ARE PEOPLE INEQUALITY AVERSE OR JUST RISK AVERSE?[1]

Fredrik Carlsson
Dinky Daruvala
Olof Johansson-Stenman

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Department of Economics
Göteborg University

Abstract

Individuals' preferences for risk and inequality are measured through experimental choices between hypothetical societies and lotteries. The median relative risk aversion, which is often seen to reflect social inequality aversion, is between 2 and 3. We also estimate the *individual* inequality aversion, reflecting individuals' 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. This is illustrated in simulations based on the empirical results.

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[1]Department of Economics, Göteborg University, Box 640, S-405 30 Göteborg. E-mail: Fredrik.Carlsson@economics.gu.se, Dinky.Daruvala@kau.se, Olof.Johansson@economics.gu.se

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I. INTRODUCTION

As expressed by Amiel and Cowell (1999, p. 1): "Any parent with two or more children needs no formal analysis to be persuaded of the importance of distributional justice." From the public debate, as well, we know that issues of equity and inequality are also crucial within societies. Given that inequality is bad, though, how bad is it? In most previous research, measures of social inequality aversion is based solely on the concavity of the utility functions, corresponding to individual risk aversion (see, e.g. Christiansen 1978, Stern 1977, Amiel and Cowell 1994, Amiel et al. 1999). 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. We also discuss possible welfare implications resulting from the assumption that individuals are both risk and inequality averse.

From a social perspective, the degree of concavity of the utility function is important in the tradeoff between efficiency and equity in public decision-making, such as in the design of optimal income taxes; see for example Mirrlees (1971) or Atkinson and Stiglitz (1980). 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' will 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 interval 0.5 - 3 are often referred to. According to Dasgupta (1998, p. 145, footnote 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.

Johansson-Stenman et al. (2002) explicitly utilize the idea of choices behind a veil of ignorance, where the respondents make tradeoffs between mean income and inequality in (hypothetical) societies, as a way of estimating the degree of relative risk aversion.[2] However, the interpretation of risk aversion as corresponding to inequality aversion is based on a number of implicit assumptions. In particular it is assumed that individuals have no preferences regarding the income distribution, or inequality, *per se*, which is questionable. Therefore, following the basic experimental design in Johansson-Stenman et al., we extend the analysis by performing two separate experiments in which the respondents choose what is in the best interest of their imaginary grandchild. In the first experiment individuals choose between hypothetical *lotteries*, where the outcomes determine their grandchildren's income 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 income is known and 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 where preferences regarding inequality have been measured. However, most of these are undertaken in a two (or few) person setting, including Loewenstein et al. (1989), Bukszar and Knetsch (1997), Fehr and Schmidt (1999), Bolton and Ockenfels (2000), and Goeree and Holt (2000). They report results from ultimatum and dictator (and other similar) games, and it is typically found that conventional economic theory, where people are motivated solely by their own monetary payoffs, performs poorly. Alternative theories where

[2]See also Johannesson and Gerdtham (1996) who estimate preferences for inequality in health care behind a veil of ignorance.

people have concerns regarding equality and fairness are therefore proposed. However, while these results contribute largely to an increase in our understanding of individual behavior, it is far from straightforward to generalize the quantitative parameter estimates to a social setting.

Amiel et al. (1999) conducted a 'leaky-bucket' experiment, where respondents (students) were able 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 to 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. Furthermore, the context in which the redistribution takes place is rather special. Even respondents who are generally positive to redistributive taxes, despite efficiency losses, may be adverse to simply confiscating money from an arbitrary rich person and giving it to an equally arbitrary poor one. Any implicit redistribution in our case is presumably interpreted much more generally than in a 'leaky-bucket' experiment. 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. What we 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.

Amiel and Cowell (1994) are perhaps closest to our experimental setting (next to Johansson-Stenman et al.). In their study, the students make repeated choices between economic programs for a hypothetical country, resulting in different income distributions among the 5 citizens. The task was to choose the program 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. As we will see, the findings in this study also question whether

monotonicity holds true.

The only study, to our knowledge, that explicitly separates inequality aversion from risk aversion is Kroll and Davidovitz (1999). They conducted candy bar experiments using 8-year-old children as respondents and found that most of them preferred an equal distribution of candy bars among the group, holding their own outcome, in terms of candy bars, fixed. However, for obvious reasons it is difficult to use the results from this study as general estimates of people's preferences regarding equality. The remainder of this paper is organized as follows: Section 2 provides the theoretical framework, followed by a description of the experimental design in Section 3, and results in Section 4. Section 5 illustrates some theoretical welfare consequences and Section 6 presents the conclusions.

