community.

You are not one of the members of this community, but please imagine that **your opinion will be taken into account by the public authorities** who have to make a decision for them. There are no right or wrong answers.

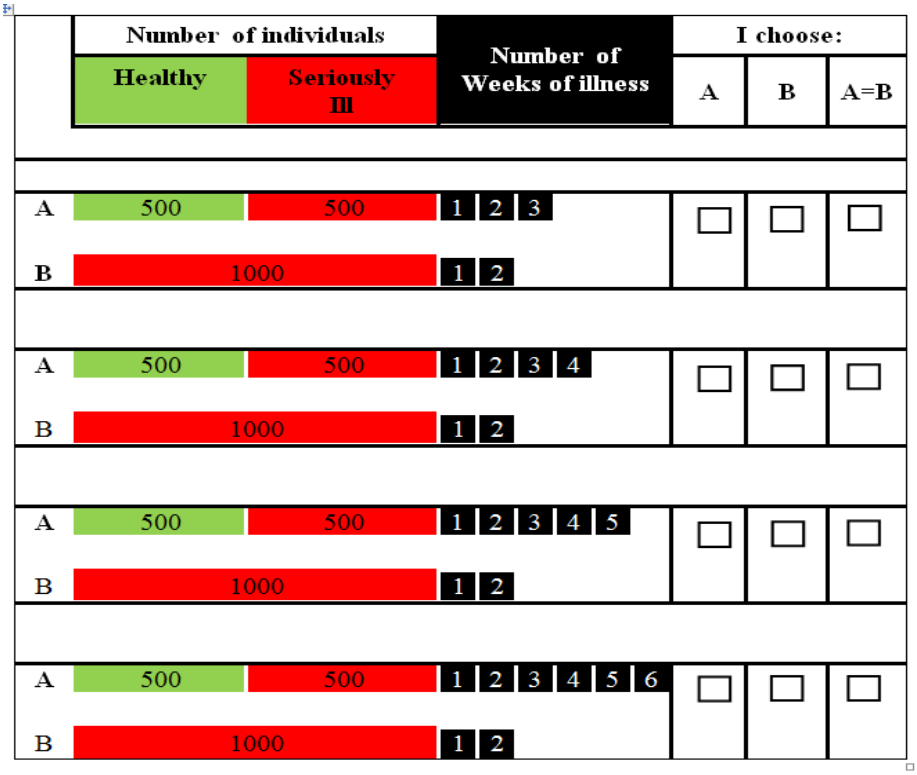
All the weeks with illness happen at random: i.e. on different and separate weeks. On different weeks means there will be no single week when a substantial proportion of the workforce is off sick at once. On separate weeks means they are non-consecutive. After this illness the individual recovers completely (there are no after-effects). There are no other illnesses. There is nothing individuals can do to change these outcomes.

IH. For each of the following four scenarios, we are going to show you two alternatives (A and B) between which we ask you to choose. Both alternatives A and B are feasible and would cost the same to society.

