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The Relation of Risk Attitudes and Other-Regarding Preferences: A Within-Subjects Analysis

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Abstract

In this paper we provide experimental evidence on the relation of individual risk attitudes and subjects' aversion to favorable inequality. In a within-subjects design we expand Blanco et al.'s (2011) modified dictator game by the risk-elicitation task of Eckel and Grossman (2002). Our data show strong support for a significant negative correlation between risk tolerance and an aversion to favorable inequality. The results are independent of gender, i.e., women and men show a similar correlation in these traits.

JEL Classification numbers: C91, D64, D81.

Keywords: Experiment, Other-Regarding Preferences, Risk Preferences.

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1 Introduction

Individual risk preferences are a central element in economic theory on choice under uncertainty. Taking the example of markets, it has been shown that higher systematic risk yields higher expected returns (e.g., Sharpe, 1964; Eberhart et al., 2004). Thus, it follows that subjects who take higher risks are more likely to end up with above-average returns.[1] This links individual risk-taking to a second important preference pattern, namely inequality aversion.

According to this concept subjects' utility may decrease when achieving higher incomes than their peers (e.g., Fehr and Schmidt, 1999). Hence, striving for higher returns by taking higher risks on the one hand and intending to avoid favorable inequality on the other hand are incompatible motives for human behavior.

Consequently, the seemingly independent preference characteristics of *risk attitudes* and *inequality aversion* may indeed be fundamentally related. More precisely, the incompatibility of high risk tolerance and pronounced aversion to favorable inequality suggests a negative correlation between the aforementioned traits. In this paper, we experimentally test this hypothesis and find strong empirical support for it.

The importance of risk aversion (Pratt, 1964; Arrow, 1965) and inequality aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000) is empirically well-confirmed for many economic outcomes (e.g., Dohmen et al., 2010). Moreover, in a laboratory study Erkal et al. (2011) investigate the relationship between earnings and giving. In this setting subjects first earn their income by competing in a real-effort tournament. Afterwards, they can redistribute wealth by sending money to other subjects. The authors report that subjects with moderate income behave more generous than rich subjects and send higher amounts to poor subjects. The results indicate that generating higher returns may be at odds with generosity. However, there is little direct evidence on the relation of the two characteristics *risk aversion* and *inequality aversion* for the same economic agents. In this article, we simultaneously study both concepts for the same subjects. More precisely, we conduct a within-subjects experiment to elicit subjects' guilt parameters within the Fehr and Schmidt (1999) model and their risk attitudes. In a first step, we derive point estimates of subjects' guilt parameters by using the method of Blanco et al. (2011). Afterwards, we expand their setup and elicit subjects' level of risk tolerance in a gamble-choice task similar to Eckel and Grossman (2002). Our results reveal a strong and highly

[1] Note that, immanent to risky assets, the investor may also realize below-average returns. However, given the near symmetry of the distribution of stock returns (Fama, 1965), risky investments will more often generate above-average returns. Moreover, the probability of losses becomes smaller, the longer the considered time horizon. We want to thank an anonymous referee for raising the issue of potential losses.

significant negative correlation between the degree of risk tolerance and the aversion to favorable inequality. A closer look reveals that the relation holds for both genders, i.e., men and women show exactly the same correlation.

2 Experimental Design

In stage one of our experiment, we measure subjects' guilt parameters (β) within the Fehr and Schmidt (1999) model. We apply the modified dictator game (MDG) by Blanco et al. (2011) to derive point estimates of individuals' β parameters. In this elicitation task, subjects are given a list with 22 pairs of payoff vectors (for details, see Table 5 in the Appendix). The participants have to choose one of the two payoff vectors for all 22 cases. Both vectors represent a money split between the dictator and the recipient. The left vector is constant and is always (20, 0). If the participants choose this vector they receive 20 and the recipients earn nothing. All vectors on the right-hand side resemble increasing equal-money splits: from (0, 0) to (21, 21).[2] After the experiment has concluded, the computer randomly pairs two players and determines a subject's role (dictator or recipient) and the payoff-relevant decision. In the modified dictator game we used "Taler" as the experimental currency. The exchange rate was 1 Taler = 0.15€.

