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EXPERIMENTAL STUDIES ON RISK, INEQUALITY AND RELATIVE STANDING

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Abstract

This thesis consists of four separate experimental studies that concern individuals' preferences and choices on issues of risk, inequality and relative standing.

In the first paper, individuals' aversion to risk and inequality, and their concern for relative standing, are measured through experimental choices between hypothetical societies. It is found that, on average, that individuals are both fairly inequality-averse and have a strong concern for relative income. The results are used to illustrate welfare consequences based on a utilitarian SWF and a modified CRRA utility function. It is shown that the social marginal utility of income may then become negative, even at income levels that are far from extreme.

The second paper measures individuals' preferences for risk and inequality using choices between imagined societies and lotteries. Most of the respondents in the study are 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.

The third paper tests the relative performance of some of the competing social preference models have been developed inspired by the evidence from economic experiments. This is done using an experimental design that is aimed at capturing pure distributional concerns in a multi-person setting. We find that the individuals in this study are heterogeneous and that they do not follow any single notion of fairness or inequality aversion. In addition, the results suggest that efficiency concerns are not confined to students of economics but are important to students of all disciplines.

The fourth paper reports results from an economic experiment where respondents are asked to make choices between risky outcomes for themselves and others. In addition, we elicit information about the respondents' perception of others risk preferences. We investigate whether subjects' own risk preferences and gender stereotypes are reflected in the prediction they make for the risk preferences of others and the way this occurs. We find no significant difference in risk preferences between men and women in the experiment. However, both men and women perceive women to be more risk averse than men. When predicting other people's risk preferences, the respondents tend to use

a combination of their own risk preferences and stereotypes. Moreover, when making risky choices for others, the respondents generally use a combination of their own risk preferences and their average predicted risk preference of the targeted group.

Preface

At the start, this study was intended to address the general equilibrium effects of subsidies on bio fuel. After more than two years of pouring over endless statistics on saw logs, pulp wood, chips, sawdust and bark I was despondent and having serious doubts regarding my choice of vocation. My heartfelt thanks to my supervisors Fredrik Carlsson and Olof Johansson-Stenman who at this point gave me the opportunity to work with them on Experimental Economics.

Through all these years they have generously shared their time and expertise and afforded me their constant feedback and support. Our meetings in Gothenburg were certainly an experience. Olof would mentally race ahead of me, spouting his various and rapidly varying trains of thought, each idea more innovative than the next. This was really inspiring but frequently left me struggling to keep up especially when he got carried away in his fast, western Swedish accent. Luckily Fredrik was always around to translate for me.

Fredrik was a real rock. He kept me going through all my highs and lows. He always answered all my questions – even the really silly ones (and there were a lot of those) without being patronising. Another thing about him is that he is a detail despot; everything from a misplaced word to large sections of text were removed mercilessly. Although I did protest at first I soon realized he was almost always right.

After each meeting with the two of them, I returned to Karlstad with many new ideas and solutions but most of all with renewed confidence. That building of confidence was the key to my continuing with the task – they never let me get in a rut and excelled at motivating me through each step.

Their encouragement and inspiration led me to realise not only the value and worth of Experimental Economics as a valid field of study but along the way demonstrated that it could be fun as well. Good fortune indeed to be given the opportunity to work with two brilliant economists who were so very generous with their time and knowledge and patient with my various personal idiosyncrasies.

I would also like to extend my gratitude to all the seminar participants at Karlstad and Gothenburg University for their various contributions. Among these, special thanks to Peter Frykblom, Martin Dufwenberg and Henrik Jaldell for their invaluable comments

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Would The Right Social Preference Model Please Stand Up!

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Abstract

A number of competing social preference models have been developed inspired by the evidence from economic experiments. We test the relative performance of some of these models using an experimental design that is aimed at capturing pure distributional concerns in a multi-person setting. We find that the individuals in this study are heterogeneous and that they do not follow any single notion of fairness or inequality aversion. In addition, the results suggest that efficiency concerns are not confined to students of economics but are important to students of all disciplines.

Keywords**:** Difference Aversion, Efficiency, Inequality Aversion, Maximin Criterion, Social Preferences.

JEL Classification: A13, C91, D63.

1. Introduction

A number of social preference models have been developed in an effort to explain and organize the evidence from economic experiments. It has been found that people share with others in dictator games, reject offers in ultimatum games, cooperate in public good games etc., all of which is in direct conflict with traditional microeconomic utility theory.

Fehr (2001) distinguishes between two approaches used when explaining the behaviour observed in experiments. The first assumes that some agents have social preferences such that their utility depends not only on their own material payoff but also on how much the other players receive. The second approach deals with "intention based reciprocity" where it is assumed that the player cares about the intention of her opponent. Although there is much evidence that perceived intentions are often important, this paper focuses solely on the former. Thus, the experiments designed here aim to capture "pure" social preferences, i.e. the nature of distributional concerns rather than strategic or retaliatory preferences. Consequently, this study examines how people respond to unfair outcomes rather than unfair intentions. More specifically, the purpose

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of this paper is to test the performance of some of the better known social preference theories of difference-aversion, maximin preferences and efficiency concerns using real money distributional experiments.

One category of social preference models are difference aversion models such as those put forward by Loewenstein, Bazerman and Thompson (1989), Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). These models presume that individuals are averse to differences in relative payoffs and would therefore never sacrifice from their own payoff or reduce the payoff of others if the action resulted in a less equitable outcome. An alternative to the difference aversion models are social welfare models that combine distributional concerns with preferences for efficiency (surplus maximization). The Quasi-maximin model by Charness and Rabin (2000) is one of the more prominent social welfare models where Rawlsian maximin preferences are integrated with efficiency concerns.

The various social preference models provide different explanations for the experimentally observed behaviour, but it is sometimes possible to explain the same experimental data using different models. For example, sharing in dictator games is explained by Andreoni and Miller (2002) as being due to maximin preferences while the same results can be explained by difference aversion according to Bolton and Ockenfels (2000) and Fehr and Schmidt (1999). Similarly rejections in ultimatum games and cooperation in prisoner's dilemma games is ascribed to difference aversion by Bolton and Ockenfels (2000) and Fehr and Schmidt (1999) while Rabin (1993) interprets such behaviour as reciprocity.

A number of studies have examined and tested various social preference models including those discussed above. The difference aversion models do not incorporate efficiency but there is evidence indicating that efficiency is an important component in preferences. Studies by Charness and Grosskopf (2001), Kritikos and Bolle (2001), Andreoni and Miller (2002), Charness and Rabin (2000, 2002) as well as Engelmann and Strobel (2004) found that a majority of participants are efficiency rather than equity orientated. Furthermore Andreoni and Miller (2002) construe participants who equalize

payoffs as exhibiting what Charness and Rabin (2000) describe as social-welfare preferences rather than difference aversion. Engelmann and Strobel compared the performance of the Bolton-Ockenfels and Fehr-Schmidt models and found a clear influence of efficiency and maximin preferences. Overall they found that the Fehr-Schmidt model fared better than the Bolton-Ockenfels model, but only when predicting the same choices as the Rawlsian principle. The jury is still out on this issue however. Fehr, Naef and Schmidt (2004) found that efficiency was of little concern when they replicated the experiments of Engelmann and Strobel using non-economist respondents. Furthermore, the authors raised doubts regarding the relevance of the Rawlsian motive in strategic games based partly on the experiments by Güth and van Damme (1998) as well as those by Frechette, Kagel and Lehrer (2003) where little concern was shown for the lowest pay-offs suggesting that maximin preferences are of little importance in strategic interactions. Further support for the difference aversion theory is given by Güth, Kliemt and Ockenfels (2003) who found that fairness concerns dominate efficiency concerns in dictator dilemma experiments where there is a trade-off between fairness and efficiency.[1] The experiments by Güth and van Damme (1998), Bolton, Katok and Zwick (1998) amongst others are used by Bolton and Ockenfels (2002) to support the theory of self-centred fairness that is embodied in their model. These results were not supported by Charness and Rabin (2000, 2002),[2] who found that individuals did indeed care about the distributions of pay-offs among other parties. Kagel and Wolfe (2001) designed a 3-person modification of the ultimatum game in order to test the Fehr-Schmidt and Bolton and Ockenfels models.[3] Their results show insensitivity to third party allocations and reject both the difference aversion models; furthermore, their results even fail to support social-welfare preferences.

The lack of concurrence regarding the empirical evidence motivates further study into the nature of distributional concerns. This paper tests the relative performance of some

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[1] In dictator dilemma games, the recipient receives more than the dictator donates.

[2] The authors designed an experiment with a direct test of Bolton and Ockenfels hypothesis that individuals are unconcerned about the allocation among other parties. The results reject the Bolton and Ockenfels model but are consistent with both the social welfare and Fehr-Schmidt models.

