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Are People Inequality-Averse, or Just Risk-Averse?

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Individuals' preferences for risk and inequality are measured through choices between imagined societies and lotteries. The median relative risk aversion, which is often seen to reflect social inequality aversion, is between 2 and 3. Most people are also found to be *individually* inequality-averse, reflecting a willingness to pay for living in a more equal society. Left-wing voters and women are both more risk and inequality-averse than others. The model allows for non-monotonic SWFs, implying that welfare may decrease with an individual's income at high-income levels, which is illustrated in simulations based on the empirical results.

Introduction

As Amiel and Cowell put it, 'Any parent with two or more children needs no formal analysis to be persuaded of the importance of distributional justice' (1999, p. 1). It is also clear that equity and inequality issues are important in public debate. Given that inequality is perceived as something disagreeable, what is the magnitude of this aversion? In most previous research, measures of social inequality aversion are based on the degree to which marginal utility of income decreases with income, corresponding to individual risk aversion (see e.g. Stern 1977; Christiansen and Jansen 1978; Amiel *et al*. 1999). Loosely speaking, the more concave the utility function, the larger the relative risk aversion, implying that an individual choosing between different societies behind a veil of ignorance would be willing to trade off more in terms of expected income in order to achieve a more equal income distribution (Vickrey 1945; Harsanyi 1955). Therefore, individuals' risk aversion may also be seen as a measure of social inequality aversion. The empirical parameter estimates of individual relative risk aversion vary considerably, but values in the 0.5–3 interval are often referred to. According to Dasgupta (1998, p. 145, fn. 11), the empirical evidence based on choices under uncertainty suggests a value of around 2, or slightly larger. Blanchard and Fischer (1989, p. 44) report that the results based on intertemporal choices are often around or larger than unity.

However, individuals may also have a willingness to pay for living in a more equal society *per se*, which we refer to in this paper as 'individual inequality aversion'. We therefore estimate individual *risk* aversion and *inequality* aversion separately, using what Amiel and Cowell (1999) refer to as a questionnaire-experimental method.[1] We also discuss possible welfare implications resulting from the assumption that individuals are both risk and inequality-averse.

Johansson-Stenman *et al*. (2002) explicitly utilize the idea of choices behind a veil of ignorance, where the respondents make trade-offs between mean income and inequality in (hypothetical or imagined) societies, as a way of estimating the degree of relative risk aversion.[2] However, the risk aversion

estimated from this experiment reflects individuals' preferences towards both risk and inequality in the society.[3] Following the basic experimental design in Johansson-Stenman *et al*., we extend the analysis by designing and performing two new experiments, in which the respondents choose what is in the best interest of their imaginary grandchildren. In the first experiment individuals choose between hypothetical *lotteries*, where the outcomes determine their grandchildren's incomes in a given society. This experiment allows for the estimation of the individual's risk aversion in a setting where the level of social inequality is fixed. In the second experiment individuals choose between hypothetical *societies* with different income distributions, where the grandchildren's incomes are known and are always equal to the mean income in each society. This experiment enables us to estimate parameters of individual inequality aversion in a risk-free setting.

There are several studies in which preferences regarding inequality have been identified or measured, including Loewenstein *et al*. (1989), Beck (1995), Bukszar and Knetsch (1997) and more recently Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), where the latter two proposed and parameterized different versions of individual inequity aversion based on extensive empirical evidence from dictator, ultimatum and other similar games. Generally, there is by now much empirical evidence that people are *not* motivated solely by their own monetary payoffs, and alternative theories in which people have concerns regarding equality and fairness are therefore proposed (see e.g. Fehr and Fischbacher 2002). There is also recent experimental research suggesting that people may have preferences for overall efficiency as well, in addition to their own payoffs and the degree of payoff inequality among subjects (Bolton and Ockenfels 2002; Charness and Rabin 2002; Engelmann and Strobel 2005; Guth *et al*. 2002). For example, an individual whose task is to choose among different allocations to himself and two other individuals may care about the total sum of money given to them, in addition to the amount of money given to himself and the distributional equity between them. Naturally, there are several ways to quantify this trade-off, which may also depend on the specific set-ups of the experiments. Partly for these reasons, it is hard to find any consensus regarding the relative importance of equity and efficiency in this literature. For example, Engelmann and Strobel (2005) find that the influence of efficiency is stronger than that of inequality aversion, whereas Bolton and Ockenfels (2002) conclude the opposite.

However, in either case it is not straightforward to generalize the finding from a two (or few)-person setting, which also typically involves small stakes, to a social setting. Do people also care about the overall income inequality in society, and if so how much do they care? This is one reason why our experimental choices are between *hypothetical* or imagined, rather than *actual*, lotteries and societies, even though there are well-known potential problems with this as well. However, we argue, following Kahneman and Tversky (1979, p. 265), that choices between large hypothetical payoffs can reveal useful information that would not be possible to obtain in experiments with real payoffs, given that the respondents have no particular reason to disguise their true preferences in the hypothetical experiment. It is also, for obvious reasons, difficult to test experimentally real choices between full-scale societies with different degrees of inequality. Nevertheless, the experimental literature that

involves real money is still extremely important for increasing our understanding of individual motivations and behaviours in various kinds of situations.

Amiel *et al.* (1999) conducted a leaky-bucket experiment, where respondents (students) were able hypothetically to transfer money from a rich individual to a poor one, incurring a loss of money in the process. They found a rather low inequality aversion compared with most existing estimates of both risk and inequality aversion. One possible explanation is that some respondents, although inequality-averse, may be opposed to redistribution regardless of the outcome,[4] and another possible explanation is the status quo effect (Samuelson and Zeckhauser 1988). Any implicit redistribution in our case is presumably interpreted much more generally than in a leaky-bucket experiment, and thus any effects of explicit redistribution or preference for the status quo should be less. This is not to say that individuals lack preferences for the specific means of redistribution, such as progressive taxes. Nor do we deny that many may have procedural perceptions of equality and fairness; see e.g. Fong (2001) for a discussion on preferences for distributive justice, and Bolton and Ockenfels (2002) and Bolton *et al.* (2003) for experimental evidence that procedural fairness may sometimes be very important. What we do wish to measure in this study, however, is individuals' preferences regarding income inequality *per se*, and not specifically for any particular method for achieving increased equality.

There is also survey evidence that relative as well as absolute income may matter for people's perceived wellbeing and political preferences (e.g. Oswald 1997; Solnick and Hemenway 1998; Johansson-Stenman *et al.* 2002). In the analysis of responses, such effects are disregarded here for pragmatic reasons, since they would be difficult to disentangle from preferences regarding inequality. However, it is possible, and perhaps even likely, that concerns over the relative position in society influence the responses. Therefore, integrating individual inequality aversion and positional preferences would be a possible extension of the present analysis.