We add a risk-elicitation task after the MDG, to study the relation of subjects' guilt and risk preferences. Hence, in stage two we apply a gamble-choice option as used in Eckel and Grossman (2002). In this task, subjects are offered five gambles with two possible outcomes (A/B) which occur with equal probability. The gambles maintain a linear relationship between the expected payoff and the risk. In the choice task, subjects have to choose exactly one of the five gambles. Subjects know that the computer will determine the outcome of the gambles at the end of the experiment. Table 1 displays the gambles and their expected payoffs. It also indicates for each choice the corresponding range of Constant Relative Risk Aversion (CRRA). The CRRA ranges are calculated as ranges of r in the function $U = x^{(1-r)}/(1-r)$ assuming constant relative risk aversion.

After subjects completed this stage they receive new instructions for two additional stages of another experiment.[3] After all stages were finished, we applied a short version of the "Big Five" personality test and subjects answered a brief questionnaire.

The experiment was programmed in z-Tree (Fischbacher, 2007). In total, 168 subjects from various fields of study participated (24 subjects per session) and were recruited with

[2] Extending the right vectors to (21, 21) allows us to account for negative betas.

[3] In this paper Müller and Rau (2015) focus on crowd-out effects in charitable giving.

Choice	Event	Probability (%)	Payoff (€)	Exp. payoff	CRRA ranges
1	A	50	0.80	0.80	$r > 2$
	B	50	0.80		
2	A	50	1.20	0.90	$0.67 < r < 2$
	B	50	0.60		
3	A	50	1.60	1.00	$0.38 < r < 0.67$
	B	50	0.40		
4	A	50	2.00	1.10	$0.20 < r < 0.38$
	B	50	0.20		
5	A	50	2.40	1.20	$r < 0.20$
	B	50	0.00		

Table 1: Subjects' gamble choices and the corresponding expected payoffs.

ORSEE (Greiner, 2004). The experiment was conducted at the University of Göttingen. The sessions lasted approximately 45 minutes and participants earned 15.73€ on average.[4]

3 Results

In this section we first report our data derived by Blanco et al.'s (2011) MDG, i.e., the point estimates of subjects' guilt parameters. Subsequently, the analysis presents the risk-preference data of the gamble-choice task as applied by Eckel and Grossman (2002). Finally, we demonstrate our main result on the relation of risk tolerance and subjects' aversion to advantageous inequality. The statistical analysis always makes use of two-sided *p-values*.

3.1 Aversion to Advantageous Inequality and Risk Preferences

We follow Blanco et al. (2011) to calculate point estimates of the subjects' β parameters. For two-player games, the Fehr and Schmidt (1999) utility of advantageous inequality aversion can be expressed by:

$$U_i(x_i, x_j) = x_i - \beta_i(x_i - x_j), \quad if \quad x_i > x_j \tag{1}$$

where x_i and x_j, $i \neq j$, denote the monetary income of players i and j. Applying Blanco et al.'s (2011) MDG one can obtain β_i by finding the egalitarian allocation, $(\tilde{x}_i, \tilde{x}_i)$, such that the dictator is indifferent between keeping the entire endowment, the (20,0) outcome, and $(\tilde{x}_i, \tilde{x}_i)$. Suppose an individual switches to the egalitarian distribution at (x_i', x_i'). That

[4]The separate earnings were: 2.74€ (stage one and two) and 12.99€ (in further stages).