[3] In this game, one person allocates a sum of money to two others, one of which is randomly chosen to accept or reject the offer. Rejection gives both the responder and the proposer zero income but a positive consolation prize is given to the non-responder. The results show little reduction in rejection rates, holding offers constant, with and without consolation prizes, contrary to the prediction of both difference aversion models.

of the more prominent social preference theories of difference-aversion, maximin preferences and efficiency concerns in distributional experiments using an approach that is somewhat different to previous studies. Firstly, within the standard approach experiments are conducted using 2 or 3 players and it is therefore of interest to observe if there is any strong correspondence to any of the social preference models when there are more players involved. In addition, the parameters of the models are rarely estimated in previous studies as the structures of these games do not usually provide sufficient information because they yield outcomes from choices that result in the highest utility for the individuals (dictator games, ultimatum games, binary choices between distributions etc) rather than indifference between choices. Finally and most importantly, the results from previous experiments do not always allow us to discriminate between the different models as the results are often consistent with more than one model. In this paper the experiments are conducted in groups of 11 individuals, where each subject is required to state what we call their "equality equivalence" for an unequal distribution for the group. We define equality equivalence as the value of the egalitarian pay-off for which the individual is indifferent between the unequal and the egalitarian outcome.[4] As will be shown, the individuals' responses classify them into one of the different models and the design of the experiment is such that membership in one of the models is mutually exclusive.

The rest of the paper is organized as follows: Section 2 provides a description of the experimental design and procedure followed by an overview of the different social preference models in sections 3. The results from the study are presented in section 4 followed by the conclusions in section 5.

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[4] According to Rabin (1993) as well as Dufwenberg and Kirchsteiger (2004), intentions play a role when individuals are motivated by reciprocity considerations. If so, the individuals in this study, believing that the other respondents would base their choices out of "kindness" would wish to reciprocate this unselfish action. However this study disregards such effects assuming that the individuals' responses reflect only their distributional concerns.

2. The Experiment

2.1 Experimental Design

We design an experiment where individuals' preferences and the performance of the different models are evaluated by observing the equality equivalence (S) for three different distributions of money among the 11 subjects. The respondents were presented with three questions, for each of which there were two alternatives. Alternative 1 was a given (unequal) distribution for the group while Alternative 2 was the egalitarian distribution where the individual's task was to choose the level of money (S) in each case so that she is *indifferent* between the pay-off distributions in Alternatives 1 and 2. In all three questions, the total surplus in Alternative 1 is 1800 SEK while the individuals pay-off is 300 SEK.[5] The distributions in Alternative 1 differ in that the pay-offs become more equal and in question 3 the lowest pay-off increases from 0 to 150 SEK. Furthermore, the individuals own pay-off is the highest in the group for the distributions in questions 2 and 3. The distributions of the three questions are presented in Figure 1 below. A translation of the exact presentation of the questions is given in appendix B.

Figure 1. *Description of the distributions.*

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Question 1

Alternative 1 | Alternative 2
Individual *i* receives 300 SEK | Each individual (including *i*) receives S_1 SEK.
6 individuals receive 0 SEK
3 individuals receive 300 SEK
1 individual receives 600 SEK

Question 2

Alternative 1 | Alternative 2
Individual *i* receives 300 SEK | Each individual (including *i*) receives S_2 SEK.
5 individuals receive 0 SEK
5 individuals receive 300 SEK

Question 3

Alternative 1 | Alternative 2
Individual *i* receives 300 SEK | Each individual (including *i*) receives S_3 SEK.
10 individuals receive 150 SEK

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note: *i* is the respondent

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[5] At the time the experiment was conducted, 1 USD = 7.3 SEK.

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A modification of the incentive mechanism by Becker DeGroot Marschak (1964) is used to avoid strategic responses by the participants. All participants receive the same pay-off if the stated value for S is less than a subsequently drawn random number. This random number is also the pay-off of each individual. In the case where S coincides with or exceeds the randomly drawn number, the pay-offs are in accordance with Alternative 1. Respondents are restricted to stating values for S less than or equal to 300 which is their payoff in Alternative 1. Thus, stating one's equality equivalence is the dominant strategy. The individuals can then be categorised into the different models. The alternatives were designed so that membership is mutually exclusive in that it is not possible for a respondent to belong to more than one group.

While the behaviour of some participants appears to be consistent with the difference-aversion models, it is possible that individuals may also have surplus concerns. In order to see whether concerns for efficiency are present, a follow up question was put to the participants. The question has similarities to the one sided dictator dilemma treatment used in the paper by Güth, Kliemt and Ockenfels (2003). The original distribution is equal for all players so that each individual receives 100 SEK. Individual i has the possibility to donate money to the others in the group. For every SEK donated, the pay-off of every other individual is increased by 0.25 SEK. Thus every SEK given away by individual i will increase the total surplus by 1.5 SEK. If the values of S given by individual i appear to correspond to the one of the difference aversion models above but a positive donation is made to increase the surplus then this is sufficient for us to conclude that in at least those cases the models are incomplete and concern for efficiency should be accounted for.

2.2. Experimental procedure

A total of 132 undergraduate students from various disciplines were recruited on campus at Karlstad University to participate in the study. The experiment was conducted in 12 sessions in groups of 11 students, although in order to ensure a full head count, 12 students were summoned on each occasion. Only the first 11 arrivals were accepted as participants while the 12th was paid a show-up fee of 50 SEK. The participants were seated individually with unobstructed views of all other participants.

Each participant was given an envelope containing full instructions (a translation is available from the author upon request) as well as an identity number. The same identity number was printed on the back of the questionnaire. The session began with the experimenter explaining how the payment procedure guaranteed complete anonymity for the participants after which the distribution part of the survey was explained first along with the incentive mechanism. This part of the experiment took between 20-25 minutes. The distribution task was explained using an example with a distribution similar to those in the survey. The incentive mechanism was illustrated using trial runs assuming different varying S-values. The cognitive demand on the students is considerable in this kind of experiment, so great pains were taken to ensure that the students had understood the nature of the task as well as the incentive mechanism.[6] The three distributions were presented on the overhead and their characteristics were described to the subjects in a similar fashion as described in section 3. In order to assist the subjects in the distribution questions they were told the following:

> *"If you have difficulty in answering the questions you may wish to follow the following procedure:*
>
> *Set S in Alternative 2 to 300 SEK and ask yourself which alternative you would prefer. If you like both alternatives equally then set S=300. However, if you prefer Alternative 2 then lower the value of S slightly and ask yourself the same question again. Repeat the procedure, decreasing or increasing the value of S until you reach a point where you consider the two alternatives to be equal in value."*

The participants were given time to answer the distribution questions before the donation to the surplus task was presented. The subjects were asked to place their pens on their tables to signal when they had finished each task. Finally the participants were required to fill in some information regarding their socioeconomic status. The variables collected were gender, number of siblings, political preferences and choice of discipline.

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[6] Nonetheless, it is possible that some participants still did not grasp that stating their equality equivalence S is the dominant strategy. Thus they were also told that if they did not fully understand the incentive mechanism, they should "trust" the instructor in that it was in their best interest to answer in accordance with their preferences and that they had nothing to gain, but could possibly lose by not doing so. They were further told that the instructor would stay behind at the end of the session to explain the incentive mechanism more thoroughly if they did not wish to ask questions in front of the group.

Each experimental session lasted about 40 minutes. The questionnaires were collected and one was picked at random. A dice was thrown by the instructor to establish for which of the four questions the payoff would occur. For questions 1-3 the incentive mechanism was evoked where a number "R" was picked at random from a box. If $R \leq S$ then the pay-offs were according to Alternative 1 whereas if R>S then all the individuals received the same pay-off R. In the former case, identity numbers were picked one by one at random with the associated pay-offs increasing in magnitude as the numbers were picked. The instructor noted the payoffs on a sheet of paper which was given to another person and the participants were able to collect their pay-offs individually using their identity cards.

3. The models

The models tested in this study are the difference aversion models of Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), the social welfare model of Charness and Rabin (2000) as well as a more general inequality aversion model. In this section we present a general overview of the different models. We begin by considering the two difference aversion models. Fehr and Schmidt assume a utility function of the following form for individual i

$$U_i = w_i - \alpha_i \frac{1}{n-1} \sum_{i \neq j} \max\{w_j - w_i, 0\} - \beta_i \frac{1}{n-1} \sum_{i \neq j} \max\{w_i - w_j, 0\},$$

where $\alpha_i \geq \beta_i$, $0 \leq \beta_i < 1$ and w_i is the pay-off of individual i. The structure of this model incorporates both envy and altruism. The disutility from inequality is greater when another individual has a larger pay-off than vice-versa thus the assumption is that envy is stronger than altruism. The implication behind $\beta_i < 1$ is that the disutility from receiving more than others is never so great that the individual is willing to sacrifice money without benefiting others.

Bolton and Ockenfels present in the theory of Equity, reciprocity and competition (ERC) an unspecified motivation function that is given by

$$V_i = (w_i, s_i),$$

where w_i denotes own payoff and s_i the individuals share of the total payoff. It is assumed that that the function increases in own payoff w_i, decreases as the relative payoff s_i moves away from the social reference share $1/n$. Thus for a given w_i, the function V_i is maximised when $s_i = 1/n$, n being the number of individuals in the reference group. In the case where $s_i > 1/n$ the marginal rate of substitution between absolute and relative pay-offs will determine how much the individual is willing to sacrifice in order to obtain an egalitarian solution.