To our knowledge, Kroll and Davidovitz (2003) is the only study that explicitly separates inequality aversion from risk aversion. In an innovative experiment, these authors conducted chocolate bar experiments using eight-year-old children as respondents and found that most of them preferred an equal distribution of bars within the group, holding their own outcome in terms of chocolate bars fixed. Amiel and Cowell (1994a) are also fairly close to our experimental setting. They let students make repeated choices between economic programmes for a hypothetical country, resulting in different income distributions among the five citizens. The task was to choose the programme with the highest social welfare. Interestingly, when testing the axiom of monotonicity, i.e. that social welfare should always increase as a function of an individual's income, they found that a substantial fraction of the respondents made choices in violation of this axiom.[5] As will be shown, this finding is replicated in the present paper.

Section I provides the theoretical framework. This is followed by a description of the experimental design in Section II, and results in Section III. Section IV illustrates some theoretical welfare consequences, and Section V presents the conclusions.

I. The Model

Estimating an individual's inequality aversion solely through his or her aversion to risk disregards the preferences that the individual may have concerning inequality *per se* (see e.g. Thurow 1971). Thus, if the individual is of the view that a more equal distribution of income promotes a more compassionate and caring society coupled with other possible consequences, such as a lower crime rate, then this personal inequality aversion should also be reflected in the individual's (reduced-form) utility function. In general, we can write an individual i's utility as $U^i = u^i(y^i, \Phi)$, where y is own income and Φ is a measure of inequality in the society. If i is individually inequality-averse, then $\partial u^i/\partial\Phi < 0$. Since we are interested in measuring both risk and inequality aversion, we conduct two separate experiments. In the risk aversion experiment the degree of inequality in the society is the same among the alternatives, whereas in the inequality aversion experiment the income for the individual is known; hence there is no risk associated with individual income.

Risk aversion

In order to link the experimental result to economic theory, we use the special class of utility functions that is characterized by constant relative risk aversion (CRRA) as proposed by Atkinson (1970):

$$(1) \qquad u = \begin{cases} Ky^{1-\rho}/(1-\rho), & \rho \neq 1 \\ K \ln y, & \rho = 1 \end{cases}$$

where y is individual income, K is a measure of aspects other than individual income and $\rho = -yu''/u'$ is the relative risk aversion; $\rho = 0$ implies a linear utility function and risk neutrality, whereas $\rho \to \infty$ corresponds to extreme risk aversion of maximin type.

The purpose of the first set of questions in the experiment is to estimate individuals' (relative) risk aversions. The respondents choose between different lotteries within the same society, the outcome of which determines their future grandchildren's incomes. Thus, the degree of inequality in society is unaffected by the choices and the outcomes of the lotteries. The interpretations of the experimental results are based on the assumption that individuals maximize their von Neumann–Morgenstern expected utility functions. The expected utility with an uncertain income y is given by

$$(2) \qquad E(u) = \int_{y_{\min}}^{y_{\max}} u(y) f(y) \mathrm{d}y,$$

where f is the probability density function for income. In the lottery uniform density functions were used, since these are relatively easy for the respondents to understand and interpret. The CRRA utility function and a uniform probability density function imply that expected utility (for $\rho \neq 1,2$) is

$$(3) \qquad E(u) = \frac{K}{y_{\max} - y_{\min}} \int_{y_{\min}}^{y_{\max}} \frac{y^{1-\rho}}{1-\rho} \mathrm{d}y = \frac{1}{(1-\rho)(2-\rho)} \frac{y_{\max}^{2-\rho} - y_{\min}^{2-\rho}}{y_{\max} - y_{\min}}.$$

An individual is then indifferent between lotteries A and B if

$$\frac{y_{\max,A}^{2-\rho} - y_{\min,A}^{2-\rho}}{y_{\max,A} - y_{\min,A}} = \frac{y_{\max,B}^{2-\rho} - y_{\min,B}^{2-\rho}}{y_{\max,B} - y_{\min,B}}. \tag{4}$$

Although there is no algebraic solution to this equation, it is straightforward to solve for ρ, using some standard numerical method.

Inequality aversion

For the inequality aversion experiment, we assumed that the individuals' utility function can be written as:

$$u = h(y\Phi^{-\gamma}), \tag{5}$$

where h is any monotonically increasing transformation, Φ is a measure of income inequality and γ is a parameter of individual inequality aversion which can be interpreted as a (constant) inequality elasticity, reflecting the percentage change in income for a 1% increase in inequality that holds utility constant. There are a number of possible functional forms with various properties, but the present one is attractive for its simplicity. $\gamma = 0$ corresponds to the conventional case where utility is independent of the income distribution *per se*, and $\gamma = 1$ implies that a 1% increase in own income gives as much utility as a 1% decrease in the inequality measure. Hence $\gamma < 0$ reflects inequality-prone preferences, whereas $\gamma > 1$ implies that a 1% decrease in the inequality gives more utility than a 1% increase in own income. There are many other possible measures of inequality, but here we will focus on the coefficient of variation, defined as $\Phi = \sigma_y/\bar{y}$, where σ_y and $\bar{y}$ are the standard deviation and the mean income in the society, respectively. This measure is symmetric, satisfying the principle of transfers, and scale-invariant; i.e., it is unaffected by equal proportional increases in all incomes (e.g. Lambert 1993). Equation (5) can then be rewritten as

$$u = h\left(y\left(\frac{\bar{y}}{\sigma_y}\right)^{\gamma}\right). \tag{6}$$

Here $\gamma = 1$ implies that for a given income standard deviation a 1% increase in own income gives as much additional utility as a 1% increase in society's mean income (through the fact that the degree of inequality in terms of the coefficient of variation will then correspondingly decrease).

The experiment's second set of questions allows us to measure individual inequality aversion. The respondents choose between two deterministic societies where both grandchildren's incomes and the income distributions differ. This choice implies a direct trade-off between a grandchild's income and equality in society. A utility-maximizing respondent would be indifferent between the two societies if $y_A\Phi_A^{-\gamma} = y_B\Phi_B^{-\gamma}$, implying that

$$\gamma = \frac{\ln(y_A/y_B)}{\ln(\Phi_A/\Phi_B)}. \tag{7}$$

The critical parameter of individual inequality aversion for which the respondent is indifferent between A and B is thus a function of the grandchild's income in the two societies and of the income distributions. Suppose an

individual is given the choice between two societies, where in society A the coefficient of variation $\Phi_A = 0.3$, and the individual's monthly income $y_A =$ 24,000 SEK, while in the more equal society B $\Phi_B = 0.2$ and $y_B = 20{,}000$ SEK. A respondent who prefers society B then has a parameter of inequality aversion γ that is larger than 0.45, and vice versa.