II. THE THEORETICAL MODEL

A. Risk and Inequality Aversion

Estimating an individual's inequality aversion solely through her aversion to risk disregards the preferences that an individual may have concerning inequality *per se* (see e.g. Thurow 1971). Thus, if the individual regards large income inequalities in society as unjust or unfair and, furthermore, 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 (Smith and Wright 1992; Benoit and Osborne 1995), then this individual inequality aversion should also be reflected in her utility function. In general we can write an individual *i*'s utility $U^i = u^i(y^i, \Phi)$, where *y* is own income and Φ is a measure of inequality in the society.

If *i* is individually inequality averse, then $\partial u^i / \partial \Phi < 0$. Consider now a general social welfare

function (SWF): $w(U^1, U^2, \ldots, U^n)$ as the social objective function. The welfare consequences of a marginal increase in individual k's income can then be written:

$$dW = m^k dy^k + \sum_i m^i MRS^i_{\Phi y} \, d\Phi \qquad [1]$$

where $m^j = \frac{\partial w}{\partial U^j} \frac{\partial u^j}{\partial y^j}$ is a measure of the quasi-concavity of the social welfare function in income, i.e. disregarding the direct welfare effects on inequality, and where $-MRS^i_{\Phi y}$ is individual i's marginal willingness to pay for reducing inequality. From (1) it is clear that this welfare change need not be positive. One additional dollar given to a wealthy individual may imply that the negative welfare consequences associated with the increased inequality outweighs the positive welfare effects for individual k. Thus, in this case the frequently made assumption of monotonicity in income of the social welfare function is violated. This will be illustrated in more detail in Section 5.

However, in order to know if the monotonicity assumption is violated and at what levels of income this may occur, we obviously need more information. First, we need to know whether people are individually inequality averse, and if so to what degree. Second, we need to know the level of individual risk aversion, in order to estimate how m decreases with income. Starting with the latter, in order to link the experimental result to economic theory we utilize a modified version of a special class of utility functions that is characterized by Constant Relative Risk Aversion (CRRA) as proposed by Atkinson (1970):

$$u = \begin{cases} \dfrac{y_r^{1-r}}{1-r}, & r \neq 1 \\ \ln y_r, & r = 1 \end{cases} \qquad [2]$$

where $r = -y_r u'' / u'$ 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 maxi-min type. y_r is a function of own income, *y*, and a measure of income inequality, Φ . In order to measure the degree of individual inequality aversion we assume that:

$$y_r = y(1 - g\Phi) \qquad [3]$$

where g is a parameter of individual inequality aversion; $g = 0$ corresponds to the conventional case where utility is independent of the income distribution *per se*. In principle any measure of inequality can be considered, but here we illustrate two cases using the coefficient of variation and the Gini coefficient as measures of inequality. Consequently we assume that individuals' utility is affected by the level of inequality in society as reflected by these measures. The coefficient of variation is defined as:

$$u = \frac{s_y}{\bar{y}} \qquad [4]$$

where s_y is the standard deviation of the income distribution, and $\bar{y}$ is mean income. The Gini coefficient is defined as:

$$G = -1 + 2\int_{y_{\min}}^{y_{\max}} \frac{yF(y)f(y)dy}{\bar{y}} \qquad [5]$$

where $f(y)$ is the probability density function for income and $F(y)$ is the cumulative density function. Both measures are symmetric, satisfy the principle of transfers and are scale invariant, i.e. they are unaffected by equal proportional increases in all incomes (Lambert 1993).

B. Individual Choice

The purpose of the first set of questions in the experiment is to enable us to estimate individuals' (relative) risk aversion. The respondents choose between different lotteries within the same society, the outcome of which determines their grandchildren's income. 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 generally given by:

$$E(u) = \int_{y_{\min}}^{y_{\max}} u(y) f(y) \mathrm{d}y \qquad [6]$$

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

$$E(u) = \frac{(1-g\Phi)^{1-r}}{y_{\max} - y_{\min}} \int_{y_{\min}}^{y_{\max}} \frac{y^{1-r}}{1-r} \mathrm{d}y = \frac{(1-g\Phi)^{1-r}}{(1-r)(2-r)} \frac{y_{\max}^{2-r} - y_{\min}^{2-r}}{y_{\max} - y_{\min}} \qquad [7]$$

An individual is then indifferent between the lotteries A and B if:

$$\frac{y_{\max,A}^{2-r} - y_{\min,A}^{2-r}}{y_{\max,A} - y_{\min,A}} = \frac{y_{\max,B}^{2-r} - y_{\min,B}^{2-r}}{y_{\max,B} - y_{\max,B}} \qquad [8]$$

