

Decision Making in Social Contexts

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Each co-author contributed significantly to the concept, design and content of the articles.

Chapter 1

Introduction

Similar to our prehistoric forefathers, many other mammal species (e.g. apes) organize group behavior based on hierarchical structures. Being of higher rank often means privileged access to resources such as food and mating partners. It is therefore not surprising that modern humans are still sensitive to cues on social ranking. Yet, for the most part in the economic literature, decisions are seen as choices taken in isolation. This has the advantage that outcomes can be taken in absolute terms. Unfortunately, the existing literature largely overlooks that there can also be a relative component to this as well. The possibility of comparing own outcomes to the outcomes of others might change individual preferences.

My dissertation therefore addresses the following questions: Does social comparison influence decision making (paper 1)? If so, what are the domains that are influenced (paper 2)? Is this effect stronger for men than for women (paper 2 and paper 3)? And what are the underlying behavioral patterns that trigger this behavior (paper 4)?

There are two main reasons why these questions are important. First, even though we like to think of ourselves as sophisticated decision makers (in other words: we know what we are doing), we are all prone to behavioral biases and misconceptions. By better understanding how and when we are influenced by these biases, we are able to mitigate and counteract their negative influence. Second, on a more methodological point, the way the economic profession thinks about decisions under uncertainty might overlook an important factor, social comparison.

The idea that humans are prone to social cues is relatively old. Leon Festinger, a social psychologist, first introduced the idea in 1954 that humans compare themselves with others. He distinguishes between two forms, downward and upward comparison. Downward comparison means that we compare ourselves with others who are worse off (the negative domain) to increase our self-esteem. Upward comparison means that we compare ourselves with others who are better off for guidance and for aspiration. This idea has been adopted and developed into different theories of how humans dislike inequality subsumed under the term “inequality aversion” (Loewenstein et al., 1989; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). The

idea is that humans dislike both advantages and disadvantages inequality to varying degrees, while being behind is considered worse than being ahead.

This can have consequences in a number of decision situations. If there is, for example, the chance for social comparison in the future, how do actors adapt their behavior today? This is closely related to the literature on risk and uncertainty. If outcomes are unsure in the future this is one of the major sources of inequality. Actors can partly influence their exposure to and the consequences of these unsure situations. The question is: does the presence of social comparison influence how actors expose themselves to risk? I answer this question in my first paper “Insurance demand and social comparison: An experimental analysis” coauthored with Katharina Lima de Miranda and Ulrich Schmidt which is published in the *Journal of Risk and Uncertainty*. In the paper we analyze if social comparison can be one additional explanation why there is low insurance take up for correlated risks. One example would be disaster insurance such as flood insurance in the United States. The insurance is state subsidized, so insurance companies can offer the contracts with a very attractive premium and still, take ups are very low. We argue theoretically and show via an experiment that correlated risks are seen as less severe than uncorrelated ones. The conclusion is that social comparison might influence risk decisions depending on how the risks are correlated to others.

Sometimes outcomes are not only unsure in the future but also their probabilities are not clear. Some agents prefer or refrain from situations that are ambiguous on top of its risk characteristics. To implement the idea of social comparison to ambiguity appears relevant, because most decisions in the real world are characterized by ambiguity rather than risk (Heath and Tversky, 1991). My aim was to investigate whether there is an effect of different outcome correlation structures on ambiguity aversion. The second paper “Gender differences in ambiguity aversion under different outcome correlation structures” coauthored with Patrick Ring and Ulrich Schmidt is published in the journal *Theory and Decision*. Similar to the results of the first study social comparison and especially the correlation structure between risks influences risk taking behavior. Additionally, we find that these results also hold for ambiguity attitudes and are particularly pronounced for men. To my knowledge, the effect of different outcome correlation structures on gender differences in ambiguity aversion has not been studied before.

It is well known that culture plays an important role for gender differences in individual risk taking as in traditional and small-scale societies women have not been found to be more risk

averse than men (Binswanger, 1980; Henrich and McElreath, 2002). Even though there is evidence for gender differences in social risk taking, it is still not clear whether these gender differences are culture-specific. In the third paper of my dissertation “Gender Differences in Social Risk Taking” coauthored with Andreas Pendorfer and Ulrich Schmidt we ask to which extent gender differences in risk taking depend on the social context and in particular which role culture plays for social risk taking. To do so we ran our experiment in a Western society and also in a small-scale society in Papua New Guinea. Our results indicate that we are not able to detect a gender difference in the small scale society in Papua New Guinea while we find gender differences in risk taking in Germany. We are able to identify inequality aversion as the main driver for women to reduce their risk taking to minimize outcome differences between them and their co-players. Based on these findings, we conclude, that societies might be the key factor why we observe gender differences in risk taking.