II. The Experiments

A total of 324 respondents, all undergraduate students from Karlstad University, participated in the experiments, which were conducted at the beginning or the end of a lecture. Participation was voluntary and there was no remuneration. The experiment consisted of three sections answered by all respondents: (i) the risk aversion experiment, (ii) the inequality aversion experiment and (iii) questions concerning their socioeconomic status. The respondents were given information both verbally and with the use of an overhead projector before each section, in addition to the information given in the questionnaire. The total time for conducting the experiment, including the instructions, varied between 20 and 35 minutes.

In the experiments, respondents made pair-wise choices between hypothetical lotteries/societies characterized by certain attributes such as income outcome, distribution and average income. The respondents were asked to consider the wellbeing of their imaginary grandchildren rather than themselves, since there are reasons to believe that it might be difficult for individuals to liberate themselves from their current circumstances. Their task was then to always choose the alternative that would be in the best interests of their imaginary grandchildren. Our hypothesis is that the respondents either use their own preferences when choosing on their grandchildren's behalf, since they have no (or limited) information regarding their grandchildren's preferences, or, alternatively, that the respondents believe that their grandchildren's preferences would be similar to their own.[6]

The respondents were presented with a background scenario describing the society in general. The respondents were told that very rich and very poor people exist outside the lottery range. This was done to avoid anchoring and lexicographic strategies, for example with respect to the lowest income in society, while responding to the questions. The respondents were informed that there was no welfare state, and that such services were provided instead through private insurance systems. The respondents were given explicit information in terms of typical consumption baskets, about the approximate level of consumption possible at different income levels, and it was emphasized repeatedly that all goods and prices were constant among the alternative lotteries/societies.

The respondents were also informed that there were no dynamic effects, such as higher future growth rates, of any specific income distribution. The final design of the experiment was based on the experiences from several pretests and discussions in focus groups.

Risk aversion experiment

In the first experiment, the respondents made repeated choices in a fixed society between two lotteries, A and B, where the lotteries determined their

grandchildren's income. Both lotteries had a uniform outcome distribution, and the respondents were told that they should place equal probabilities on all outcomes for their grandchildren. They were also told that the outcome of the lotteries would not affect how their grandchildren perceived their jobs in terms of how hard they worked, job satisfaction, etc. It was emphasized that society as a whole, including the income distribution, would be completely unaffected by the respondent's choice and the outcomes of the lotteries. The respondents were also told that the income distribution in the society varied uniformly between 10,000 and 50,000 SEK per month, i.e. as in lottery A, in addition to the small group of people whose incomes were unspecified and lay outside the stated interval. To avoid effects from expected social mobility, the respondents were told that the outcomes of the lotteries determined their grandchildren's *lifetime* monthly incomes; otherwise respondents might have believed that there would be new opportunities for their grandchildren to achieve better success at a later date; cf. Benabou and Ok (2001).

For all choices, lottery A remained unchanged, with income varying uniformly between 10,000 and 50,000 SEK; hence the expected income was 30,000 SEK. Nine different B lotteries were presented, and thus the respondents made nine pair-wise choices. The distribution of the outcome in each lottery corresponds to a certain level of risk aversion at which the respondent is indifferent between the lotteries. The lotteries are presented in Table 1, along with the implicit parameters of relative risk aversion.[7]

Inequality aversion experiment

The structure of the second experiment is similar to the first. The respondents made a number of repeated choices between a fixed society A and various B societies, which were described by their income distributions and an imaginary grandchild's income. There was no uncertainty, and the imaginary grandchild's income was equal to the mean income in each society. In the experiment, no

TABLE 1
LOTTERIES IN EXPERIMENT 1

	Min. income	Mean income	Max. income	Relative risk aversion ρ if indifference between A and B
Lottery A	10,000	30,000	50,000	
Lottery B_1	21,800	32,700	43,600	− 0.5
Lottery B_2	20,000	30,000	40,000	0
Lottery B_3	19,400	29,100	38,800	0.5
Lottery B_4	18,800	28,200	37,600	1
Lottery B_5	17,200	25,800	34,400	2
Lottery B_6	15,800	23,700	31,600	3
Lottery B_7	13,600	20,400	27,200	5
Lottery B_8	12,200	18,300	24,400	8
Lottery B_9	10,000	15,000	20,000	∞

TABLE 2
SOCIETIES IN EXPERIMENT 2

	Min. income	Mean income	Max. income	Inequality aversion γ if indifference between A and B	Equivalent relative risk aversion η if indifference between A and B
Society A	10,000	30,000	50,000		
Society B_1	21,800	32,700	43,600	− 0.12	− 0.5
Society B_2	20,000	30,000	40,000	0	0
Society B_3	19,400	29,100	38,800	0.04	0.5
Society B_4	18,800	28,200	37,600	0.09	1
Society B_5	17,200	25,800	34,400	0.22	2
Society B_6	15,800	23,700	31,600	0.34	3
Society B_7	13,600	20,400	27,200	0.56	5
Society B_8	12,200	18,300	24,400	0.71	8
Society B_9	10,000	15,000	20,000	1.0	∞

explanation was given for the differences in income distribution between the societies.

The respondents' choices now reflect their attitude towards inequality *per se*. The coefficient of variation, Φ, is equal to 0.385 in society A and to 0.1925 in all B societies. The societies are presented in Table 2, along with the implicit parameters of inequality aversion that arise when the respondent is indifferent between societies A and B. To make the results more easily comparable with those from the risk experiment, we also present what we denote *the equivalent relative risk aversion*, η.

Consider a veil of ignorance experiment between two societies where respondents do not know the position of their grandchildren, but only the income distribution and hence also the probability distribution in each society. Suppose that respondents are risk-neutral, but inequality-averse. An analyst who believes the contrary, i.e. the standard view that the respondent is risk-averse and not individually inequality-averse, can then estimate the perceived relative risk aversion. This measure of inequality aversion is what we denote the *equivalent relative risk aversion* η.

Possible hypothetical bias

It is no trivial task to generalize the preferences observed in experiments or surveys to the real world. The respondents might use the survey situation as a means to buy 'moral satisfaction' (Kahneman and Knetsch 1992). For example, if the act itself of choosing a more equitable society gave the respondents moral satisfaction, then the estimates of inequality aversion would be upwardly biased. Similarly, Akerlof and Kranton (2000) argued that self-image or perceptions of identity are important factors in explaining many real-world phenomena. In this case one can, for example, hypothesize that individuals with an egalitarian self-image might compound this image by choosing more equitable alternatives, irrespective of their genuine preferences.

If so, the estimates of individual inequality aversion might be upwardly biased. Furthermore, it is also possible that some individuals might seek to enhance their self-image as risk-taking adventurers, suggesting that the estimates of risk aversion would be downwardly biased. This is consistent with some empirical evidence suggesting that people become more risk-averse in experiments when the amount of money involved increases (Kachelmeier and Shehata 1992). We believe, however, that the framework of choosing for an imagined grandchild, rather than for oneself, limits self-image influences.