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

The second set of questions allows us to measure individual inequality aversion. The respondents choose between two deterministic societies (with no uncertainty involved) where both their grandchildren's income and the income distributions differ. This choice implies a direct tradeoff between the grandchild's income and equality in the society. A utility-maximizing

respondent would be indifferent between the two societies if $y_{rA} = y_{rB}$, and hence $y_A(1 - g\Phi_A) = y_B(1 - g\Phi_B)$, implying that:

$$g = \frac{y_A - y_B}{y_A\Phi_A - y_B\Phi_B} \qquad [9]$$

The parameter of individual inequality aversion is thus a function of the grandchild's income in the two societies, and on the income inequalities. Suppose an individual is given the choice between two societies, where in society A the coefficient of variation $u_A = 0.3$, and the individual's monthly income $y_A = 24{,}000$ SEK, while in the more equal society B, $u_B = 0.2$ and $y_B = 20{,}000$ SEK. A respondent that prefers society B then has a parameter of inequality aversion g that is larger than 1.25, and vice versa.

III. THE EXPERIMENT

A total of 324 respondents, all undergraduate students from The University of Karlstad 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, (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 or outcome distribution and

average income. The respondents were asked to consider the well-being of their imaginary grandchildren rather than themselves, since there are reasons to believe that it may 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 interest 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.

The respondents were presented with a background scenario in which the society in general was described. 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 are provided through private insurance systems instead. 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 pre-tests and discussions in focus groups.

A. 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 determine their grandchildren's income. Both lotteries had a uniform outcome distribution, and the respondents were thus told that they should place an equal probability on all outcomes for their grandchild. They were also told that the outcome of the lottery would not affect how their grandchildren perceives her job in terms of how hard she works, job satisfaction etc. It was emphasized that society as a whole, including the income distribution, is completely unaffected by the respondent's choice and the outcome of the lottery. To avoid effects from expected social mobility the respondents were told that the outcome of the lottery determined their grandchildren's *lifetime* monthly income[3]

For all choices, lottery *A* remains unchanged with income varying uniformly between 10,000 and 50,000 SEK; hence the expected income is 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 when the respondent is indifferent between the lotteries. The lotteries are presented in Table 1 below, along with the implicit parameters of relative risk aversion and relative risk premiums. The relative risk premium is defined as the respondent's maximum willingness to pay (in terms of a lower expected income) for the risk level corresponding to lottery *A* instead of *B.*

[Table 1 about here]

B. Inequality Aversion Experiment

The structure of the second experiment was similar to the first. The respondents made a number of repeated choices between a fixed society *A* and various *B*-societies, which were described

[3] Otherwise the respondents may have believed that there would be new opportunities for their grandchild to achieve better success at a later date; see Benabou and Ok (2001).

by their income distribution and an imaginary grandchild's income. There were no uncertainty and the imaginary grandchild's income was equal to the mean income in each society. In the experiment no explanation was given for the differences in income distribution between the societies.

The respondents' choices in the experiment will now reflect their attitude towards inequality *per se*. The coefficient of variation u , is equal to 0.385 in society *A* and 0.1925 in all *B* societies, while the Gini coefficient, *G*, is approximately equal to 0.222 in society A and 0.111 in society B. The societies are presented in Table 2 below, along with the implicit parameters of inequality aversion. Note that the implicit parameter depends on the inequality measure. The relative inequality premiums included in the table correspond to the cases where the respondents are indifferent between society *A* and *B*. The relative inequality premium is defined as the respondent's maximum willingness to pay (in terms of a lower income) for living in a society with an income inequality as in society *A* rather than *B*.

[Table 2 about here]

C. Possible Hypothetical Bias

It is no trivial task to generalize the preferences observed in experiments or surveys to the real world (Loomes, 1998). The respondents may, for example, use the survey situation as a possibility to buy "moral satisfaction" (Kahneman and Knetsch, 1992). For example, if the action itself of choosing a more equitable society gives the respondents moral satisfaction, then the estimates of inequality aversion are upwardly biased. Similarly, Akerlof and Kranton (2000) recently argued that self-image or perceptions of identity are important factors for explaining real-world phenomena. In this case one can hypothesize that individuals with an egalitarian self-image may compound this image by choosing more equitable alternatives, irrespective of their 'genuine' preferences. If so, the estimates of individual inequality aversion may be upwardly biased.