The last paper of my dissertation: “Self-image concerns as a commitment device to explain strong reciprocity” investigates the underlying behavioral patterns that trigger this inequality avoiding behavior. For evolutionary biologists it is somewhat puzzling how morals and ideas of fairness evolved. In the end, evolution theory stipulates that individuals with such morals need to have a competitive advantage over individuals without it. Yet, the argument how someone with a preference for equality and fairness would have an advantage over a pure selfish individual is hard to make. One way to do so is by looking at the group level. Comparing groups with cooperation with groups without, it is easy to see how one has a comparative advantage over the other. This advantage can be large enough to outweigh the costs to the individual. I argue that strong reciprocal behavior, which is crucial to start and maintain cooperation in groups without reputation; can be driven by self-image concerns as a commitment device for compliance. I conclude that self-image concerns by moral sentiments for fairness can be useful for groups and for individuals.

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Chapter 2

Insurance Demand and Social Comparison: An Experimental Analysis

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Abstract

This paper analyzes whether social comparison can explain the low take up of disaster insurance usually reported in field studies. We argue that risks in the case of disasters are highly correlated between subjects whereas risks for which high insurance take up can be observed (e.g. extended warranties or cell phone insurance) are typically idiosyncratic. We set up a simple model with social reference points and show that in the presence of inequality aversion social comparison makes insurance indeed less attractive if risks are correlated. In addition we conducted a simple experiment which confirms these theoretical results. The average willingness to pay for insurance is significantly higher for idiosyncratic than for correlated risks.

Keywords: disaster insurance, social reference points, loss aversion, inequality aversion

JEL classification: C91, D03, D14, D81, G22

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1 Introduction

A major puzzle in insurance economics is the fact that people underinsure low-probability events with high losses. It is well documented that many people do not take up disaster insurance even though premiums are often subsidized (Kunreuther et al. 1978; Kunreuther and Pauly 2004). A very prominent example for this type of behavior is flood insurance in the USA. At the same time, many people insure modest risks at highly loaded premiums, e.g. extended warranties, cell phone insurance or low deductibles for home insurance. Sydnor (2010) for example analyzes a sample of 50,000 home insurance policies with either a \$500 deductible or a \$1000 deductible. The average extra premium for the low deductible policy was \$100. Given a claim rate of 5%, the average extra value of the low deductible policy was only \$25. Interestingly, the majority of homeowners preferred the low deductible policy. Fitting the demand for low deductibles to expected utility leads to implausible high degrees of risk aversion (Sydnor 2010), which shows that expected utility theory cannot explain the observed choice patterns.

Apart from these field studies also experimental evidence shows that insurance take-up increases with the probability of a loss (Slovic et al. 1977; McClelland et al. 1993; Ganderton et al., 2000). In an attempt to explain the observed behavior, Slovic et al. (1977) propose that there is a probability threshold below which an individual considers the probability to be zero. Similarly, Camerer and Kunreuther (1989) argue that low probability events are not well perceived; subjects either dismiss low probabilities or overestimate them. In two experiments on insurance demand McClelland et al. (1993) observe a bimodal distribution with some subjects bidding zero and others bidding much more than the expected value. However, Laury et al. (2009) argue that results of previous experiments may be due to confounds in the experimental design, in particular the lack of monetary incentives. Fixing these design issues, they observe precisely the opposite evidence, i.e. insurance take-up is actually decreasing with the probability of losses. This conflicting evidence raises doubt whether the misperception of low probabilities plays a key role in the observed choice patterns.

An alternative explanation for the low take-up of disaster insurance is an expected government bailout in case of disasters, which creates a type of samaritan's dilemma situation. Homeowners that believe they will be helped by disaster assistance *ex post*, will be less likely to take up insurance against the risk *ex ante*. Yet, the postulated negative relationship between disaster insurance and disaster assistance has empirically not been found valid (Kunreuther et al. 1978). Browne and Hoyt (2000), using data from the United States' National Flood Insurance Program, even find a positive relationship between insurance take-up and disaster assistance in the USA.