III. Results

Descriptive results

There were 306 and 310 valid (consistent) responses for the risk-aversion and individual inequality-aversion experiments, respectively.[8] The results of the relative risk aversion experiment are presented in Table 3. The table shows that the median relative risk aversion lies in the interval between 2 and 3, and that a large fraction of the respondents (63%) have a relative risk aversion between 1 and 5; 5% of the respondents have an extreme risk aversion with a parameter value larger than 8, and 8% were found to be risk-lovers. The results of the inequality aversion experiment are presented in Table 4.

The median value of inequality aversion is in the interval between 0.09 and 0.22, and most responses reflect a positive inequality aversion with relatively few 'extreme' responses; 7% appear to be inequality-lovers, i.e. willing to sacrifice income for a society more unequal than society A, whereas 6% are extremely inequality-averse.[9]

If we compare the equivalent relative risk aversion results from this experiment with the relative risk aversion results from the first experiment, we find that the equivalent relative risk aversion is lower than the actual relative risk aversion, which appears reasonable. The median equivalent risk aversion is between 1 and 2, and the median actual risk aversion is between 2 and 3. At the

Table 3
Results of the Relative Risk Aversion Experiment

Relative risk aversion parameter	No.	Frequency	Cumulative frequency
$\rho < -0.5$	9	0.03	0.03
$-0.5 < \rho < 0$	18	0.06	0.09
$0 < \rho < 0.5$	27	0.08	0.17
$0.5 < \rho < 1$	27	0.08	0.25
$1 < \rho < 2$	60	0.18	0.43
$2 < \rho < 3$	80	0.24	0.66
$3 < \rho < 5$	82	0.21	0.87
$5 < \rho < 8$	27	0.08	0.95
$8 < \rho < \infty$	19	0.04	0.99
$\rho > \infty$*	2	0.01	1.00

*This is of course mathematically impossible; instead, these responses should be seen as incompatible with any monotonous functional form or possibly as reflecting misunderstandings.

TABLE 4
RESULTS OF THE INEQUALITY AVERSION EXPERIMENT

Inequality aversion parameter	Equivalent relative risk aversion	No.	Frequency	Cumulative frequency
$\gamma < -0.12$	$\eta < -0.5$	8	0.03	0.03
$-0.12 < \gamma < 0$	$-0.5 < \eta < 0$	13	0.04	0.07
$0 < \gamma < 0.04$	$0 < \eta < 0.5$	39	0.11	0.18
$0.04 < \gamma < 0.09$	$0.5 < \eta < 1$	36	0.11	0.29
$0.09 < \gamma < 0.22$	$1 < \eta < 2$	78	0.23	0.52
$0.22 < \gamma < 0.34$	$2 < \eta < 3$	71	0.20	0.73
$0.34 < \gamma < 0.56$	$3 < \eta < 5$	37	0.11	0.84
$0.56 < \gamma < 0.71$	$5 < \eta < 8$	28	0.07	0.91
$0.71 < \gamma < 1.0$	$8 < \eta < \infty$	17	0.04	0.95
$\gamma > 1.0$	$\eta > \infty$*	21	0.06	1.00

*This is of course mathematically impossible. This reflects the fact that for such a large inequality aversion it is impossible to interpret the choices (among societies behind a veil of ignorance) in terms of relative risk aversion coefficients.

same time, there are more extreme responses in the second experiment. Furthermore, the correlation coefficient between the estimated parameters in the two experiments is 0.46, which shows that there is a strong correlation between individual risk and inequality aversion.

The approach in this study differs from that of Johansson-Stenman *et al.* (2002), where effects of individual inequality aversion are embedded in the estimates of risk aversion. The estimates of relative risk aversion are therefore expected to be lower in the current experiment. The mean parameter of relative risk aversion in this experiment is equal to 2.4, which can be compared with 3.0 in Johansson-Stenman *et al.* (2002). Hence the difference is in the expected direction.[10] Nevertheless, in light of the rather large estimates of individual inequality aversion, perhaps one would have expected even larger differences.

Econometric analysis

The econometric estimations were undertaken in order to gain insights into the determinants of individual risk and inequality aversion. In the regressions, the dependent variable is either the relative risk aversion parameter or the inequality aversion parameter. In order to account for the fact that we observe interval-censored parameters, we estimate an interval regression model. In the relative risk aversion regression, the two groups with the highest relative risk aversion are grouped together, so that at the extreme we have a group of individuals with a relative risk aversion parameter greater than 8. We estimate two models for each experiment: one where risk and inequality aversion are estimated separately as a function of the explanatory variables, and one where they are estimated simultaneously, and are assumed to depend on each other. The latter model is estimated with two-stage least squares (2SLS).

We observe in Table 5 that the pattern is quite similar for risk and inequality aversion with respect to the signs of the statistically significant parameters associated with the explanatory variables. Females appear to be

TABLE 5
INTERVAL REGRESSIONS OF RELATIVE RISK AVERSION AND INEQUALITY AVERSION PARAMETERS*

	Risk aversion		Inequality aversion		Mean
Variable	Independent estimation	Simultaneous estimation (2SLS)	Independent estimation	Simultaneous estimation (2SLS)	
Intercept	2.700	2.059	0.311	0.168	
	(0.000)	(0.000)	(0.000)	(0.002)	
Female	0.611	0.427	0.09	0.055	0.45
	(0.003)	(0.033)	(0.008)	(0.085)	
No. of siblings	− 0.142	− 0.135	− 0.002	0.054	1.55
	(0.150)	(0.150)	(0.891)	(0.718)	
Votes for a left–wing party	0.898	0.458	0.214	0.166	0.24
	(0.000)	(0.057)	(0.000)	(0.000)	
Education					
Technology	− 1.143	− 0.912	− 0.117	− 0.056	0.34
	(0.000)	(0.000)	(0.008)	(0.188)	
Business	− 0.634	− 0.278	− 0.176	− 0.142	0.42
	(0.026)	(0.317)	(0.000)	(0.001)	
At least one semester in economics	− 0.196	− 0.243	0.021	0.031	0.26
	(0.476)	(0.351)	(0.631)	(0.452)	
Frequent church visitor	− 0.040	− 0.167	0.065	0.067	0.05
	(0.930)	(0.699)	(0.376)	(0.336)	
Grown up in a big city	− 0.357	− 0.442	0.044	0.063	0.11
	(0.271)	(0.152)	(0.391)	(0.199)	
Parents earned less than average	0.047	− 0.049	0.048	0.046	0.19
	(0.855)	(0.840)	(0.242)	(0.235)	
Grandchild expected to earn more than average	− 0.367	− 0.269	− 0.047	− 0.027	0.53
	(0.072)	(0.166)	(0.151)	(0.375)	
Inequality aversion		2.073			0.283
		(0.000)			
Relative risk aversion				0.053	2.030
				(0.000)	