Furthermore, it is also possible that some individuals may seek to enhance their self-image as risk-taking adventurers, suggesting that the estimates of risk aversion would be downwardly biased.[4] We hope, however, that the framework in this study, where the choices are made for an imagined grandchild, will limit self-image influences.

IV. RESULTS

A. Descriptive Results

There were 306 and 310 valid responses for the risk-aversion and individual inequality-aversion experiments respectively.[5] The results of the relative risk aversion experiment are presented in Table 3.

[Table 3 about here]

The table shows that the median relative risk aversion is in the interval between 2 and 3, and 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.

[Table 4 about here]

The median value of inequality aversion is in the interval between 0.29 and 0.64 for the coefficient of variation measure and between 0.51 and 1.11 for the Gini measure. Most of the values are

[4]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).

[5]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, or that the respondent has another functional form for utility.

within this interval and there are few "extreme" responses. A small fraction (6%) are inequality lovers, i.e. they are willing to sacrifice income for a society more unequal than society *A*.

In Johansson-Stenman et al. (2002), on the contrary, individual inequality aversion was not estimated directly. Instead, respondents made choices between hypothetical *societies*, implying that any 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. We estimate a mean relative risk premium of 5042 SEK, corresponding to a parameter of relative risk aversion equal to 2.4 in this experiment which can be compared with 6336 SEK and 3.0, respectively, in Johansson-Stenman et al. (2002). Hence, the difference is in the expected direction.[6] Nevertheless, in light of the rather large estimates of individual inequality aversion, perhaps one would have expected even larger differences. One explanation for why we do not observe this could be the added cognitive burden involved in the first experiment, where individuals were required to consider the aspects of risk and inequality aversion simultaneously. It is possible that many individuals opted for the easy alternative, merely focusing on their grandchildren's income, ignoring their preferences of equality *per se*.[7]

B. Econometric Analysis

The econometric estimations were undertaken in order to gain insights into determinants of

[6]The differences are mainly due to fewer extreme risk-averse responses in the present study. In Johansson-Stenman et al. (2002) 29% of the respondents had a relative risk aversion of at least 5, while the corresponding figure is 14% in the present experiment. A large part of these differences may be explained by left-wing voters' individual inequality aversion.

[7]Another explanation could be differences in the design of the two experiments. The introduction in the second experiment was slightly more thorough when giving examples for the positive and negative effects of inequality *per se*- crime/ more caring society/ less interesting society etc..

individual risk and inequality aversion. We use the relative risk premium, which is the difference between the mean incomes of lottery *A* and *B* for which the respondent is indifferent, as the dependent variable for the risk aversion experiment.[8] The coefficients in the regressions can also be converted into partial effects (at sample means), in terms of relative risk aversion and individual inequality aversion, by solving equation (8) for the partial effect on r and solving equation (9) for the partial effect on g .[9]

[Table 5 about here]

Left-wing voters[10] are found to be significantly more risk averse; their relative risk aversion is almost 0.9 units higher than others. The number of siblings does not affect the level of relative risk aversion, and females are more risk averse than males; the latter supporting the results by e.g. Jianakoplos and Bernasek (1998). Both business and technology students were found to be significantly less risk averse than other students; technology students have a relative risk aversion that is about 1.1 units lower than others. Neither the respondents expectations of their grandchildren's income, nor their parents' income, significantly affect the level of risk aversion.

The relative inequality premium is used as the dependent variable in the regression for

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[8]The relative risk premium was calculated as follows: In the pair-wise alternative where the respondent first chooses lottery *A*, the difference between the mean income in lottery *A* and the average of the mean *B* incomes between the present and the preceding pair-wise alternative was calculated. For the extreme cases $r < -0.5$ and $\rho \rightarrow \infty$ we set the deviation to -2,700 and 15,500 respectively.

[9]The partial effect on r has to be solved numerically. The notion *partial* effect is used instead of *marginal* effect since all explanatory variables are discrete.

[10] A Left-wing party refers to the Swedish Social Democrats, the Left Party itself and the Green Party. A lower fraction than expected said that they would vote for a left-wing political party, "if an election was held today", which may partly be linked to the fact that business students were over-represented in the sample.

the inequality aversion experiment, i.e. the difference between the imaginary grandchild's income in society *A* and *B* for which the respondent is indifferent between the societies. The relative inequality premium is calculated in a way similar to that of the relative risk premium.[11]

[Table 6 about here]

The pattern for individual inequality aversion is similar to that of risk aversion; the only difference with respect to significant parameters is that parents' income affects the inequality aversion but not the risk aversion. Respondents whose parents earned less than the mean income are more inequality averse than others, with a parameter of inequality aversion that is about 0.14 units larger than others, if we assume that individuals care about inequality in terms of the coefficient of variation. Consequently, if a respondent's parents earn less than the mean this will affect her aversion to inequality, but will have no effect on her aversion to risk. Left-wing voters are more inequality averse, corresponding to almost 0.4 units higher compared to others, if we assume that individuals care about inequality in terms of the coefficient of variation. Thus, we have seen that left-wing voters are both significantly more risk averse and inequality averse than others.