The difference between the two difference aversion models is that in the Fehr-Schmidt model the individual compares her own pay-off with each and every other individual in the reference group. In the Bolton-Ockenfels model the individual's only concern is her share of the total surplus and the pay-offs of other individuals do not enter directly into the motivation function. In the case where a transfer of money is made from an individual with a higher pay-off to an individual with a lower pay-off, utility will increase in the first model but remain unchanged in the second.

The social welfare model that we will test is the Quasi-maximin model of Charness and Rabin (2000), which is basically a reinterpretation of the Andreoni and Miller (2002) model[7] where people make sacrifices to increase the payoff of all recipients, but especially for the lowest pay-off recipient. The individual's utility function is given by

$$\text{U}_i = (1-\gamma)w_i + \gamma[\delta \min\{w_1, w_2...w_n\} + (1-\delta)\sum_{j=1}^{n} w_j],$$

where the parameter $\gamma \in [0,1]$ corresponds to the weight the individual places on social welfare, expressed as $[\delta \min\{w_1, w_2...w_n\} + (1-\delta)\sum_{j=1}^{n} w_j]$, versus her own monetary payoff w_i. When $\gamma = 0$ then preferences are consistent with pure self-interest. If $\gamma = 1$, the individual displays purely "disinterested" preferences where the individual values the pay-offs of others as much as her own. The parameter $\delta \in [0,1]$ measures the degree

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[7] Charness and Rabin refer to the working paper by Andreoni and Miller from 1998 that was subsequently published in 2002.

of concern for helping the lowest pay-off recipient versus increasing the total surplus. Thus $\delta = 1$ is consistent with the Rawlsian criterion while $\delta = 0$ corresponds to maximisation of the total surplus.

We also introduce a more general model where utility is assumed to be a function of some measure of inequality. With multi-person experiments, it is possible that the level of inequality per se is an issue. For example, in the Carlsson et al (2005) study individuals were found to have strong preferences regarding the level of inequality per se in the case of income. In order to encompass this we introduce a general function assuming that the individual's utility is dependent on her own payoff w_i, the general level of inequality ϕ and some function $v(w_1,...,w_n)$ of the pay-offs of others so that the utility function is

$$U_i = U[w_i, \phi, v(w_1,...,w_n)]$$

The function $v(w_1,...,w_n)$ may for example represent concerns for the least pay-off individual, concerns for the total surplus, differences between the individuals own pay-off and the pay-off of others or any combination of the above. We refrain from stipulating any precise functional form as the purpose here is merely to obtain some measure of the proportion of subjects that have concerns for inequality per se.

Depending on the values of the stated equality equivalence (S) each individual can be categorised into one of the different models. Defining the inequality premium, E, for a particular distribution as the maximum amount of money an individual is willing to sacrifice from her endowment in order to achieve an equal distribution for the group so that E=300-S, we then have the following classification of responses.

1) If $E_2 = E_3 < E_1$ then the individual's preferences fit the Fehr-Schmidt model. The distributions in questions 2 and 3 are equivalent in this case as the redistribution of pay-offs between the other participants does not affect the average distances to the individuals own pay-off. It is also necessary that the inequality premium in question 1 be higher than in the other two questions as the average distance from those with lower and higher pay-offs increases, and thus the distribution in question 1 will give the individual the lowest utility.

2) If $E_1 = E_2 = E_3 > 0$ then the individual's preferences correspond to Bolton and Ockenfels model. The ERC model assumes that individuals care only about their payoffs relative to the total and are unconcerned regarding the relative pay-offs between the other participants. The individual's share of the total surplus is the same, and thus the inequality premiums will be the same in all 3 cases.

3) If $E_1 = E_2 > E_3$ then the individual exhibits quasi-maximin preferences. Since the lowest pay-off is the same in the first two questions and increases in the third, the inequality premium will decrease in the third question.

4) If $E_1 > E_2 > E_3$, then this implies that the preferences are consistent with the more general case where the individual has an aversion for inequality per se. Thus the premium that an inequality-averse individual is willing to pay will be decreasing as the degree of equality in the distributions increases.

5) If $E_1 = E_2 = E_3 = 0$, then preferences correspond to pure self interest where the individual disregards the pay-off of others. This is consistent with traditional microeconomic theory.

4. Results

The values for the inequality premiums for the first two questions (E_1 and E_2) range from 0 to 300 with means of 101 and 92 respectively. The corresponding values for E_3 are from 0 to 200 with a mean of 57. Detailed tables including the means and standard deviations of the inequality premiums for the total and each group separately are given in table A1 in appendix. If we look at the mean values directly, we have that $E_1 > E_2 > E_3$. This implies that preferences are consistent with the inequality aversion model that was developed in this paper. However, individuals are heterogeneous between as well as within models and we use the inequality premiums of each individual to classify them into the different models.

Table 1 below presents the number of participants whose responses are consistent with the different models; note again that the groups are mutually exclusive. The group "Other" consists of individuals whose preferences do not appear to fit any of the models

above. The table also includes the number of individuals in each category that sacrificed money in order to increase the total surplus in the follow-up question.

Table 1: *Frequency of participants that qualify into the different model categories and give surplus increasing donations.*

	Number of respondents within each category. (% of total)	Number of respondents that gave surplus increasing donations. (% of group)
Fehr-Schmidt	9 (6,8%)	3 (33.3%)
ERC	28 (21,1%)	9 (32.1%)
Quasi-Maximi	36 (27,3%)	10 (27.8%)
Inequality-averse	39 (29,5%)	11 (28.2%)
Self Interest	10 (7,6%)	0 (0.00%)
Other	10 (7,6%)	3 (30.0%)
Total	**132 (100%)**	**36 (27,3%)**

The group of responses consistent with our general model of inequality aversion was the largest with 39 individuals (29.5%). followed by the difference aversion group consisting of the Fehr-Schmidt and the ERC models with a total of 37 individuals. Within the difference aversion group the ERC model fares considerably better than the Fehr-Schmidt model with more than three times the number of participants falling into the former category. The Quasi-maximin model was in close third place with 36 individuals. Although the difference aversion models appear to perform at least as well as the Quasi-maximin model, each group receiving roughly 28% of the respondents, nearly a third of the respondents in the difference aversion group made donations in order to increase the surplus, thereby also increasing the level of inequality. This is in direct conflict with the predictions of both difference aversion models and the implication would be that for those individuals at least, the models do not completely capture preferences. Nor can we exclude possible preferences for efficiency among those individuals within the group who did not make a donation as the disutility from the lower payoff and increased inequality may not have compensated for the utility derived from the increase in the total surplus. There were 10 individuals (7.5%) in the "Self interest" group, i.e. those individuals who were unconcerned with the pay-off of

others.[8]   The group "Others" had the same number of individuals as the Self Interest group. The only general pattern observed in this group was that 9 out of 10 of the respondents considered the distribution in question 2 to be the worst and as such had the highest inequality premiums.

Apart from stating their inequality premium for the three distributions, the participants were also required to answer some questions on their socio-economic status. A multinomial logit model was used in order to see if it was possible to classify respondents into the different model groups based on values of the set of socio-economic characteristics. The only variable found to have any effect was gender in the model group "Self Interest" where 80% of the individuals in the group were male.[9] Consequently, we are not able to explain the difference in preferences using observable individual characteristics to any great extent.

As mentioned in the introduction it is possible to estimate the parameters values of the Fehr-Schmidt as well as the Charness-Rabin utility functions using the information provided in the experiment. The parameter values of both models were calculated and the descriptive statistics of these are given in tables A2 and A3.[10] The Pearson correlation measure between the two parameters α and β for the Fehr Schmidt group was found to be -0.625 at a significance level of 0.36. Thus, individuals with higher β values tend to have lower α values and vice versa, or in other words, those who are more altruistic tend to be less envious and vice versa. In the Quasi-maximin group it was found that as many as 11 of the δ parameter values and one of the γ parameter values were greater than 1 which is clearly unreasonable as $\delta>1$ implies that the parameter for efficiency $(1-\delta)$ is less than 0 implying that an increase in efficiency lowers the individual's utility. With the numbers in this particular experiment it is

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[8] This is considerably less than in previous studies where 30% is the proportion mentioned in some of the literature but consistent with results from experiments where reciprocity is not an issue, e.g. Charness and Rabin (2000) where the proportion of individuals motivated solely by self-interest is around 10%.

[9] This corresponds with results from previous studies for example Selten and Ockenfels (1998 pg 529). However as there are only 10 respondents in the Self Interest group it is not possible to draw any definite conclusions from this result.