*P-values in parentheses.

more risk and inequality-averse than males. The former finding supports the results of Jianakoplos and Bernasek (1998) and Hartog *et al*. (2002), who also found that women tend to be more risk-averse. The latter finding is consistent with Eckel and Grossman (1998), who present evidence from dictator games that women tend to behave more altruistically than men, and of Andreoni and Vesterlund (2001), who found that 'Men are more likely to be either perfectly selfish, or perfectly selfless, whereas women tend to be more 'equalitarians' who prefer to share evenly' (p. 293). The number of siblings does not affect either the level of relative risk or inequality aversion significantly. Left-wing voters[11] are found to be significantly and sizeably more risk-averse; their relative risk

aversion and inequality aversion parameters are about 0.9 and 0.2 unit higher, respectively, than those of others in the independently estimated models. Business and technology students are found to be less risk and inequality-averse than other students. Studying economics does not seem to affect either risk aversion or inequality aversion. The latter is worth noting, given the rather strong focus on efficiency issues (compared with distributional ones) in mainstream economics education. Nor does an actively religious life-style, reflected by frequent church visits, have any non-negligible impact, although a caveat should be made regarding the sub-sample size, since only 5% responded that they were frequent church visitors. Nor are there any significant effects arising from where the respondents had grown up or from whether their parents earned more or less than average. We also see that a large fraction (53%) believed that their future grandchildren would have higher incomes than average, which is not surprising, given that the respondents were university students. Those who believed this were also less risk-averse, even though we told respondents that the outcome of their future grandchildren would be determined by a lottery.

We also find that people who are inequality-averse are also more risk-averse when controlling for other variables, and that the reverse relation also holds true; risk-averse individuals tend to be more inequality-averse. There are of course many possible explanations for this, including genetic and cultural ones, but we refrain from speculating further owing to our limited information on the subject.

The parameter signs of the explanatory variables are typically the same in both regressions, implying that the parameter estimates are typically smaller in the simultaneous regressions. However, we have now both a direct effect, holding risk or inequality aversion constant, and an indirect effect. For example, when considering the effect of gender on risk aversion, there is both a direct and an indirect effect through increased inequality aversion (which in turn also has a direct and indirect effect). It turns out that the total effect, i.e. the sum of the direct and the indirect effects, is typically very close to the parameter estimates of the independent estimations. For example, the direct effect of gender on relative risk aversion is 0.427 unit and the indirect effect is 0.181 unit, implying that the total effect is 0.608 unit. To illustrate this, let us write the estimated coefficient of relative risk aversion (ignoring error terms) as $\rho = \beta_f female + \beta_x x + \beta_\gamma \gamma$, and the coefficient of individual inequality aversion as $\gamma = \alpha_f female + \alpha_x x + \alpha_\rho \rho$, where *female* is a dummy variable for a female respondent, x is a vector of other explanatory variables, and αs and βs are the estimated parameters. Substituting the second equation into the first gives (after simplification)

$$\rho = \frac{\beta_f female + \beta_x x + \beta_\gamma \alpha_f female + \beta_\gamma \alpha_x x}{1 - \alpha_\rho \beta_\gamma}.$$

Thus, the total female effect on the relative risk aversion is equal to $(0.427 + 2.073 * 0.055)/(1 - 2.073 * 0.053) = 0.608$, which is very close to the result in the independent regression. The total effect for the other variables can (of course) be correspondingly calculated.

IV. Welfare Implications

In this section we illustrate possible welfare implications of our finding that individuals are both risk and inequality-averse. If we assume that welfare W can be written as a general Bergson–Samuelson social welfare function (SWF), i.e. $W = s(U^1, U^2, ..., U^n)$, then the welfare consequences of a marginal increase in individual k's income can be written

$$\frac{\mathrm{d}W}{\mathrm{d}y^k} = \mu^k + \sum\nolimits_i \mu^i MRS^i_{\Phi y} \frac{\partial \Phi}{\partial y^k}, \tag{8}$$

where

$$\mu^k = \frac{\partial s}{\partial U^k} \frac{\partial u^k}{\partial y^k}$$

is the social marginal utility of income when disregarding the direct welfare effects on inequality, and $-MRS^i_{\Phi y}$ is individual i's marginal willingness to pay to reduce inequality. Hence, there are two welfare components, where, in addition to the direct effect resulting from the increased utility to individual k, there is a second indirect or external effect arising from the changed inequality that results from k's income increase. From (8) it is clear that the total welfare change need not be positive. One additional dollar given to a wealthy individual may imply that the negative welfare consequences associated with increased inequality outweigh the positive welfare effects for individual k. Thus, the frequently made assumption that the social welfare function is monotonically increasing in income is violated.

To illustrate possible implications of the empirical results, we assume the following utility function:

$$u = \frac{\left(y\Phi^{-\gamma}\right)^{1-\rho}}{1-\rho} = \frac{y^{1-\rho}}{1-\rho}\Phi^{-\gamma(1-\rho)}. \tag{9}$$

This function, which needless to say is restrictive, is consistent with both (1) and (5); i.e. it exhibits both a constant relative risk aversion and a constant inequality aversion elasticity. To investigate social welfare implications, let us assume an ordinal utilitarian SWF as follows:[12]

$$W = \sum_{i=1}^{n} u_i(y_i, y_{-i}) = w(y_1, ..., y_n). \tag{10}$$

Further, assuming a common utility function for all individuals as given by (10), we can write the social marginal rate of substitution (SMRS) between two individuals i and j, i.e. the social welfare ratio of giving one dollar to individual i instead of j, as

$$SMRS_{ij} \equiv -\left.\frac{\mathrm{d}y_i}{\mathrm{d}y_j}\right|_{w=w_0} = \frac{\partial w/\partial y_i}{\partial w/\partial y_j} = \frac{y_i^{-\rho}\Phi^{-\gamma(1-\rho)} - \gamma\dfrac{\overline{u}(y_i - \overline{y} - \sigma\Phi)(1-\rho)}{\overline{y}\sigma\Phi}}{y_j^{-\rho}\Phi^{-\gamma(1-\rho)} - \gamma\dfrac{\overline{u}(y_j - \overline{y} - \sigma\Phi)(1-\rho)}{\overline{y}\sigma\Phi}}. \tag{11}$$

Without inequality aversion, i.e. when $\gamma = 0$, the expression reduces to $\left(y_i/y_j\right)^{-\rho}$. In this case we see that if for example y_i is five times y_j, one dollar

given to individual j contributes as much to social welfare as 5^{ρ} dollars given to individual i. Thus, it is then legitimate to see ρ as a measure of social inequality aversion. However, when $\gamma > 0$ the sign of the overall expression cannot be determined generally, since negative welfare effects from increased inequality may dominate the direct utility effect at sufficiently high income levels. The second term of both the numerator and the denominator becomes negative for income levels above $\overline{y} + \sigma\Phi$, and hence reduces the marginal utility. This is natural, since income increases above this level increase the measure of inequality and income increases below this level decrease the measure of inequality. The slope of the SMRS curve is always negative in income, since both the first and the second terms of the nominator decrease in income.