Eckel and Grossman (1998) present evidence from dictator games that women tend to behave more altruistically than men, whereas Andreoni and Vesterlund (2001) 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. 0) This is consistent with the findings here, since the women in our sample are significantly more inequality averse. It is worth noting that studying economics does not seem to affect either risk aversion or inequality aversion.

[11]For the extreme cases g < -0.514 and g > .7321 we set the deviation to -2,700 and 15,500.

V. WELFARE IMPLICATIONS

In this section we illustrate the welfare implications of our findings that individuals are both risk and inequality averse. This is done by investigating the Social Marginal Rate of Substitution (*SMRS*) for the more realistic lognormal income distribution, under the assumption that individuals care for inequality in terms of the coefficient of variation.[12] Assuming an ordinal utilitarian SWF we have

$$W = \sum_{i=1}^{n} u_i\left(y_i, y_{-i}\right) = w\left(y_1, \ldots, y_n\right) \qquad [11]$$

Assuming further a common utility function for all individuals as given by [2], and that $\Phi = u$, it can be shown that the *SMRS* between two individuals can be written:

$$SMRS_{ij} \equiv \frac{\partial w/\partial y_i}{\partial w/\partial y_j} = -\left.\frac{dy_i}{dy_j}\right|_{W=W_0} = \left(\frac{y_j}{y_i}\right)^{r} \frac{1-\gamma(1-\gamma u)^{r-2}\left(\frac{y_i}{s_y}-\frac{1}{u}-u\right)(1-r)\frac{\bar{u}}{\bar{y}}y_i^{r}}{1-\gamma(1-\gamma u)^{r-2}\left(\frac{y_j}{s_y}-\frac{1}{u}-u\right)(1-r)\frac{\bar{u}}{\bar{y}}y_j^{r}} \qquad [12]$$

where the first factor is identical to the *SMRS* without individual inequality aversion, i.e. when $\gamma = 0$. In this case we see that if for example y_i is 5 times y_j, one dollar given to individual *j* contributes as much to social welfare as 5^r dollars given to individual *i*. Thus, it is legitimate to see r as a measure of inequality aversion here. 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.

To illustrate this point, we plot the *SMRS* as a function of income using a lognormal

[12]The main findings in this section are not very sensitive to the exact shape of the income distribution or of the choice of coefficient of variation as a measure of inequality.

income distribution with an associated Gini-coefficient roughly corresponding to the income distribution for Sweden in 1996. We plot the social marginal rate of substitution $SMRS_{k,0} \equiv a_k / a_0$ as a function of income for various parameter values of risk and inequality aversion. We choose the reference income level to be 10,000 SEK/month. When holding the parameter of inequality aversion fixed (figure 1) at 0.5, roughly corresponding to the results in this study, we find that the *SMRS* becomes negative at income levels which are not at all extreme, even in the case of risk neutrality.

[Figure 1 about here]

When holding relative risk aversion fixed (figure 2) and equal to 2.5, we find that not only does *SMRS* decrease rapidly with income, but also becomes negative at low income levels even when a fairly conservative estimate of inequality aversion is used.

[Figure 2 about here]

Although the estimated parameter of relative risk aversion in this paper is far from extreme, one may believe, e.g. on intuitive grounds, that it should be smaller in reality. For this reason we instead assume a relative risk aversion equal to unity, and again plot the *SMRS* as a function of income for different values of inequality aversion.

[Figure 3 about here]

Although, higher income levels are required for a negative *SMRS*, we still find that for an inequality aversion of 0.2, which is much smaller than for most people in this study, *SMRS* becomes negative at surprisingly low income levels.

However, one should be very careful when drawing policy conclusions from the results since 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,

also implying that strongly inequality averse individuals may oppose tax-increases for the rich. The preferences regarding equality in a given society may also depend on other factors, such as social mobility (see e.g. Benabou and Ok 2001), which are not assumed in this study.

VI. CONCLUSION

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. Additionally, individuals whose parents had an income lower than the mean are more inequality averse, but not more risk averse, than others.