[10] Bolton and Ockenfels do not use a specific function to describe preferences and in this study. In addition, we do not specify a precise functional form for the comparison inequality aversion model. In both cases the value of the inequality premium is used as the measure of difference aversion and inequality aversion respectively.

sufficient that $E_2 > 2 E_3$ for δ to be greater than 1. The descriptive statistics in the appendix also include adjusted parameters where values greater than 1 were set equal to 1. More than 60% of the adjusted parameter values for efficiency $(1-\delta)$ were zero implying that efficiency was not a factor considered important by most of the respondents. Two of the respondents had adjusted values of $\gamma=1$ implying that they have purely "disinterested" preferences in that they value the pay-offs of others as much as their own.[11]

The test for efficiency in the follow-up question is rigorous in the sense that those individuals who make positive donations to the common surplus are both sacrificing money and moving away from the egalitarian solution, and as such their concern for efficiency is irrefutable. However, although the test above is sufficient in order to ascertain preferences for efficiency, we cannot rule out such preferences for those who do not make such a donation as it is quite possible that the utility gain from the increased surplus does not outweigh the disutility from the decrease in own wealth and equality. Positive donations were made by 36 (27.3%) individuals. Of these, the donations ranged between 5 and 100 SEK, with a mean and standard deviation of 28 and 22 respectively. These results are in stark contrast to the results from the two-person dictator dilemma game by Güth, Kliemt and Ockenfels (2003) who found that individuals never violate the fairness constraint in order to increase efficiency. If we consider efficiency in Quasi-maximin model, we found 15 individuals (42%) exhibited preferences for efficiency within the model.[12] Allowing for inaccuracies in model specifications we thus have *at least* 41 individuals (31%) in this study who appear to exhibit strong preferences for efficiency. Furthermore, we find the proportion of respondents making positive donations, and as such have strong preferences regarding efficiency to be stable between the groups (with the exception of the Self-Interest group who as expected exhibited no efficiency concerns) which would lead us to believe that preferences for efficiency are not overrepresented within the Quasi-maximin group. If we accept this notion then the estimate of subjects with efficiency concerns within this

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[11] One of the two respondents had parameter values $\delta=\gamma=1$ which corresponds to the extreme case where the individuals only concern is the for the lowest pay-off recipient.

[12] There were 15 respondents within the Quasi-maximin model who either had a positive parameter for efficiency (14), gave a surplus increasing donation (10) or both.

study would then be 51 or roughly 38.5%. These results support the conclusions of Engelmann and Strobel that distribution concerns are a significant factor in pure distributional situations,[13] Fehr and Schmidt (2004) argue that the relevance of the efficiency motive is largely restricted to students of economics and business administration who value efficiency rather than equality. It might be the case that students of economics may have been taught that efficiency should be considered as an important issue and as such would value equity less and efficiency more than students of other disciplines so we checked for subject pool effects in this issue. 72 of the participants were students of economics who had completed at least one term of economics while the remaining 60 participants came from various other disciplines. Of these 20 economists (27.8%) and 16 non-economists (26.7%) gave surplus increasing donations. We tested using a Chi-2 test whether it is more likely that economists gave positive donations than non-economists. Similarly, we also checked for any relationship between choice of discipline and surplus concerns. In addition we conducted t-tests to check if the mean donations differed between the two groups in that economists contributed more toward increasing the total surplus than others. The results show no significant difference between economists and non-economists in any of the tests conducted. Thus, our results do not support the argument made by Fehr and Schmidt that efficiency concerns are mainly restricted to students of economics and business.

5. Conclusions

This paper uses a distributional experiment in order to test the performance of some of the better known social preference theories and efficiency concerns in a neutral arena in order to examine how people respond to unfair outcomes in multi-person setting. The results show that the individuals in this study are heterogeneous and that they do not follow any single notion of fairness or inequality aversion. The number of subjects that qualified into the three categories was fairly even with the largest proportion of subjects falling into the reference inequality aversion model closely followed by the difference aversion and quasi-maximin models. Within the difference aversion group we found that the ERC model performed considerably better than the Fehr-Schmidt model with more than three times the number of participants falling into the former category.

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[13] Fehr and Schmidt (2004) also argue that the relevance of the efficiency motive is largely restricted to non-strategic interactions.

Although the difference aversion category appear to perform at least as well as the other two, contrary to the model specification nearly a third of the respondents in the group made donations in order to increase the surplus. While difference aversion models may provide an insight into players' willingness to donate to others when ahead, they cannot explain donations which lead to an increased level of inequality. This suggests that in at least a third of the cases the difference aversion models do not completely capture preferences. Finally, we found that roughly one third of the respondents have quite strong concerns for the total surplus. It is sometimes argued that the relevance of the efficiency motive is largely restricted to students of economics and business administration and is of less concern to students of other disciplines. This study found no such correlation.

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Appendix A-Descriptive statistics tables

Table A1: Descriptives of the Equality premiums for all categories.

		Mean	Std. deviation	Minimum	Maximum
Total	E1	100.98	59.570	0	300
	E2	91.88	54.324	0	300
	E3	56.86	48.659	0	200
Fehr-Schmidt	E1	90.56	41.416	20	140
	E2	51.67	44.159	0	100
	E3	51.67	44.159	0	100
ERC	E1	91.79	37.348	20	150
	E2	91.79	37.348	20	150
	E3	91.79	37.348	20	150
Quasi maximin	E1	113.06	51.036	30	300
	E2	113.06	51.036	30	300
	E3	53.33	45.529	0	150
Inequality aversion	E1	136.02	58.739	20	250
	E2	100.21	52.541	10	220
	E3	52.05	49.227	0	200
Self interest	E1	0	0	0	0
	E2	0	0	0	0
	E3	0	0	0	0
Others	E1	57	38.601	0	120
	E2	111.50	41.637	10	150
	E3	52	51.597	0	120

Table A2: Estimations of the parameter values for the Fehr- Schmidt category.

	Mean	Std. Deviation	Minimum	Maximum
α	0.9519	1.03858	0.13	3.33
β	0.3444	0.29439	0.00	0.67

Table A3: Estimations of the parameter values for Quasi-maximin category.

	Mean	Std. Deviation	Minimum	Maximum
$\gamma\_adjusted$	0.3970	0.19847	0.08	1.00
$\delta\_adjusted$	0.9267	0.13605	0.48	1.00
unadjusted γ values	0.3984	0.20294	0.08	1.05
unadjusted δ values	0.9571	0.15922	0.48	1.11

Appendix B- Translation of the exact presentation of the questions in the questionnaire.

Questions 1-3.

You have just been shown an example of your task by the monitor. You will now be required to answer three questions that are similar to the example.

 For Alternative 1, the total allocation of money is 1800 SEK for all three questions and your share is always 300 SEK.

The questions differ in that the allocation between the participants becomes more even. The distribution in question 2 is more even than in question 1 and question 3 in turn, is more even than in question 2. In addition the lowest pay-off increases to 150 SEK in question 3.

The distributions for Alternative 1 for the three questions are presented below.

Alternative 1

Question 1	**Question 2**	**Question 3**
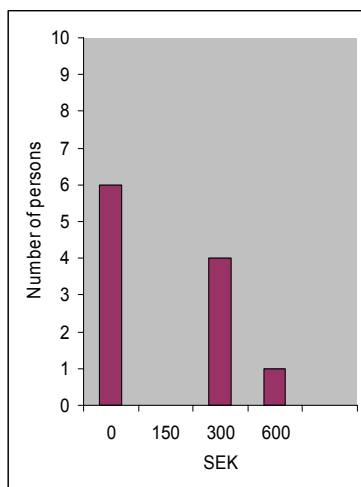
You receive 300 SEK	**You receive 300 SEK**	**You receive 300 SEK**
6 people receive 0 SEK	**5 people receive 0 SEK**	**10 people receive 150 SEK**
3 people receive 300 SEK	**5 people receive 300 SEK**	
1 person receives 600 SEK		

Alternative 2

All participants (including you) receive the same amount _S_ SEK.

Answer 1

  I like the distribution in Alternative 1 in question 1 *as much as* the distribution in Alternative 2 when S=＿＿＿＿ SEK.

Answer 2

  I like the distribution in Alternative 1 in question 2 *as much as* the distribution in Alternative 2 when S=＿＿＿＿ SEK.

Answer 3

  I like the distribution in Alternative 1 in question 3 *as much as* the distribution in Alternative 2 when S=＿＿＿＿ SEK.

Question 4.

In this question you have the possibility to give away money, _if you so wish_, from your allocation to the others in the group. For every SEK you choose to give away, _each_ of the other participants will receive 0.25 SEK more.

Each person in the group receives 100 SEK.

Answer 4

I wish to give away ＿＿＿＿ SEK from my 100 SEK to the others in the group.

Abstract

This paper reports results from an economic experiment where respondents are asked to make choices between risky outcomes for themselves and others. In addition, we elicit information about the respondents' perception of others risk preferences. We investigate whether subjects' own risk preferences and gender stereotypes are reflected in the prediction they make for the risk preferences of others and the way this occurs. We find no significant difference in risk preferences between men and women in the experiment. However, both men and women perceive women to be more risk averse than men. When predicting other people's risk preferences, the respondents tend to use a combination of their own risk preferences and stereotypes. Moreover, when making risky choices for others, the respondents generally use a combination of their own risk preferences and their average predicted risk preference of the targeted group.