In order to illustrate the relation between SMRS and income for a more realistic income distribution than the one in the experiments, we utilize a log-normal income distribution with a Gini coefficient roughly corresponding to the Swedish income distribution in 1996. The probability density function for a log-normal distribution is given by

$$f(y) = \frac{1}{y\sqrt{2\pi k_1^2}} e^{-(\ln y - k_2)/2k_1^2}. \tag{12}$$

We assume that $k_1 = 0.6$ and $k_2 = 10$, corresponding to a mean income in the society of about 26,000 SEK per month and a Gini coefficient equal to 0.33.

Figure 1 plots the SMRS as a function of income for various parameter values of risk aversion when holding the parameter of inequality aversion fixed at 0.2, roughly corresponding to the median value in this study; the reference income level is without loss of generality chosen to equal 10,000 SEK per

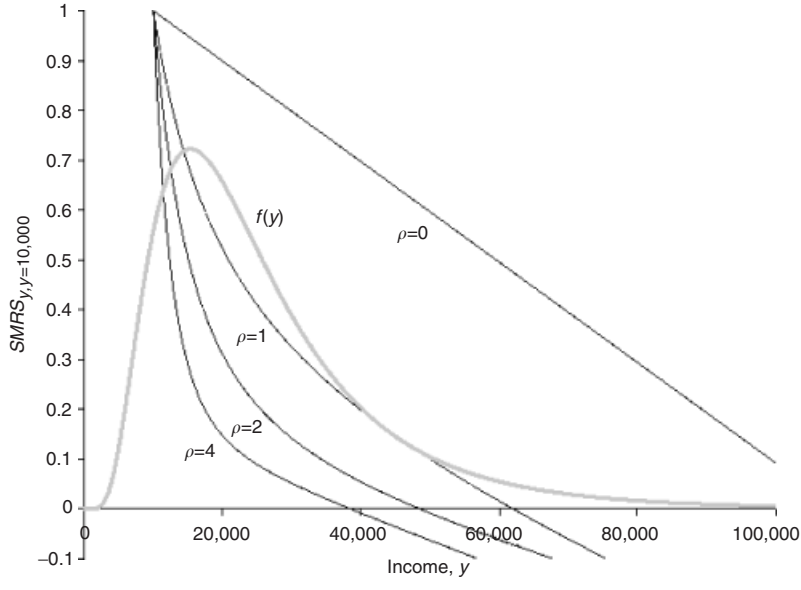

FIGURE 1. Social marginal rate of substitution for different parameter values of relative risk aversion, for a constant individual inequality aversion ($\gamma = 0.2$).

month. For example, we see that SMRS is roughly equal to 0.5 at $\rho = 1$ when income y is equal to 20,000 SEK. This implies that taking 100 SEK from the richer person with an income equal to 20,000 and giving 50 SEK to the poorer person with an income of 10,000 would keep social welfare constant, *ceteris paribus*. Furthermore, we see that the SMRS becomes negative at income levels that are not at all extreme, even in the case of risk neutrality. The interpretation of this is that, if we give a small income increase to an individual with a sufficiently high income level (for the SMRS to be negative) and hold income constant for all others in the economy, the social welfare will decrease. The reason is that, although utility will increase for the wealthy individual, the sum of all others' utility losses arising from the increased income inequality will more than offset this increase. Thus, we have illustrated that, given our assumptions and estimated parameter values, the potential violation of the monotonicity assumption appears to be more than a theoretical curiosity.

In Figure 2 we instead hold relative risk aversion fixed and equal to unity, and vary the parameter of inequality aversion γ. Again, we find that, not only does SMRS decrease rapidly with income, but it also becomes negative at non-extreme income levels, even when conservative estimates (according to our study) of both risk and inequality aversion are used.

Finally, let us consider how the shapes of the curves vary with income and inequality aversion, and corresponding implications. The effect of γ on the slope of the SMRS curve is not immediately straightforward to understand. One might have suspected that introducing individual inequality aversion would increase the slope, since this is one additional reason why it may be socially beneficial to decrease inequality, and since giving a dollar to a poorer person will always decrease inequality more than if the dollar were given to a richer person. However, for sufficiently low income levels this intuition turns out to be incorrect, and the slope of the SMRS curve will instead be flatter with a positive γ, as seen in Figure 2.

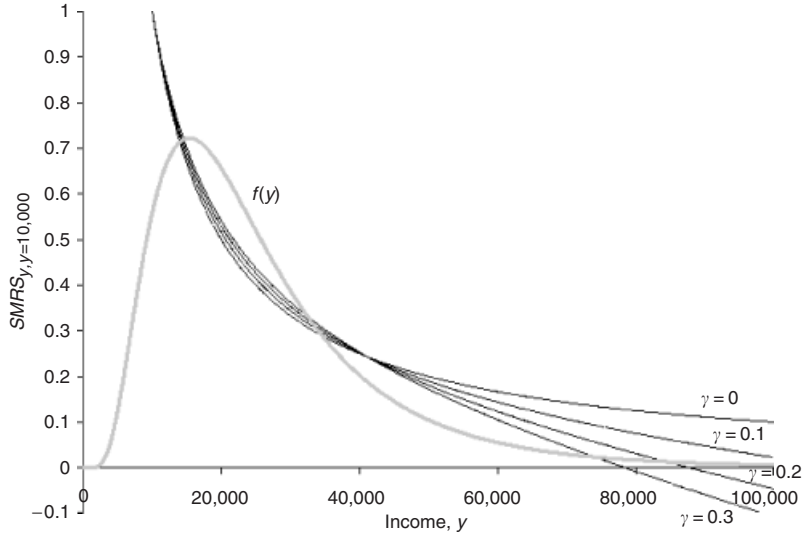

FIGURE 2. Social marginal rate of substitution for different parameter values of individual inequality aversion, for a constant relative risk aversion ($\rho = 1$).