is, the individual prefers $(20, 0)$ over $(x_i' - 1, x_i' - 1)$ but (x_i', x_i') over $(20, 0)$. Hence, $\tilde{x}_i \in [x_i' - 1, x_i']$. This yields

$$\beta_i = 1 - \frac{\tilde{x}_i}{20} \tag{2}$$

Following Blanco et al. (2011), we set $\tilde{x}_i = x_i' - 0.5$.[5] For subjects who prefer (0, 0) over (20, 0) we cannot observe a switching point. Thus, we set $\beta = 1$. Fehr and Schmidt (1999) and Blanco et al. (2011) point out that subjects with $\beta < 0$ may exist. We control for these types to get a broad understanding of the relation between risk and favorable inequality. Therefore, we extend Blanco et al.'s (2011) choice set by the decision between (20, 0) and (21, 21). Subjects switching at this point reveal that they have: $\beta = -0.025$. As we cannot identify a switching point for subjects who never switch, we assume that these subjects would switch when presented with a choice between (20, 0) and $(22, 22)$. Hence, we set $\beta = -0.075$ in this case.

Table 2 reports the distribution of subjects' guilt parameters (β). The table also compares our results to Blanco et al.'s (2011) data. We had to drop 25 subjects because of inconsistent choices.[6]

β	Müller & Rau (2015)	Blanco et al. (2011)
$\beta < 0.235$	26%	29%
$0.235 \leq \beta < 0.5$	21%	15%
$0.5 \leq \beta$	53%	56%
obs.	143	61

Table 2: Distribution of β in our data and in Blanco et al. (2011).

Table 2 demonstrates that our data closely follow the distribution of Blanco et al. (2011). This is statistically confirmed by a Kolmogorov-Smirnov test which reveals no significant difference between our data and their data (D = 0.086, $p = 0.883$).[7] Similar to Blanco et al. (2011), we find that the majority of subjects (53%) have a beta ≥ 0.5.

We now turn to the analysis of subjects' risk tolerance. Table 3 reports the distribution of subjects' risk preferences. The representation also compares our results to Eckel and Grossman's (2002) data.

Our findings confirm the results of Eckel and Grossman (2002). It turns out that the subjects' mean gamble choice (3.14) is not significantly different from the data of Eckel

[5]Note, that this selection does not affect the qualitative results of our statistical analyses.

[6]These subjects had multiple switching points. To ensure comparability to Blanco et al. (2011) all negative betas in Table 2 are set to $\beta = 0$. In our further analyses we do not apply this adjustment.

[7]See Figure 3 in the Appendix.

Gamble Choice	Müller & Rau (2015)	Eckel & Grossman (2002)
1	14%	6%
2	18%	19%
3	32%	33%
4	10%	17%
5	26%	25%
Total	168	52

Table 3: Subjects' distribution of gamble choices.

and Grossman (2002) (3.37) ($\chi^2(4) = 4.49,\ p = 0.344$). A Kolmogorov-Smirnov test cannot reject the null hypothesis of equal distributions (D = 0.085, $p = 0.909$).[8] It can be seen that most of our subjects (32%) choose gamble three. This again is in line with Eckel and Grossman (2002) who report that 33% choose gamble choice three.

We now turn to our main research question and analyze whether subjects' risk tolerance correlates with their aversion to favorable inequality.

3.2 The Relation of Risk Attitudes and Inequality Aversion

Figure 1 presents our main result. It reports subjects' aversion to advantageous income inequality (β) conditioned on their risk tolerance.