This paper provides and tests a new explanation for the low take-up of disaster insurance based on social comparison. One fact mostly overlooked until now is that the two situations, disaster insurance and e.g. cell phone insurance, do not only differ in the probability of losses but also in the correlation of risks. A flood (and also other natural disasters) will most likely not only affect you, but also your neighbors and peers. It can be considered to have highly correlated risks. Events that entitle to compensation for cell phone insurance are hardly correlated with neighbors or peers. Hence, they

can be considered as idiosyncratic risks. The same seems to hold for extended warranties or home insurance. While nearly everybody incurs a loss in the case of correlated risks, an unlucky person is typically the only one losing in the case of idiosyncratic risks. It has been shown in many studies (e.g. Fehr and Schmidt 2006) that the social context can serve as a reference for our subjective wellbeing. If we do not only care for absolute wealth but also for our wealth relative to peers, the correlation of risks may have a strong impact on insurance decisions.

Having in mind that the social context may play a vital role for decisions under risk we examine both theoretically and experimentally how the correlation of risks influences insurance decisions. We claim that insurance is less attractive for correlated than for idiosyncratic risks. This is theoretically shown in a simple model with a social reference point. Furthermore, we conduct an experiment, which shows that the willingness to pay for insurance is significantly lower for correlated than for idiosyncratic risks.

The rest of the paper is organized as follows. In Section 2 we set up the empirical and theoretical background. Section 3 analyzes in a simple insurance demand model how insurance take-up is influenced by the correlation of risks among subjects. We consider inequality aversion and also allow for strategic interaction between subjects. Our experimental design is presented in Section 4. In order to observe decisions under risk in situations where risks are either idiosyncratic or correlated, participants were presented with the choice to take up insurance against a possible loss. While in one treatment the risk to lose was idiosyncratic, it was perfectly correlated among participants in the other treatment. In Section 5 we describe our main experimental findings and Section 6 concludes.

2 Empirical and Theoretical Background

Under expected utility theory a risk averse subject will buy full insurance if and only if premiums are fair, i.e. equal expected losses. This excludes not taking up subsidized disaster insurance or full cellular phone insurance at highly loaded premiums. Also, fitting the demand for low deductibles to expected utility leads to implausible high degrees of risk aversion (Sydnor 2010). The standard theory of decision making under risk, is thus not able to explain the observed choice pattern of high insurance take-up for modest risks and low take-up for small risks. This is just one of a variety of observed choice patterns that contradict expected utility theory, which have induced the development of alternative theories that attempt to explain these deviations (Starmer 2000). Some of these theories imply that either full insurance is demanded also at unfair premiums or less than full insurance at fair premiums (see e.g. Schlesinger 1997). However, they are not able to explain diverging behavior for correlated and uncorrelated risks.

Experiments have shown that choices vary depending on whether outcomes are coded as gains or losses. It is empirically well established that people are significantly more averse to lose a certain amount than they are attracted to winning that same amount (e.g. Loewenstein and Adler 1995; Gneezy and Potters 1997). This phenomenon is referred to as loss aversion and was first introduced by Kahneman and Tversky (1979). In prospect theory loss aversion is captured by imposing that the

utility function is steeper for losses than for gains. A second manifestation of reference dependence in prospect theory is diminishing sensitivity. Diminishing sensitivity demands that marginal utility is decreasing as one moves away from the reference point which implies that the utility function is concave (convex) for gains (losses).

For application of reference dependent theories the determination of an appropriate reference point is crucial. In most cases, the reference point is assumed to be the status quo, like current income or wealth (e.g. Rabin 2000; Samuelson and Zeckhauser 1988) or the price of an asset (Odean 1998). Some models derive the reference point endogenously by modeling expectations-based reference points (e.g. Köszegi and Rabin 2006; Gill and Prowse 2012). Also theories with state dependent reference points have been proposed (e.g. Sugden 2003; Köszegi and Rabin 2006; Schmidt et al. 2008; Trautmann et al. 2011). This allows to analyze situations where a fixed (i.e. state independent) reference point is implausible since the status quo is state dependent. In particular when buying insurance, initial wealth is state dependent and hence modeling the status quo as reference point requires state dependence (Schmidt 2012).

In the discussion so far the social context was omitted. Most economic decisions are not made in isolation. Tversky and Kahneman (1992) suggest that a reference point may not solely depend on the decision maker's status quo but may also be influenced by social comparison which generates social reference points. In social comparison loss aversion could be observed in the sense that people are more affected by being worse off than others than being better off than others. While there is clear evidence that disadvantageous inequality (being worse off) decreases utility (e.g. Shamay-Tsoory et al. 2007) there is contradicting evidence on how utility is influenced by advantageous inequality (being better off). Some empirical findings suggest that comparison to less fortunate subjects enhances subjective well-being (Buunk 2007; Wills 1981). However, there is also evidence that people dislike this kind of inequality and care about the equality of the payoff distribution (e.g. Camerer and Thaler 1995). Fehr and Schmidt (1999) for example model a simple utility function where disadvantageous inequality has a strong and advantageous inequality a relatively weaker negative effect on a subject's utility.