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

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 are rather surprised by the magnitude, and the strong welfare implications. In future research we encourage the use of other samples (e.g. in other countries) and theoretical and experimental set-ups, to find out whether the main findings can be generalized.

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Table 1. Lotteries in experiment 1.

	Min income	Mean income	Max income	Relative risk premium if indifference between *A* and *B*	Relative risk aversion r if indifference between *A* and *B*
Lottery *A*	10000	30000	50000		
Lottery B_1	21800	32700	43600	2700	-0.5
Lottery B_2	20000	30000	40000	0	0
Lottery B_3	19400	29100	38800	900	0.5
Lottery B_4	18800	28200	37600	1800	1
Lottery B_5	17200	25800	34400	4200	2
Lottery B_6	15800	23700	31600	6300	3
Lottery B_7	13600	20400	27200	9600	5
Lottery B_8	12200	18300	24400	11700	8
Lottery B_9	10000	15000	20000	15000	4

Table 2. Societies in experiment 2.

	Min income	Mean income	Max income	Rel. inequality premium if indifference between *A* and *B*	Inequality aversion g if indifference between *A* and *B*	
					Ineq. measure: Coeff. of var.	Ineq. measure: Gini coeff.
Society *A*	10000	30000	50000			
Society B_1	21800	32700	43600	2700	-0.51	-0.89
Society B_2	20000	30000	40000	0	0	0
Society B_3	19400	29100	38800	900	0.15	0.26
Society B_4	18800	28200	37600	1800	0.29	0.51
Society B_5	17200	25800	34400	4200	0.64	1.11
Society B_6	15800	23700	31600	6300	0.9	1.56
Society B_7	13600	20400	27200	9600	1.26	2.18
Society B_8	12200	18300	24400	11700	1.46	2.53
Society B_9	10000	15000	20000	15000	1.73	3

Table 3. Results of the relative risk aversion experiment

Parameter values	No.	Freq.	Cum. Freq.	Relative risk premium
$r < -0.5$	9	0.03	0.03	-2700
$-0.5 < r < 0$	18	0.06	0.08	-1350
$0 < r < 0.5$	27	0.08	0.16	450
$0.5 < r < 1$	27	0.08	0.25	1350
$1 < r < 2$	60	0.18	0.43	3000
$2 < r < 3$	80	0.24	0.66	5250
$3 < r < 5$	82	0.21	0.87	7950
$5 < r < 3$	27	0.08	0.95	10650
$8 < r < \infty$	19	0.04	0.99	13350
$r > \infty$ *	2	0.01	1.00	15500

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

Table 4. Results of the inequality aversion experiment

Inequality aversion parameter		No.	Freq.	Cum. Freq.	Relative inequality premium
Coeff. of variation	Gini coeff.				
g < -0.51	g < -0.89	8	0.03	0.03	-2700
-0.51 < g < 0	- 0.89 < g < 0	13	0.04	0.07	-1350
0 < g < 0.15	0 < g < 0.26	39	0.11	0.17	450
0.15 < g < 0.29	0.26 < g < 0.51	36	0.11	0.29	1350
0.29 < g < 0.64	0.51 < g < 1.11	78	0.24	0.52	3000
0.64 < g < 0.90	1.11 < g < 1.56	71	0.20	0.73	5250
0.90 < g < 1.26	1.56 < g < 2.18	37	0.11	0.83	7950
1.26 < g < 1.46	2.18 < g < 2.53	28	0.07	0.90	10650
1.46 < g < 1.73	2.53 < g < 3.00	17	0.04	0.94	13350
g > 1.73	g > 3.00	21	0.06	1.00	15500

Table 5. OLS-regression of the relative risk premium.

Variable	Coefficient	P-value	Mean	Partial effect on ρ
Intercept	6320.46	0.00		
Female	1366.03	0.01	0.45	0.635
Number of siblings	-307.03	0.14	1.56	-0.144
Left	1861.09	0.00	0.24	0.885
Education: - Technology	-2503.20	0.00	0.34	-1.149
- Business	-1605.15	0.01	0.41	-0.740
At least one semester in economics	-181.03	0.75	0.26	-0.083
Frequent church visitor	135.71	0.89	0.05	-0.063
Area: Big city	-802.29	0.24	0.11	-0.366
Parents earned less than mean	-45.3	0.93	0.19	-0.021
Grandchild will earn more than the mean	-563.78	0.19	0.53	-0.26
R-squared	0.19			
Breusch-Pagan	$14.18 \sim \chi^2_{chr(0.05;10)} = 18.31$			

Table 6. OLS-regression of the relative inequality premium.