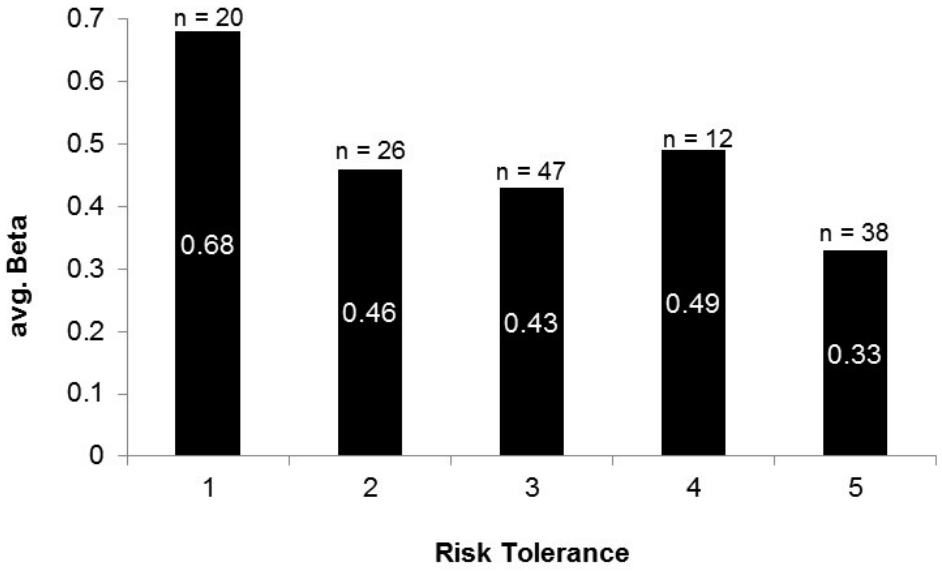

Figure 1: Subjects' average beta conditioned on their level of risk tolerance.

The diagram clearly confirms our hypothesis, i.e., we find a highly significant negative

[8] See Figure 4 in the Appendix.

correlation between risk tolerance and subjects' aversion to favorable inequality (Spearman's rank correlation coefficient, $\rho = -0.280,\ p < 0.001$).[9] Hence, less risk-tolerant people (risk = 1) have the highest average beta ($\beta = 0.68$). By contrast, people with the highest risk tolerance (risk = 5) have a substantially smaller beta ($\beta = 0.33$) (Mann-Whitney test, $p < 0.001$).

Result 1:
Subjects' risk tolerance is negatively correlated with their aversion to favorable inequality.

The experimental literature has established prominent findings on gender differences in risk-taking and dictator giving. More precisely, women are commonly more risk averse (e.g., Eckel and Grossman, 2008) and tend to give more in dictator games (e.g., Eckel and Grossman, 1998) than men. In light of these stylized facts, our first result could be driven by those differences. Indeed, if gender differences are sufficiently strong, our aggregate finding might even occur as a result of the opposite correlation for each gender separately. Hence, in the next section we focus on gender differences.

3.3 The Impact of Gender

Figure 2 is a bubble plot presenting the relation between risk tolerance and the average beta of men and women. Larger (smaller) bubbles correspond to a higher (lower) number of subjects with a certain degree of risk tolerance.

The diagram nicely shows that the biggest mass of men is located at the right end of the x-axis (risk tolerance 3–5), whereas the majority of women can be found at the left end (risk tolerance 1–3). It follows that women exhibit a significantly lower average level of risk tolerance (2.72) than men (3.53) (Mann-Whitney test, $p < 0.001$). Thus, we confirm the findings of Eckel and Grossman (2008). Focusing on subjects' average beta, it turns out that the female data is located at a higher level of the y-axis than compared to men. As a consequence, women have a significantly higher average beta (0.50) than men (0.40) (Mann-Whitney test, $p = 0.053$). This shows that women exhibit a higher aversion to favorable inequality as compared to men.

The diagram emphasizes that the negative correlation between risk tolerance and beta holds for men (Spearman's rank correlation coefficient, $\rho = -0.252,\ p = 0.029$) and women (Spearman's rank correlation coefficient, $\rho = -0.241,\ p = 0.048$).[10] Moreover, it

[9] This also holds for a Pearson's Rank Correlation Coefficient test ($\rho = -0.307,\ p < 0.001$).

[10] This also holds for Pearson's Rank Correlation Coefficient tests (men: $\rho = -0.285,\ p = 0.013$; women: $\rho = -0.271,\ p = 0.026$).