The reason for this paradoxical result can be understood from (11). The ratio of the first terms of the numerator and the denominator equals the SMRS with no inequality aversion. The SMRS will then be smaller than the one without inequality aversion (the ratio of the first terms) if the ratio of the second terms is smaller than the ratio of the first terms.[13] Even though increasing the income for a poor individual decreases the inequality measure more than an identical income increase for a richer individual, it does not follow that the *ratio* of these associated welfare effects, through inequality aversion, is larger than that obtained without inequality aversion. Indeed, for the quite general class of utility functions where the SMRS goes to infinity when income goes to zero in the absence of inequality aversion, this will always be the case at some income level. Hence introducing inequality aversion *decreases* the relative weight that should be given to the poorer of two individuals at sufficiently low income levels.[14]

We can also see that inequality aversion appears to change the pattern of the SMRS curves primarily in the upper part of the income distribution. Naturally, these conclusions depend strongly on our assumptions with respect to the underlying utility function. For example, if we instead consider an asymmetric inequality aversion, where people's utility decreases if inequality increases owing to decreased income of the poor but is independent of income increases for the rich, then this pattern would of course change. It is also possible that some people may care differently about inequality depending on their own positions. As noted by a referee, some people may dislike inequality only with respect to those who are wealthier. The main findings here are otherwise not very sensitive to the exact shape of the income distribution, or to the choice of coefficient of variation as a measure of inequality; we have tested many different income distributions and also used the Gini coefficient as the inequality measure, with similar results.

Johansson-Stenman *et al.* (2002) found that the social marginal utility of income may become negative at non-extreme income levels based on a model with preferences characterized by risk aversion (which may also incorporate a certain degree of inequality aversion) and concerns for relative income levels. The same result is found here in a model with preferences characterized by risk aversion as well as inequality aversion. We believe that such effects can contribute to our understanding of various phenomena, such as why many people seem to be so upset about the high salaries of top executives.

It may be tempting also to draw far-reaching policy conclusions from the results; but it is important to recall that the analysis is based on a number of critical assumptions, including the functional form of the utility function and the ethics underlying a utilitarian SWF. Furthermore, some individuals may have strong preferences regarding the means by which a more (or less) equal society is achieved, implying for example that even strongly inequality-averse individuals might oppose tax increases for the rich. The preferences regarding equality in a given society may also depend on other factors, such as social mobility over time (see e.g. Benabou and Ok 2001), which are not analyzed in this study.

V. Conclusions

The main finding in this paper is that many people appear to have preferences regarding equality *per se*. We have also found that both relative risk aversion and inequality aversion vary with sex and political preferences. On average, women and left-wing voters have higher parameter values for both relative risk aversion and inequality aversion. In addition, technology and business students tend to be less risk and inequality-averse than other students.

Assuming a utilitarian SWF, we have illustrated some welfare implications based on our results on risk and inequality aversion. We have showed in simulations that, given our functional form, social welfare may decrease with an individual's income, even at income levels that are not at all extreme. Although one should be cautious when drawing policy conclusions from these results, since they rest on a number of assumptions that can be questioned, the *potential* strength of the welfare effects when individual inequality aversion is introduced is still striking.

The findings of this study should be seen as the first (to our knowledge) attempt to quantify *individual* inequality aversion in a social setting. Although our conjecture was that many respondents would value equality intrinsically, we were rather surprised at the magnitude of the result. Of course, methodological reasons cannot be ruled out, and we are fully aware of the fact that, like other known methods, the method used here to measure inequality aversions has drawbacks. For example, to make the experiments reasonably realistic we had to use a specific framing, and this, together with possible order effects, may have influenced how the respondents behaved in the experiment. Another possible reason for the rather large inequality aversion found may be due to our sample. Eckel and Grossman (2000) found that in dictator games pseudo-volunteers, such as the end-of-class participants used here, behaved more extremely than pure volunteers, in the sense that they behaved less selfishly.[15] Therefore, we encourage the use of other samples (e.g. in other countries) and other theoretical and experimental setups in future research, to investigate the extent to which our findings can be generalized.

Appendix: The Experimental Part of the Questionnaire

Part I

In this experiment we require you to choose which society you consider to be the best one for your grandchild or another imaginary person living two generations into the future, that is to say the society in which your grandchild will be most content. A person's income depends on a number of factors, some of which can be affected while others may be beyond the person's control. Since you do not have any information about your imagined grandchild, it is reasonable to think of the outcome for your grandchild as a lottery. We require you to make choices between two different lotteries (lottery A and lottery B), which describe the income for your grandchild.

For each lottery the lowest and highest outcome is given, and the distribution of the outcome is uniform. Therefore you should assume that there is an equal probability that your grandchild will find himself/herself in either the higher or the lower income bracket. We ask you to assume this even if you expect your grandchild's income to be higher than the mean.

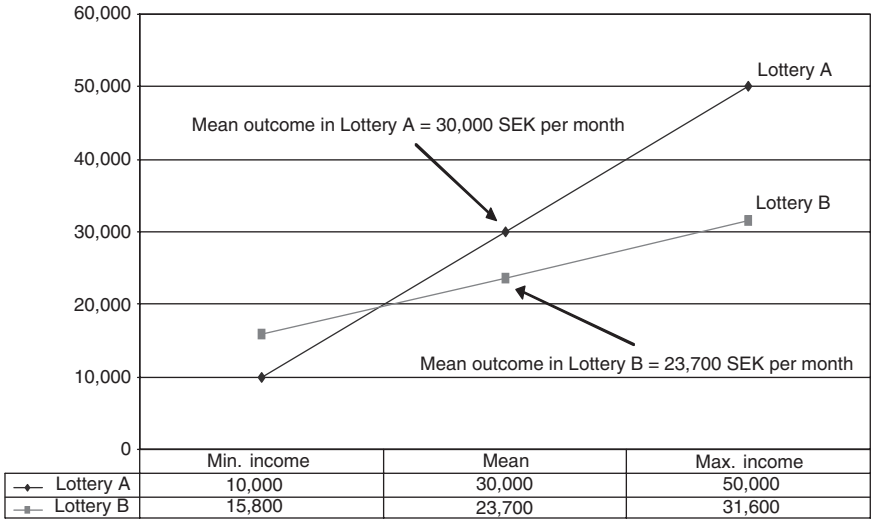

FIGURE A1.

The outcome of the lottery does not determine the degree of job satisfaction and other similar factors enjoyed by your grandchild. That is, a higher salary does not imply a more stimulating job, or that your grandchild has to work harder. The lotteries describe nothing more than the outcomes in terms of income.

We ask you to make a series of choices between two lotteries. However, while lottery A remains unchanged, lottery B will vary. Let us illustrate this with an example. Imagine that you are choosing between two different lotteries:

- in lottery A the outcome varies between 10,000 and 50,000 SEK per month, which means that the mean outcome is 30,000 SEK per month;
- in lottery B the outcome varies between 15,800 and 31,600 SEK per month, which means that the mean outcome is 23,700 SEK per month.

In both lotteries the distribution of the outcome is uniform between the highest and lowest possible outcomes. The lotteries are illustrated in the Figure A1. The spread is consequently greater in lottery A. This means that in lottery A it is possible that your grandchild may enjoy a high income; however, he/she also runs the risk of having a very low income. For lottery B, the spread in outcomes is smaller, which means that your grandchild can earn neither a lot of money nor a small amount of money as in A. In this example the mean outcome is lower in lottery B than in lottery A.