1. Introduction

There are a wide range of areas within modern society where people are required to make decisions involving risk on behalf of others i.e. policy makers, community leaders, physicians, financial advisors etc. In a situation where the risks are not borne by the decision maker, then, given no paternalism, the optimal decision would be one that reflects the will of those the decision affects. This requires an unbiased perception of the risk preference of those affected and that the decision made should perfectly reflect that perception. Although numerous experiments have been conducted on the measurement of risk preferences (e.g.: Carlsson et. al, 2005; Holt and Laury, 2002; Isaac and Duncan, 2000; Kachelmeier and Shehata, 1992), relatively little work has been undertaken on measuring how people predict the risk preferences of others (Hsee and Weber, 1997, 1998, 1999; Siegrist, et al., 2002; Eckel and Grossman, 2002, a,b; Chakravarty et. al, 2005), and as far as we are aware, the only study that has investigated how people

make choices for others in situations where the outcome may have various levels of risk is Chakravarty et al, 2005.[1]

This paper reports results from an incentive-compatible real-money risk experiment where participants were required to make choices between risky outcomes for themselves and others. Furthermore, we elicit information regarding the respondents' perception of other peoples risk preferences. We use the results to bring together a number of issues. We examine the accuracy of individuals' forecasts and the extent in which individuals own risk attitudes and the gender of the target are reflected in the prediction they make for the risk preferences of others. In addition, we examine whether subjects make risky choices on behalf of other people based solely on their expectation of the risk preference of those affected or whether their own risk attitudes are reflected in their choice.

While many neo-classical economists may assume that people have an unbiased perception of reality including predicting others' risk preferences, psychologists have presented a number of theories concerning people's perception of the risk preferences of others. The most straightforward of these theories is based on the false consensus effect and what Hsee and Weber (1997) refer to as the *default* hypothesis that simply states that people believe that others think like themselves and therefore predict the same risk preference for others.[2] Support for the default theory was found by Hsee and Weber (1997) as well as in a recent experiment by Chakravarty et al (2005).[3] Within the *Risk-as-value* hypothesis formulated by Brown (1965) people perceive themselves to be more risk seeking than their peers based on the related assumptions that risk seeking is an admirable characteristic (Shapira 1995) and that they are better than others – ergo, they are more likely to have a higher propensity for risk than others.[4] Hsee and Weber (1997) find evidence for what they refer to as the *Risk-as-feelings* hypothesis which

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[1] The paper by Chakravarty et al. came to our attention after the experiments in this study were performed.

[2] The default hypothesis is analogous to the false consensus effect in social psychology where people tend to overestimate the degree to which their own behaviour, attitudes, beliefs etc. are shared by other people (Ross, Greene and House, 1977).

[3] In the Chakravarty et al study, respondents were required to predict the average risk propensity of the other participants by guessing the average choice made by all participants.

[4] See Siegrist et al., (2002) and references therein for results from studies testing the risk-as-value hypothesis.

states that an individual will predict that another is more risk neutral than them.[5] This theory is based on the notion that people often have strong feelings when faced with a risky choice and they have difficulty in conceiving that others have the same depth of feeling as themselves and therefore the prediction for the target regresses to risk neutrality.[6]

The hypotheses above use the premise that the predictor will project their determination of another's risk preference on the basis of their own, the *Stereotype* hypothesis on the other hand is based on the theory that the prediction of another person's risk preference is based on the predictor's stereotype about the group to which the target belongs in terms of gender, race etc. Studies by Hsee & Weber (1997, 1999) find evidence of such stereotyping on the basis of race while studies by Eckel & Grossman (2002,a,b) and Siegrist et al., (2002) find evidence of gender stereotyping when examining subjects predictions of the risk aversion of others.

Gender differences in risk responses are well documented in a number of different fields and although most of the empirical work suggests that women are indeed more risk averse than men, the evidence is not clear cut. Byrnes, et al., (1999) conducted a meta-analysis of 150 studies finding a significant difference in the risk attitudes of men and women. Men were generally greater risk takers although the gender difference varied with the risky environment. Studies exploring gender differences in risk aversion in the context of non-financial decisions concerning for example health (e.g: Kristiansen, 1990; Swanson, Dibble, and Trocki, 1995; Hersch, 1996) and traffic (e.g: Hersch, 1996; Brinig, 1995; Svenson, 1978) behaviour find evidence of women's greater risk aversion. A number of studies indicate women are more risk averse than men in financial risk taking; see for example Sunden and Surette (1998), Jianakoplos and Bernasek (1998), Bajtelsmit, Bernasek and Jianakoplos (1999), Pålsson (1996). The same pattern is observed from a number of experimental studies eg: Levin et al, (1988),

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[5] See Loewenstein et al., (2001) for a detailed description of the *Risk-as-feelings* theory.
[6] Hsee and Weber (1997) find that the risk-as-feelings hypothesis holds when the target is anonymous. However, in a second study, they find that when respondents are asked to predict the risk preferences of an individual visible to them, the results are consistent with the default hypothesis. The authors explain the results by arguing that it is easier for individuals to project their own feelings towards risk in the case where the target is vivid than when the target is abstract.

Eckel and Grossman (2002,a,b), Powell and Ansic (1997), Levy, Elron and Cohen (1999). However, not all studies support the stereotype that men are less risk averse than women in financial decision making. Schubert et al (1999) find no general gender differences when subjects face contextual decisions[7] and argue that adequate conclusions cannot be drawn using results from abstract gambling experiments.[8] Other studies that contradict the notion of gender differences in risk attitudes are Kruse and Thompson (2001, 2003) as well as Holt and Laury (2002).

Even if the evidence on whether women are in fact more risk averse than men is not clear cut, the mere perception that women have a lower risk propensity may lead to statistical discrimination that has an impact on womens' (and mens') opportunities, incomes and choices. If women are perceived to be less able to make risky decisions, then they may be less likely to be given corporate promotions underlying the concept of the "glass ceiling". Johnson and Powell (1994) find no differences in decision quality and risk propensity between male and female managers and argue that the exclusion of women from such positions may be based on false stereotypes derived from observations from the non-managerial population. Eckel and Grossman (2002, a.) note that if women are perceived to be more risk averse or less willing to risk the breakdown of negotiation then they may receive less generous initial offers in employment negotiations and face more aggressive bargaining, leading to lower negotiated wages.[9] Wang (1994) finds evidence of gender stereotyping by financial advisors where female clients were offered lower risk-return investments relative to those offered to male clients. Stereotyping may even have effects in the area of health care where evidence from several studies show that doctors tend to prescribe less aggressive treatment for women patients compared with men exhibiting the same symptoms (e.g., Schulman, et. al. 1999; Tobin et. al. 1987), but where patient preferences alone do not explain these

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[7] The authors conducted an experiment where subjects were required to make abstract gambling decisions as well as financially motivated risky decisions embedded in an investment or insurance context.

[8] In addition they point out those results from survey data showing gender specific risk attitudes may be due to differences in individuals' opportunity sets. This theory is supported partly by the results of Säve-Söderberg who studied premium pension portfolio choices and found that after controlling for a wide range of variables that the only significant gender difference appeared at the upper end of the risk distribution.

[9] Eckel and Grossman also refer to a model developed by Vesterlund (1997) where if more risk-averse workers can be identified, then they (women if the stereotype is applied) face a distribution of wages that is stochastically dominated by the distribution for the less-risk-averse group even when the productivity of the two types of workers are identical.

gender disparities (e.g., Saha, et al., 1999; Schecter et. al. 1996), indicating that the difference in treatment may be caused by the physician's gender stereotype of patients' risk preferences.

The gender stereotype with regard to risk is one of the issues considered in this study. We also examine the extent to which subjects' own risk preferences are reflected in the predictions they make for the risk preferences and the choices they make on the behalf of others. Although we found no significant relationship between gender and stated risk preference, both sexes predicted that women were more risk averse than men. The results also suggest that the participants own risk preferences are a significant factor when they estimate the risk preferences of others. Furthermore, when required to make risky choices on behalf of the other participants, we find again that the individuals own attitudes to risk is a factor on which they base their choice.

The rest of the paper is organised as follows: sections 2 and 3 provide a description of the experimental design and procedure. The results from the study are presented in section 4 followed by the conclusions in section 5.

2. The Experiment

The experiment was conducted in two parts. The purpose of the first part was to elicit the risk preference of each of the subjects as well as the subject's prediction of the risk preference of each of the other participants in that session for the same risk scenario. In the second part the subject was required to make a similar decision for the rest of the group as a whole but at no risk to themselves.

In the first part of the experiment, individuals were asked to state their certainty equivalence for a gamble with a 50% probability of receiving either 200 SEK or 0 SEK.[10] We use this approach rather than the standard reservation price method in order to minimise any loss aversion effects. The question was presented in a similar fashion to the example below.

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[10] At the time the experiment was conducted, 1 USD = 7.3 SEK

Figure 1: *Description of the question used to determine individuals' own certainty equivalences.*

Question 1

You are presented with two alternatives below.

Alternative 1:

A dice is thrown

In the case of an odd number you receive   0 SEK

In the case of an even number you receive   200 SEK

Alternative 2:

You are unconditionally given   *C* SEK

For what value of C do you consider Alternative 1 to be *as good as* Alternative 2?

Answer: I like both alternatives *equally* when C = _____ SEK

In order to avoid strategic responses, a modification of the Becker DeGroot Marschack (1964) procedure is used where the certainty equivalences are matched with a randomly drawn number to determine the individual's payoff. The response to question 1 provides each *individual's own certainty equivalence (OCE)*, which is used as the measure of risk aversion.