Variable	Coefficient	P-value	Mean	Partial effects on g	
				Coeff. of var.	Gini coeff.
Intercept	4893.28	0.00			
Female	1474.74	0.00	0.46	0.188	0.327
Number of siblings	-76.01	0.75	1.56	-0.01	-0.017
Left	3175.86	0.00	0.24	0.389	0.674
Education: - Technology	-1376.73	0.05	0.34	-0.179	-0.310
- Business	-2421.08	0.00	0.42	-0.314	-0.544
At least one semester in economics	717.61	0.26	0.27	0.091	0.158
Frequent church visitor	1136.11	0.32	0.05	0.141	0.245
Area: Big city	706.94	0.29	0.11	0.089	0.154
Parents earned less than mean	1105.12	0.09	0.2	0.139	0.241
Grandchild will earn more than the mean	-709.87	0.15	0.52	-0.091	-0.157
R-squared	0.22				
Breusch-Pagan	$21.69 \sim \chi^2_{chr.(0.05;10)} = 18.31$				

Figure 1. Social marginal rate of substitution for different parameters of relative risk aversion for a constant inequlality aversion=0.5.

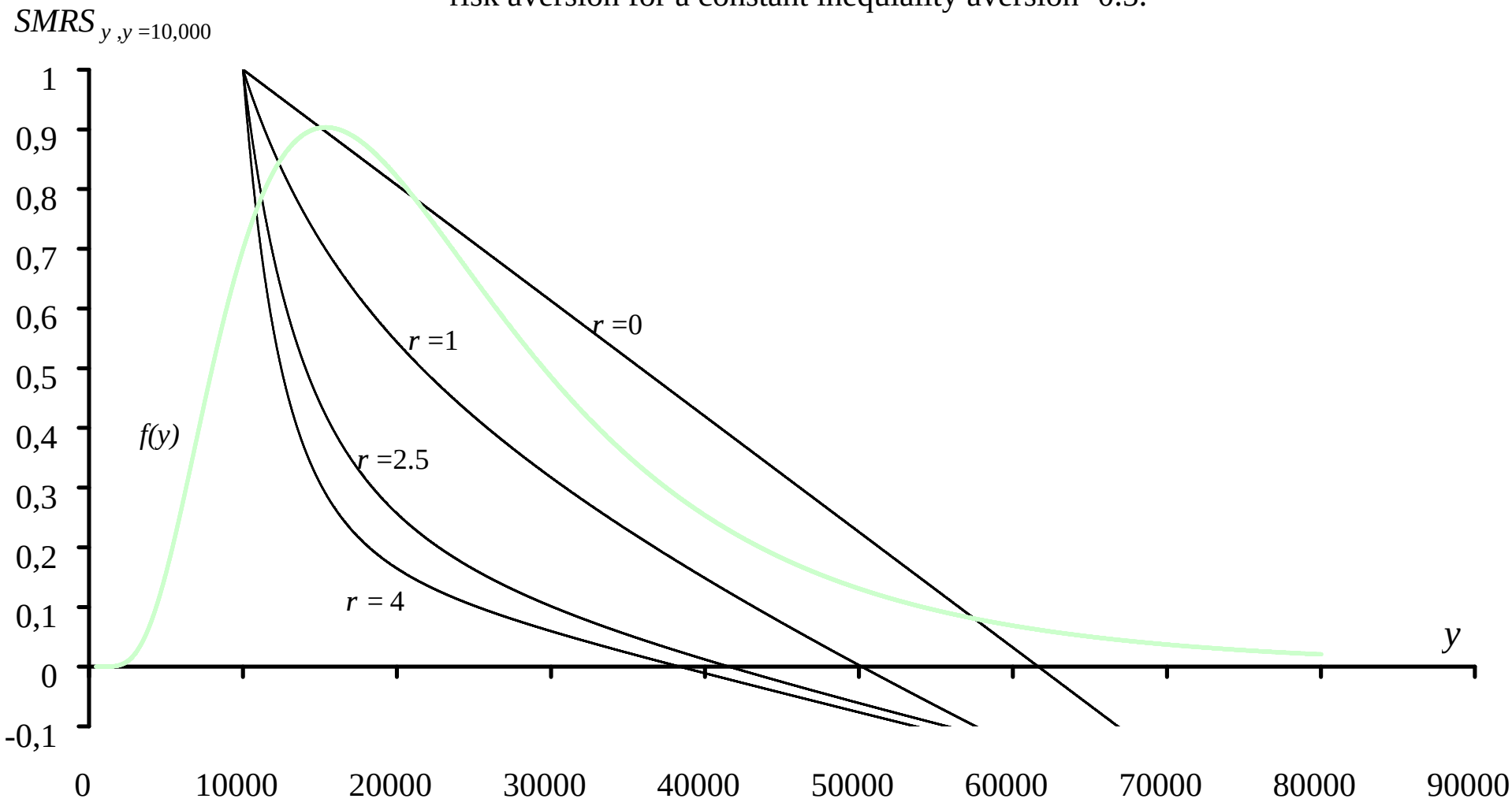

Figure 2. Social marginal rate of substitution for different degrees of inequality aversion for a constant relative risk aversion=2.5.