The welfare state in both societies is negligible, meaning that medical services, childcare, education etc. are obtained through insurance and private funding. In order to enable you to relate the income levels to actual consumption, a hypothetical budget that describes consumption possibilities at different income levels is given below. As can be seen, an individual with the lowest income has a meagre consumption and must live sparingly.

Monthly income 10,000		Monthly income 20,000		Monthly income 30,000		Monthly income 50,000	
Rent 1 room	5,000	Rent 2 rooms	7,500	Rent 3 rooms	10,000	Rent 4 rooms	14,000
Insurance	3,000	Insurance	7,000	Insurance	10,000	Insurance	20,000
Food	1,500	Food	2,500	Food	2,500	Food	3,000
Other	500	Other	3,000	Other	7,500	Other	13,000

In all other respects the societies are the same. Your choice does not affect anything in the society. The income distribution in the societies varies uniformly between 10,000 and 50,000 SEK per month (i.e. as in lottery A). Furthermore, there is a small group of people whose incomes are unspecified and lie outside the stated interval (e.g. the homeless, and top company directors).

It is important that you focus on what is in the best interest of your grandchild when responding. There is no 'correct' answer to these questions, and we ask you to reflect on the choices carefully. If you change your mind along the way, you may of course change your earlier responses.

Part II

In the following questions, we again ask you to make a series of choices. The main difference here is that your grandchild's income is given while the income distribution in the society varies between the alternatives. We ask you to make choices between societies with different income distributions. Your grandchild's income is always the same as the mean income in society. As before, we require you to choose the society that you consider to be the best one for your grandchild, that is to say the society in which your grandchild will be the most content.

The income distribution in each society is described in a similar way as the lotteries were described. For each society, the incomes of the individuals with the lowest and highest incomes are given. The income distributions in both societies are uniform. In a society where the lowest monthly income is 10,000 SEK and the highest income is 50,000 SEK, there will be as many people with an income between, say, 10,000 and 11,000 SEK as there will be between 20,000 and 21,000 SEK or between 49,000 and 50,000 SEK. Your grandchild's income is always the same as the mean income in the society, which in the case above means that your grandchild will earn 30,000 SEK per month.

Furthermore, there is a small group of people whose incomes are unspecified and who lie outside the stated interval. In both societies there are individuals who are destitute, for example the homeless. Moreover, there is also a group that has exorbitant incomes, such as top company directors and certain individuals in the sports or movie industries. Your grandchild will not belong to either of these extreme groups. As both of these groups exist in all societies, you may disregard them.

The welfare state in both societies is negligible, meaning that medical services, child care, education, etc., are obtained through insurance and private funding

The variety of goods and their prices are the same for both societies; i.e. for 100 SEK you can buy the same goods and the same amounts in both societies. The table is the same as in Part I. An individual with the lowest income has a meagre consumption and must live sparingly.

Monthly income 10,000		Monthly income 20,000		Monthly income 30,000		Monthly income 50,000	
Rent 1 room	5,000	Rent 2 rooms	7,500	Rent 3 rooms	10,000	Rent 4 rooms	14,000
Insurance	3,000	Insurance	7,000	Insurance	10,000	Insurance	20,000
Food	1,500	Food	2,500	Food	2,500	Food	3,000
Other	500	Other	3,000	Other	7,500	Other	13,000

One of the alternatives, society A, remains unchanged. The income distribution in society B is more equal than the one in society A. The mean income in society B decreases successively, and consequently your grandchild's income decreases.

It is important that you consider only the factors influencing the interests of your grandchild. You may not only consider the income of your grandchild. You may for example believe that your grandchild (for different reasons) would be more content in a

society that is more equal, or maybe you believe the opposite. However, you should *not* deliberate on whether you consider society A to be better in itself than society B or vice versa. Nor should you consider what you believe your grandchild would judge the best society as a whole. As you lack information regarding your grandchild, you may wish to assume that your grandchild has the same preferences as yourself.

It is important that you focus your answer on what is in the best interest of your grandchild. There are no 'correct' responses to these questions, and we ask you to reflect on the choices carefully. If you change your mind along the way, you may of course change your earlier responses.

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NOTES

1. See Glejser *et al*. (1977) and Gevers *et al*. (1979) for early applications of such methods to measure preferences for equality.
2. See also Johannesson and Gerdtham (1996), who estimate preferences for inequality in health care behind a veil of ignorance.
3. See Amiel *et al*. (2001) and Cowell and Schokkaert (2001) for recent discussions on the relationship and differences between individuals' perceptions of risk and inequality.
4. Furthermore, even respondents who are generally positive to redistributive taxes, despite efficiency losses, may of course be adverse to simply confiscating money from an arbitrary rich person and giving it to an equally arbitrary poor one.
5. See also Bolton and Ockenfels (2002) for other empirical evidence of violation of this axiom, and Amiel and Cowell (1994b, 2002) for theoretical analysis of a monotonicity.
6. It is also possible, however, that the responses reflect the respondents' perception of what is intrinsically important within a society in general, rather than the respondents' own preferences *per se*. Still, we find it likely that such perceptions are influenced by the respondents own preferences.
7. A referee points out that the respondents' choices may partly reflect preferences regarding inequality, given that they have preferences for the equality of the lotteries, and not only with respect to the outcome of the lottery; cf. Diamond (1967). Hence lottery A could be chosen on the grounds that the respondents want their offspring to have the same opportunities as others in the society (given that others' outcome in the society has been determined stochastically, which the respondents had no information about). However, on the basis of the responses at focus group discussions, we find it unlikely that many of the respondents have reasoned in this way.
8. Respondents are considered inconsistent if they switch from choosing alternative A to alternative B in later choices. There could be several reasons for these responses, including learning or fatigue effects.
9. The interpretation of the latter finding is sensitive to the functional form chosen, however.
10. The differences are largely due to fewer extreme risk-averse responses in the present study.
11. 'Left-wing party' refers to the Swedish Social Democrats, the Left Party and the Green Party. A lower fraction than expected said that they would vote for a left-wing political party 'if an election were held today', which may be linked in part to the fact that business students were over-represented in the sample.
12. Note that the ordinality refers to the SWF; the utility measures used are, and must be, cardinal.
13. Hence, we use $(A+C)/(B+D) > A/B$ if and only if $C/D > A/B$.
14. We can also see that the crossing point at which SMRS, with and without inequality aversion, is the same appears to be independent of γ. This is a result of the specific functional form chosen. From (11) we have in this case that $(y_i - \overline{y} - \sigma\Phi)y_i^{\rho} = (y_j - \overline{y} - \sigma\Phi)y_j^{\rho}$. The solution to this equation is independent of γ.
15. On the other hand, it is possible that end-of-class participants are more representative than pure volunteers, since in the latter group people who are very concerned about earning money for themselves may be over-represented.

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