The follow up question in this part of the experiment then asked each participant to predict the response to question 1 by *each* of the other 10 participants in their session. The only information a subject has on which to base their prediction are the visual clues provided by observing the others. These responses can be used to calculate

- *each individual's average prediction of the whole group (PCE)*
- *each individual's average prediction for the men in the group(PCE^m)*
- *each individual's average prediction for women in the group(PCE^f)*

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The information obtained from the responses to the question and its follow-up i.e. an individual's own and their prediction of the certainty equivalence's of others, allows analysis of the issues presented in the introduction: (i) To what extent are subjects' own risk preferences reflected in the prediction they make for the risk preferences of others? (ii) Is there a stereotype effect with regard to gender and risk?.

Within the second part of the experiment, each participant faced the same choice as in question 1. The difference was that the choice was made on behalf of the *other* participants in the session. Each individual was given 200 SEK regardless of the outcome for the others in the group. The payment was made to the subject to avoid negative feelings of not receiving any money themselves as well as an attempt to anchor the feeling that the decision made for others is a payment for performing a "task". The subject would thus be more inclined to make the effort to reach a well considered decision. The question was presented in a similar fashion to the example below:

Figure 2: *Description of the question used to determine the individual's certainty equivalence when the outcome affects others.*

Question 2

Your task is to make a decision on behalf of the *other* people in this group. You will receive 200 SEK for this task regardless of the outcome for the others in the group.

Alternative 1:

A dice is thrown

In the case of an odd number the other 10 people *each* receive   0 SEK

In the case of an even number the other 10 people *each* receive   200 SEK

Alternative 2:

Each of the other 10 people unconditionally receive   C SEK

You will receive 200 SEK regardless of the outcome in both alternatives.

For what value of C do you consider Alternative 1 to be *as good as* Alternative 2?

Answer: I like both alternatives *equally* when C = _____ SEK

The responses will allow some interesting comparisons between the first and second part of the experiment. First of all we can test to what extent the subjects based their answer on what they believe the rest of the group's preference would be (which can be calculated by the individual's average prediction of the whole group in the follow up question in part 1). Second, and more importantly, we can test whether the individual's response in question 2 reflects the actual will of the group as ascertained by calculating the average of the actual certainty equivalence stated by the rest of the group in the results of question 1.

3. Experimental Procedure

The study was conducted with undergraduates from various disciplines at Karlstad University in Sweden. A total of 71 men and 61 women in groups of 11 participated in 12 separate experimental sessions, each of which lasted around 40 minutes. There was a minimum of 2 and maximum of 8 women in each session. In order to guarantee a full head count at each session, 12 students were summoned on each occasion but only the first 11 arrivals were accepted. The 12th was paid a show-up fee of 50 SEK. The participants were seated with unobstructed views of each other but without being able to see the written responses of other individuals. They were specifically instructed not to communicate with each other for the duration of the session. Each participant was given an envelope containing a questionnaire with full instructions as well as a small card with a unique identity number (1 – 132). The same number was printed on the back of the questionnaire. The participants were requested to keep this identity number secret. Verbal instructions with supporting overheads along with the written instructions were used throughout the session. The payment procedure and the anonymity it ensured was explained at the beginning of each session. The participants were informed that they would be given time to answer each question before the next was presented. They were instructed to place their pens on their table to indicate when they had finished each task. They were made aware that they could ask for assistance at any time.

At the start of each session, the tasks and the incentive mechanism were explained using an example similar to question 1. The incentive mechanism was illustrated with trial runs assuming different C values. The cognitive demand on the students is considerable

in this kind of experiment, so great pains were taken to ensure that the students had understood the nature of the task as well as the incentive mechanism. In order to assist the subjects in the certainty equivalence questions, they were asked to consider the following:

If you have difficulty in answering the questions, consider the following procedure: Set C to any random number and ask yourself whether you would prefer alternative 1 or 2 for that specific value of C. If you like both alternatives equally, then keep that value as your answer to C. If you prefer alternative 2 then lower the value of C slightly and ask yourself the same question again. Similarly if you prefer alternative 1, then raise the value of C slightly. Repeat the steps, iteratively increasing or decreasing the value of C until you reach the value where you are equally happy with both alternatives.

To identify each participant for the responses required to the follow up exercise to question 1, one of the letters (A – K) boldly printed to A4 size was distributed to each of the participants. The subjects were then told to regard each of the other participants in the session and predict their responses to the first question using the alphabet convention to identify each subject within their answer. While the subjects were performing this task, the experimenter was discretely noting the gender of the participant associated with each letter. Being students, the group was visually fairly homogenous in terms of ethnic background, age, dress etc. and the primary differentiating characteristic was gender.

At the end of each session, the payoff procedure was evoked. This had been explained to the participants at the beginning of the session. The method was that a number "R" was picked at random from a box. If the value of R > C, alternative 2 of the question was applicable and the individual received the higher amount R. When R ≤ C, a dice was thrown by the instructor to invoke the gamble described in alternative 1 i.e. odd yields 0 SEK, even yields 200 SEK. The questionnaires were collected and the instructor threw a dice to establish which of the two questions would be used in the payoff procedure. If the pay-off procedure was used in

question 1, then the process above was repeated for every questionnaire, so that each individual's personal response affected their reward. In the case of question 2, one of the questionnaires was picked at random by the instructor and used to evoke the payment procedure once only but for the others in the group. The individual whose questionnaire is picked of course received 200 SEK. The entire payment process was conducted in full view of the participants in the session. The value of the payoffs for each individual (using their unique identity number) was written on the white-board and transcribed onto a sheet of paper. The instructor gave the payoff information to a third party. The participants collected their payment privately from the third party using the card with their identity number.

4. Results

Subjects own certainty equivalence

The estimates of participants own certainty equivalences (*OCE*) showed no difference between the risk preferences of men and women. The mean certainty equivalence of all participants was 97 SEK which is fairly close to the risk neutrality level of 100 SEK. The mean for females (98.28 SEK) was only slightly higher than that for males (95.9 SEK) and the null hypothesis that the mean *OCE* does not differ between the sexes cannot be rejected (t=0.464, p=0.643). This result was confirmed using the Mann-Whitney test (p=0.913). Detailed descriptive statistics of the participants *OCEs* and the number of respondents in each risk category by gender are given in tables A1 and A2 in the appendix.

Even if the mean certainty equivalence is the same, the distribution of risk preferences can differ. Figure 3 below illustrates the distribution of the participants' certainty equivalences in intervals by gender. A Chi-2 test shows no significant relationship ($\chi^2(12) \cong 13.76$, p= 0.32) between gender and the risk preference interval chosen by the individual. This result is contrary to the majority view where women are generally regarded to be more risk averse than men.

Figure 3. *Histogram illustrating the distribution of OCEs in intervals by gender.*
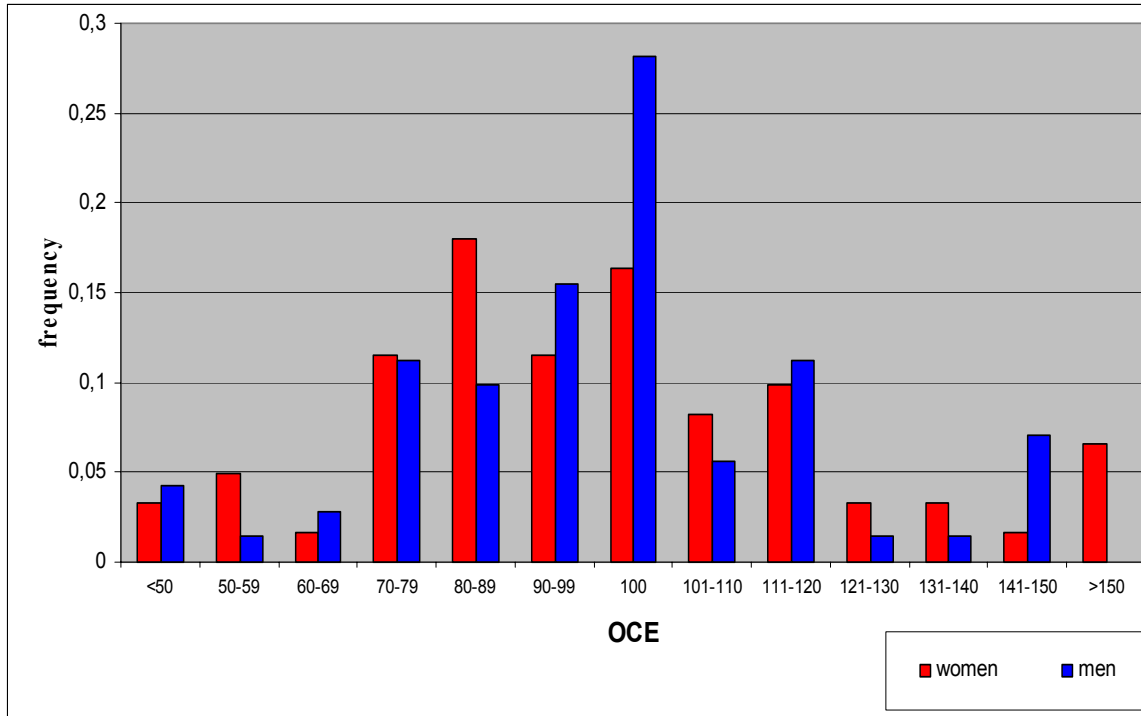
Subjects predictions for the certainty equivalence of others.