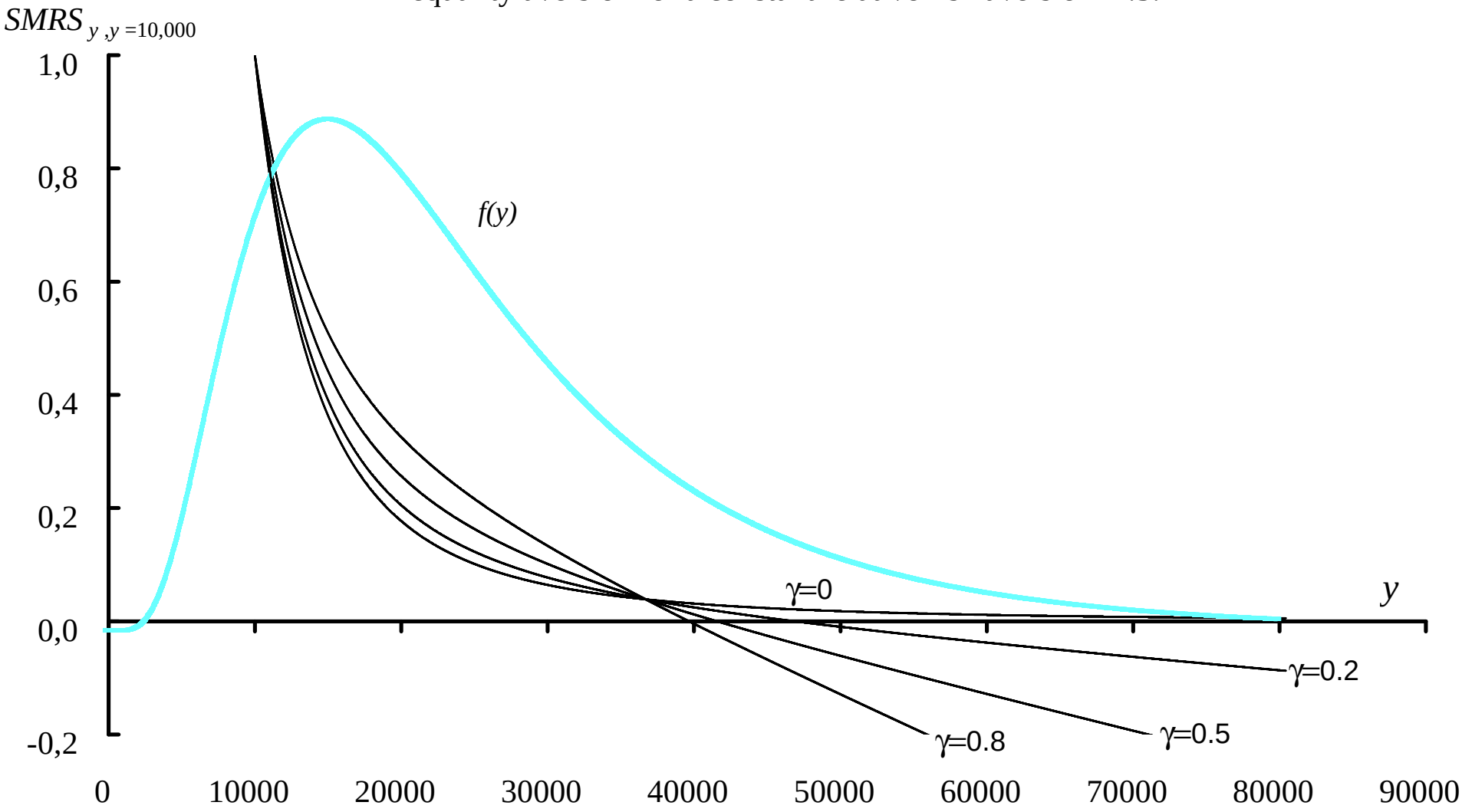

Figure 3. Social marginal rate of substitution for different degrees of inequality aversion, for a constant relative risk aversion=1.