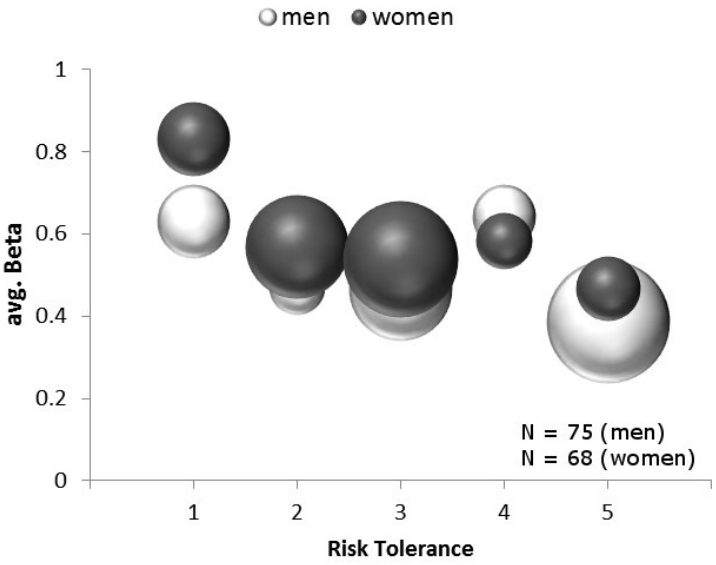

Figure 2: Men and women's average beta conditioned on their level of risk tolerance.

suggests a similar linear relationship between the two traits for both gender. Hence, our main result is independent of gender.

Result 2:
(a) Women are less risk tolerant and more averse to favorable inequality than men.
(b) The relation between risk tolerance and subjects' aversion to favorable inequality is independent of gender.

To apply robustness checks, we run censored Tobit regressions on subjects' betas (see Table 4).[11] The following regressors are used: *risk* which corresponds to subjects' gamble choice, *female* is a dummy which is positive for women, *age* corresponds to subjects' age, and *econ* is a dummy which is positive for subjects studying economics. It also includes the "Big Five" measures: *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*. We incorporate the interaction *risk* $\times$ *female* to control whether the risk-beta correlation is driven by gender. The regressions are left censored at -0.075 and right censored at 1.[12]

Regression 1 shows that *risk* is highly significant and negative, confirming the previous result. Regression 2 emphasizes that this finding is robust when incorporating the demographics and the "Big Five." Again, *risk* is highly significant and the coefficient hardly

[11]OLS estimates yield the same qualitative results in terms of size and significance of coefficients.
[12]Beta is defined between -0.075 and 1.

changes. *Female* and *age* are insignificant. *Econ* is significant and negative, indicating smaller betas for econ students. Focusing on the "Big Five" measures, we find that all dimensions of human personality traits have no impact.[13] Regression 3 again highlights that *risk* is significant. Moreover, it can be seen that our main result is not driven by gender differences, i.e., *risk* × *female* and *female* are insignificant. This emphasizes that men and women exhibit the same linear relation between *beta* and *risk* (see Figure 2).

	beta					
	(1)		(2)		(3)	
risk	-0.082***	(0.020)	-0.069***	(0.026)	-0.062**	(0.026)
female			0.114	(0.144)	0.058	(0.146)
risk × *female*			-0.021	(0.044)	-0.002	(0.043)
age					0.008	(0.009)
econ					-0.176***	(0.055)
big five	no		no		yes	
constant	0.703***	(0.070)	0.635***	(0.100)	0.608	(0.378)
obs.	143		143		141	
Pseudo R^2	0.119		0.126		0.259	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Censored Tobit regressions on beta.

4 Conclusion

We analyze the relation between risk tolerance and subjects' aversion to favorable inequality. The results reveal strong support that risk preferences and subjects' guilt parameters are indeed highly correlated. The findings are of importance as risk preferences and other-regarding behavior play a key role in economics. The data demonstrate that more risk-tolerant people tend to be less averse to favorable income inequality, whereas risk-

[13]The only exception is *conscientiousness* which is negative and weakly significant when using the OLS specification.

averse subjects show higher degrees of inequality aversion. Put differently, risk tolerance is of importance when maximizing profit in markets. At the same time, making a profit may lead to advantageous inequality. Hence, risk tolerance and the aversion to favorable income inequality may be incompatible preferences. Our findings contribute to the synthesis of two seemingly independent explanations for certain phenomena in human behavior. We suggest that risk aversion and subjects' aversion to advantageous inequality are indeed two sides of the same coin.

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