In addition to choosing their own certainty equivalence, each subject also predicted the certainty equivalences of each of the other ten participants in the session making a total of 1320 predictions. Each subject's mean prediction for males (PCE^{m}) and females (PCE^{f}) as well as for the whole group (PCE) in each session is calculated so that three prediction observations are assigned to each participant. These are reported in Table 1.

Table 1. *Average certainty equivalence predictions for subjects by gender of target and predictor. Standard deviations are in parenthesis.*

Predictors	N	Average predicted certainty equivalences.			Test statistics for differences in subjects' mean predictions for men and women	
		PCE^m	PCE^f	PCE	t-test	Wilcoxon sign rank test
Female subjects	61	94.58 (20.03)	86.31 (20.28)	90.38 (16.93)	t=3.757 p<0.000	Z=-3.833 p<0.000
Male subjects	71	91.83 (19.68)	82.89 (19.82)	87.20 (17.63)	t=8.937 p<0.0001	Z=-4.812 p<0.000
All Subjects	132	93.10 (19.23)	84.47 (20.03)	88.67 (17.32)	t=5.901 p<0.000	Z=-6.054 p<0.000

The gender Stereotype.

We begin by testing whether there is a gender stereotype with respect to risk preferences. Contrary to the actual choices made but consistent with the gender stereotype, both sexes predicted that women were more risk averse than men, see table 1. The latter is consistent with the findings of Eckel & Grossman (2002,a,b) and Siegrist et al., (2002). The mean prediction by all subjects of 93.1 for males is significantly greater than the mean prediction of 84.47 for females. The mean prediction by women for women of 86.3 is significantly smaller than their prediction of 94.58 for men. Similarly, men's mean prediction of 82.89 for women is significantly smaller than their prediction of 91.83 for men. In addition the mean predictions for men and women did not significantly differ by gender (for men: t=0.819, p=0.414; for women: t=0.979, p=0.33).

Own preferences versus predictions.

In this section we compare individuals' own risk preference with their prediction of the risk preferences of others. First, we address the issue of whether subjects' predictions of others tend to regress to risk neutrality. If this is the case, then risk averse individuals will generally predict that others are less risk averse than themselves and vice versa for risk seekers. Tables A3 and A4 in the appendix show the participants' predictions

relative to own preference by risk category. If we consider subjects' average predictions for males (PCE^m) we find that $OCE < PCE^m$ in 48 cases within the risk averse category consisting of 63 individuals. Similarly, for risk seekers we find that $OCE > PCE^m$ in 36 of 39 cases. In both categories we can confirm that predictions regress towards neutrality ($\chi^2(1) = 17.28, p = 0.00$; $\chi^2(1) = 27.92, p = 0.00$ respectively)

In the case of subjects' predictions for women (PCE^f), we find somewhat different results for the risk averse category where only 24 of 63 cases are consistent with the theory that $OCE < PCE^f$, thus we can reject the hypothesis that $OCE < PCE^f$ for risk averse individuals. The predictions by subjects for women follow the pattern for men in the risk seeking group with $OCE > PCE^f$ in 38 of 39 cases. Thus, in the case of PCE^f only the risk seeking group's predictions' regress to risk neutrality.

Thus, individuals' risk predictions for others tend to regress towards risk neutrality. In the case of risk averse individuals however, this apparently depends on the gender of the target. Within the risk seeking group the respondents consistently predict the risk preference of others to be lower regardless of the sex of the target.

We can illustrate the relationship between individuals' own risk preferences and their prediction of the risk preferences of others using the piecewise linear regression model below:

$$PCE^i_j = \beta_0 + \beta_1 OCE_j + \beta_2(100 - OCE_j)D_j + \varepsilon_j$$

where the dependent variable PCE^i_j is the prediction made by individual j of the average certainty equivalence of the other participants in the session belonging to gender i. In addition to the own certainty equivalence, we include the risk premium $(100 - OCE_j)$ for risk seeking respondents. The dummy variable, D_j, is equal to one if the risk premium is lower than 0, i.e. if the respondent is risk seeking. Finally, ε_j is a normally distributed error term. So if the individual is risk averse or risk neutral their average prediction for gender i is given by

$$PCE^i_j = \beta_0 + \beta_1 OCE_j + \varepsilon_j.$$

If the individual is risk seeking it is given by,

$$PCE_j^i = (\beta_0 + 100\beta_2) + (\beta_1 - \beta_2)OCE_j + \varepsilon_j$$

Consequently, if β_2 is positive, the intercept will be higher for risk seeking individuals and at the same time the slope will be flatter compared with risk averse individuals. The results of the regressions are given in table 2 below. A chow test[11] does not reveal any gender differences and therefore we do not perform separate regression for the predictions by male and female participants.

Table 2: *Regression results for certainty equivalence predictions for men and women by all subjects.*

	Coefficients	t-value	p-value
PCE^f			
Intercept (β_0)	19.28	2.921	0.004
OCE (β_1)	0.728	9.619	0.000
(100-OCE) *D (β_2)	0.621	4.968	0.004
R^2=0.477			
PCE^m			
Intercept (β_0)	38.94	5.854	0.000
OCE (β_1)	0.592	7.759	0.000
(100-OCE)*D (β_2)	0.367	2.954	0.004
R^2=0.424			

The coefficient β_2 is significant and positive in both cases. The regression equation for PCE^f estimates the average prediction for women's certainty equivalences made by risk averse and risk neutral subjects to be

$$PCE_j^f = 19.2 + 0.728OCE_j.$$

While the predictions for women made by risk seeking subjects are estimated at:

$$PCE_j^f = 75.64 + 0.116OCE_j$$

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[11] F[3,126]=0.596,p=0.62 and F[3,126]=1.75576, p=0.16 for PCE^m and PCE^f respectively.

Similar expressions can be constructed for the prediction of males' certainty equivalence. In figure 3 below we illustrate the regression predictions by the participants.

Figure 3: *Predictions for males and females by all subjects.*
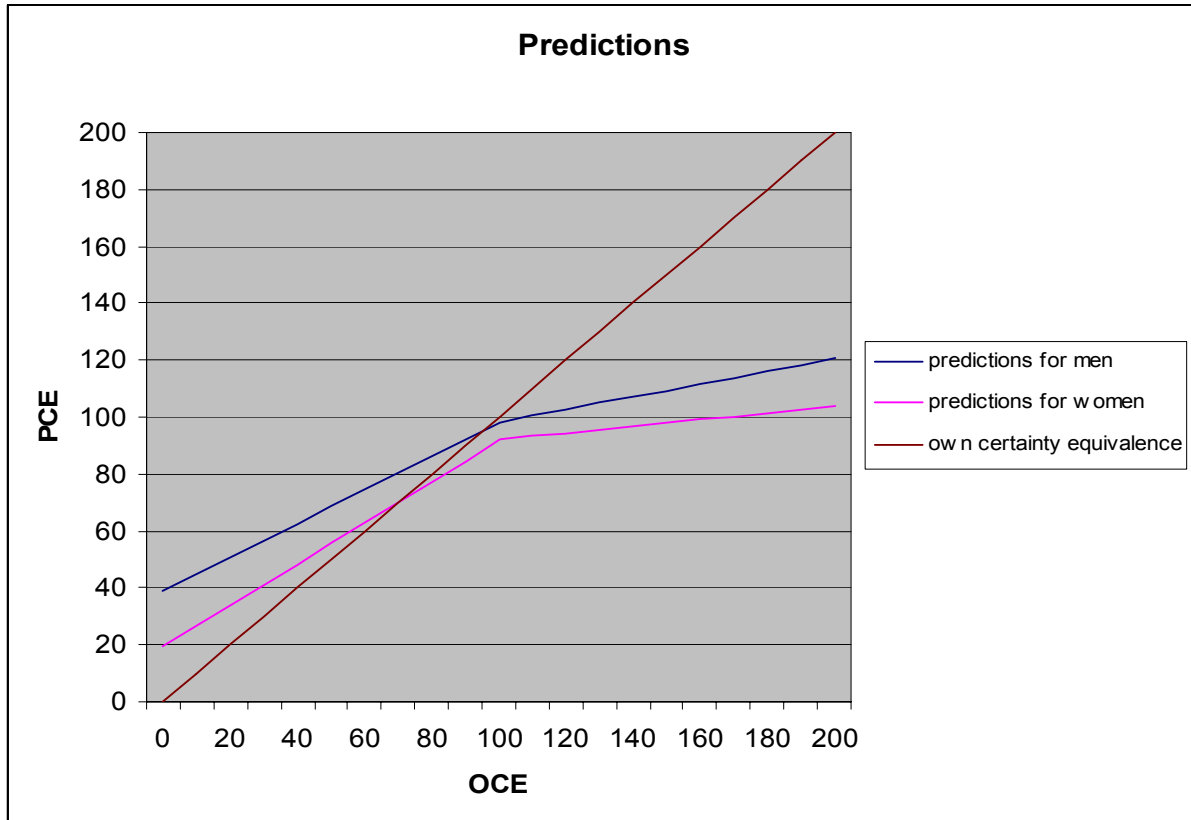
Firstly, predictions of female certainty equivalences are lower irrespective of the risk category or gender of the predictor. We see that the regression line for PCE^f intersects the 45° line at $OCE = 70.6$, suggesting that the gender stereotype leads to moderately risk averse individuals predicting that women are more risk averse than themselves. Secondly, there is a significant and positive relationship between own certainty equivalence and the predicted certainty equivalences. Thus, subjects' perceptions of others' risk preferences are clearly influenced by their own preference.