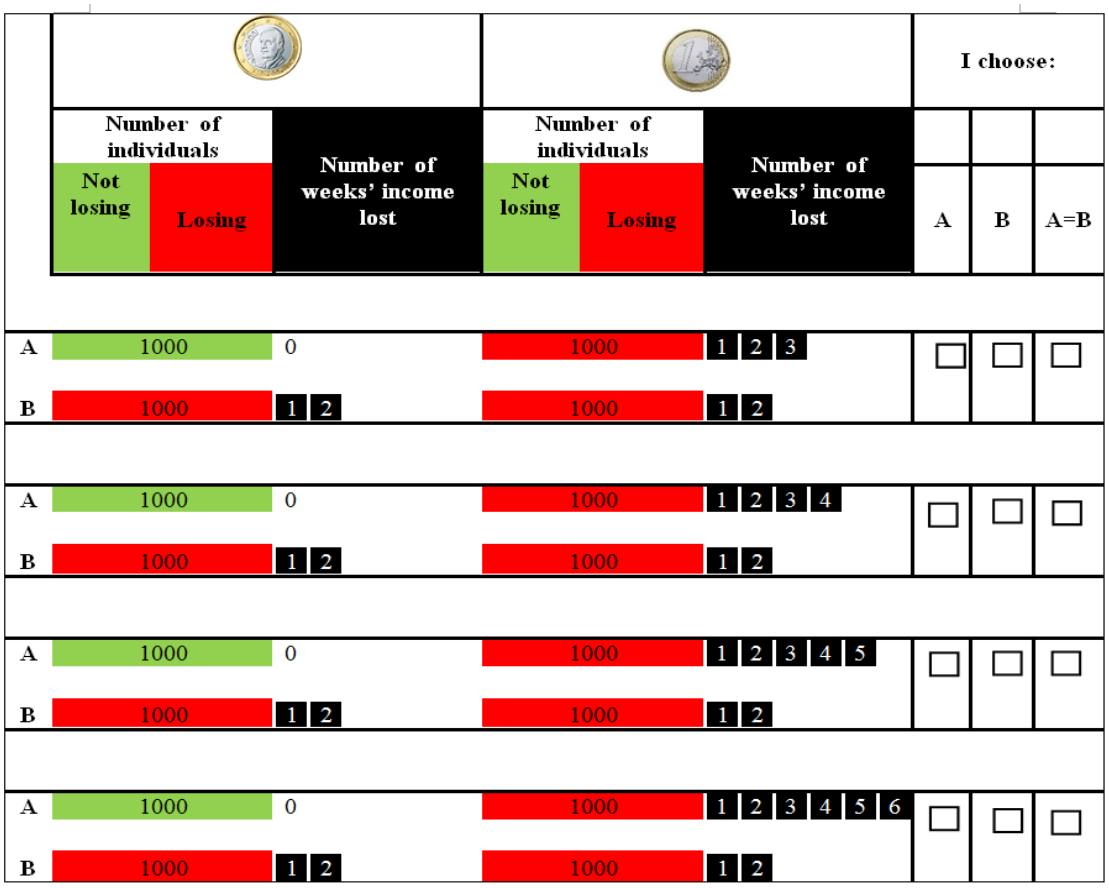
Outcome of Alternative (A): one half (500 individuals) will not be ill (i.e. they will be healthy) and the other half (500 individuals) will be seriously ill for 3 weeks.

Outcome of Alternative (B): everybody will be seriously ill for 2 weeks.

EXAMPLE VISUAL AID FOR IH



EXAMPLE VISUAL AID FOR RY



APPENDIX 2: DISTRIBUTION OF ALL VALID RESPONSE OPTIONS

Scenario	Alternative	IH		RH		IY		RY	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
1	A	331	79.2%	316	75.6%	255	61.0%	294	70.3%
	I	2	0.5%	1	0.2%	0	0.0%	3	0.7%
	B	85	20.3%	101	24.2%	163	39.0%	121	28.9%
2	A	190	45.5%	158	37.8%	119	28.5%	131	31.3%
	I	46	11.0%	28	6.7%	39	9.3%	28	6.7%
	B	182	43.5%	232	55.5%	260	62.2%	259	62.0%
3	A	84	20.1%	61	14.6%	51	12.2%	49	11.7%
	I	5	1.2%	4	1.0%	2	0.5%	6	1.4%
	B	329	78.7%	353	84.4%	365	87.3%	363	86.8%
4	A	62	14.8%	46	11.0%	38	9.1%	33	7.9%
	I	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	B	356	85.2%	372	89.0%	380	90.9%	385	92.1%

NB. A, B, and I indicate the chosen option (A, B or indifferent, respectively). Four observations given by four respondents across four different questions were excluded on the basis of ambiguity. (I-I-B-B) for IH; (A-I-I-B) for RH; (I-I-B-B) for IY; (I-I-B-B) for RY.