The results allow us to reject the default theory that the participants believe that others have the same risk preference as themselves. The *risk-as-value* hypothesis is based on

the assumption that risk taking is admired in our society and people would wish to consider that they possess this admirable characteristic to a greater degree than others. The results from the predictions by risk averse individuals refute the *risk-as-value* hypothesis where the assumption is that individuals will consistently predict others as being more risk avert than them. However, because β_2 is positive, the slope is flatter for risk seeking individuals and as such the absolute distances between $OCE's$ and $PCE's$ is greater for this group it could be argued that *risk-as feelings* may play some role in the predictions people make for others.[12]

The *risk-as-feelings* hypothesis states that people do not believe that others share the same depth of feeling toward risk as them and thus tend to predict that others are more risk neutral than themselves. The results from this study confirm this theory with the exception of predictions for women by the risk averse subjects.

While the findings (at least in the case of predictions for males) appear to conform to the *risk-as-feelings* hypothesis, the results may also be seen as exhibiting a general mean reverting tendency, as in this particular case, average $OCE's$ lie close to risk neutrality and thus what may appear to be regression to risk neutrality for male predictions may in fact be predictions regressing to the mean.

One possible explanation for this result could be the effects of a false consensus effect and a gender stereotype effect influencing predictions. The false consensus effect in this case would represent a bias that occurs when people overestimate the degree to which their risk attitudes are shared by others. For example, although an extremely risk averse individual recognises that she is more risk averse than the mean, her estimation of the other subjects risk attitude is biased towards her own choice. In the case where the target is female, the gender stereotype that women are more risk averse than men will lower average predictions of women's risk attitudes relative that of men.

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[12] Risk seekers, recognizing that they have a greater propensity for risky choices than others would regard risk seeking as a positive characteristic and would wish to consider that they possess this admirable characteristic to a greater degree than others and would thus increase the distance between themselves and others, while the opposite would be true for extremely risk averse individuals.

Individuals' choice on behalf of others

In the second part of the experiment the subjects were required to make a decision, at no risk to themselves, but where the outcome of their decision determined the pay-offs of the other participants of the session. We use CCE to denote this choice made by the individual. Under the premise that the optimal decision would be one that reflects the will of those whom the decision affects, the requirement would be that the subject accurately predicts the (average) will of the group and furthermore, bases her decision on that prediction. We assign a new variable ACE (Average Certainty Equivalence) to each individual which is the average OCE stated by the other 10 members of each session which we then use in order to make a comparison with PCE and CCE. We use ACE as an imputed measure to represent the "will of the group". We find that ACE is significantly different from PCE (t=5.478, p<0.000) implying that the subjects were, on average, inaccurate in their predictions. In addition, ACE is found to be significantly different from CCE (t=2.028, t=0.045) implying that the decisions made by the subjects did not generally reflect the will of the others in the group. We also find that subjects do not base their choice of CCE solely on their predictions of the others. Although the null hypothesis that there is no significant difference between the variables CCE and PCE (t=1.952, 0.053) cannot be rejected, the low level of significance indicates that other factors are relevant.

We perform a regression in order to ascertain to what degree individuals base their choice of outcome for others on what they believe the rest of the group's preference would be and also on their own certainty equivalence value. We use a simple OLS regression model below in order to estimate this relationship

$$CCE_j = \beta_0 + \beta_1 OCE_j + \beta_2 PCE_j + \varepsilon_j$$

where the dependent variable CCE_j is individual j's certainty equivalence when making the risky choice on behalf of the others in the group. The regression is based on the responses from the whole population as a chow test does not reveal any gender differences (F[3,126]=0.35138; p=0.79), thus we cannot motivate not using the restricted model. In addition it was found that own risk preference was not a significant

direct factor (although it implicitly enters the model through OCE and PCE). The results are presented in Table 3.

Table 3: *Regression results for choices made by all subjects on behalf of the other members of the session.*

	Coefficients	t-value	p-value	Std. error
CCE				
Intercept	31.638	3.134	0.002	10.094
OCE	0.297	3.163	0.002	0.094
PCE	0.363	2.289	0.024	0.159
R²=0.287				

The values of the coefficients are possibly unreliable due to multicollinearity and therefore we cannot ascertain the exact weights individuals assign on the two variables.[13] However, it appears clear that individuals in this study do not base their choices for others solely on the predictions they made for the others in the group which would be expected if they would wish to reflect what they believed to be the will of the group, but also tend to base their choice of CCE on their own certainty equivalence values.

We refrain from excessive speculation on the psychological reasons behind this result although one possible factor may possibly be a feeling of paternalism on the part of the subject where she believes her choice to be the more "correct" than that of the other individuals in the group. Anchoring problems caused by the experimental design may also have contributed to this result as the framing of the questions where the individuals were asked to state their own preferences and their beliefs of others may have coloured their choice.

5. Conclusions

The first part of this study was designed to measure and compare the risk propensity of individuals as well as their prediction of the risk propensity of others. We find that the

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[13] Two separate regressions were performed, using a single dependent variable OCE and PCE in each. We found the magnitude of the coefficient estimates to be similar to the pooled model.

individuals in this study were generally inaccurate in their predictions for others. We also find no significant relationship between gender and risk preference, both sexes however predict that women are more risk averse than men, which is contrary to the actual choices made but consistent with the gender stereotype.

When comparing individuals' own risk preference with their prediction of the risk preferences of others, we find that the category of risk preference to which the individual belongs is related to their prediction of the certainty equivalence of others. We find that individuals' risk predictions for others tend to regress towards risk neutrality. In the case of risk averse individuals however, this is only the true when the target is male. If the *risk-as-feelings* theory is accepted as the reason behind these results, then individuals who are extremely risk averse base their prediction on the recognition that they have stronger feelings against risk than most people. However, the regression to risk neutrality for the predictions for males may also be interpreted as a mean regressing tendency where a false consensus effect, together with a gender stereotype effect also provide an explanation for subjects' predictions for women. It is therefore not possible to take an unequivocal position on the validity of the *risk-as-feelings* hypothesis when explaining these results and a further study would be required in order to confirm the *risk-as-feelings* hypothesis. If for example, the same subjects were confronted with a similar choice as in the first experiment but where the stakes were increased ten-fold we may possibly find that many of the risk seeking respondents in the first experiment make risk averse choices in the second when the stakes are increased. If the *risk-as-feelings* hypothesis and thus regression to risk neutrality holds that these individuals would then reverse their predictions and believe themselves to be more risk averse than others. However, if the respondents still predict that they are less risk averse than others, then we would be required to reject the *risk-as-feelings* hypothesis.

In the second part of the experiment the subjects were required to make a decision, at no risk to themselves, but where the outcome of their decision determined the pay-offs of the other participants of the session. We find that the individuals in this study do not base their choices for others solely on the predictions they made for the others in the group which would be expected if they would wish to reflect what they believed to be

the will of the group, but also tend to base their choice for others on their own certainty equivalence values.

The results suggest several interesting areas for future research. Firstly, experiments using varying levels of stakes may provide further insight into the relationship between individuals' own risk preference and their prediction of the risk preferences of others. Secondly, experiments where real decision makers are included among the participants would facilitate comparison of predictions and decisions made for others vary by the different subject categories. Finally, as many decisions made for others are in the non-financial realm it would be of interest to design experiments that elicit subjects' risk preferences and risk predictions in situations where the risks are non-financial.

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Table A1:*Descriptive statistics of OCE by gender of subject.*

	Male subjects	**Female subjects**	**All subjects**
Mean	95.9	98.28	97
Standard deviation	26.931	31.923	29.25
range	(20, 150)	(30, 180)	(20, 180)
N	71	61	132

Table A2: *Number of subjects in each risk category by gender*.

Risk preference	**Male subjects**	**Female subjects**	**All subjects**
Risk averse (OCE<100)	32 (45.1%)	31 (50.8%)	63 (47.7%)
Risk neutral (OCE=100)	20 (28.2%)	10 (16.4%)	30 (22.7%)
Risk seeking (OCE>100)	19 (26.8%)	20 (32.8%)	39 (29.5%)
Total	**71 (100%)**	**61 (100%)**	**132 (100%)**

Table A3: *Predictions for women relative to own certainty equivalence by risk category.*

	Risk preference category			
	Risk averse	**Risk neutral**	**Risk seeking**	**Total**
$OCE < PCE^f$	24	4	1	**29**
$OCE = PCE^f$	7	6	0	**13**
$OCE > PCE^f$	32	20	38	**90**
Total	**63**	**30**	**39**	**132**

Table A4: *Predictions for men relative to own certainty equivalence by risk category.*

	Risk preference category			
	Risk averse	**Risk neutral**	**Risk seeking**	**Total**
$OCE < PCE^m$	48	9	2	**59**
$OCE = PCE^m$	3	4	1	**8**
$OCE > PCE^m$	12	17	36	**65**
Total	**63**	**30**	**39**	**132**