While there is ample research on social comparison and decision making in a social context, applications to risky situations are still rare (see Trautmann and Vieider 2012 for an overview of the recent literature). Linde and Sonnemans (2012) find that individual decision making is influenced by social comparison in a way that contradicts diminishing sensitivity. They conducted experiments where participants had to choose between lotteries while a peer was facing a fixed payoff. Participants were more risk averse in the loss domain (possibility to earn at most as much as the peer) than in the gain domain (at least as much as the peer). Vendrik and Woltjer (2007) investigate whether utility derived from relative income displays diminishing sensitivity. They estimate a utility function with respect to relative income from a large German panel and find that it is concave in the loss and gain domain. They explain the concavity in the loss domain, by increasing marginal costs for subjects to participate in social activities of their peer group. While both, the studies of Linde and Sonnemans (2012) and Vendrik and Woltjer (2007) reject diminishing sensitivity in the presence of

social reference points, they report evidence in favor of loss aversion. In contrast, Bault et al. (2008) find the opposite of loss aversion (i.e. gain seeking) in the presence of social reference points. Their result relies however on rating of emotions by subjects and a model that does not precisely resemble prospect theory. Another related experimental study was done by Rhode and Rhode (2011) examining how participants' decisions for lotteries were affected by the risk a peer group faced. They find that people prefer risks to be distributed idiosyncratically rather than correlated.

Altogether, these studies show that social comparison can have a strong impact on decisions under risk. Since the social reference point for insurance problems differs considerably for correlated and idiosyncratic risks insurance demand may be significantly influenced by correlation. The next section shows within a simple model with inequality aversion that insurance is indeed less attractive for correlated risks, which could explain the low take up of disaster insurance. Given the rejecting evidence concerning diminishing sensitivity in the social context we consider a piecewise-linear utility function and analyze the impact of inequality aversion.

3 The Model

The goal of this section is not to provide a general and comprehensive analysis of insurance demand in the presence of social comparison. Instead, we want to show in a rather simple model that social reference points may decrease the attractiveness of insurance for correlated risks and thereby motivate the experimental study presented in the subsequent sections. We consider a model with two individuals and two states of the world, in one of which a loss occurs. The two individuals maximize their utility taking the other persons' wealth as a reference point and are inequality averse. We allow this social reference point to vary depending on the state the other individual is in. There is the possibility to buy full insurance against the loss at an actuarially fair premium. We consider two cases. In case 1 risks are uncorrelated among subjects. A loss can thus occur to both subjects, to one only or to none. This would be the case of theft insurance or extended warranties for example. In case 2 risks are perfectly correlated and therefore, either both or none is affected by a loss. This would mirror natural disasters, like floods or storms, which affects many people in one region.

We start with a basic model, where we consider the utility of one subject only. Her utility depends on her own income and that of a peer. Afterwards, we relax this assumption and allow for strategic interaction between the two individuals.

3.1 The Basic Model

Individuals are denoted by A and B both with initial wealth y . With probability p a loss L occurs. In the absence of an insurance contract final wealth for A and B is therefore given by y with probability $1-p$ and $y-L$ with probability p . We analyze the decision of individual A who has the possibility to take up full insurance at the actuarially fair insurance premium pL . Buying insurance results in a final wealth of $y-pL$ independent of which state of the world occurs. A's social reference point is the final wealth of B and therefore depends on A's expectations whether B takes up insurance or not. If B is fully

insured the correlation of risks is immaterial, as B does not face any risk in this case. Therefore, in this section we assume that A expects B to be uninsured. This assumption will be relaxed in the next subsection.

In order to focus on inequality aversion and in view of the evidence reported in the preceding section we take the utility function of Fehr and Schmidt (1999) where disadvantageous inequality (being worse off than a peer) has a strong and advantageous inequality (being better off) a relatively weaker negative effect. In the two-player case the utility function for A is given by

$$U^A(x^A, x^B) = x^A - \alpha^A \max\{x^B - x^A; 0\} - \beta^A \max\{x^A - x^B; 0\} \quad (1)$$

where x^j is the final wealth of individual j and with $\beta < \alpha$ and $0 \leq \beta < 1$. We now consider the utility derived from insurance take-up in the two cases – idiosyncratic and correlated risks.

3.1.1 Case 1 - Idiosyncratic risks

In case of idiosyncratic risks a loss can occur to A only, to B only, to none or to both. A's utility is therefore given by

$$U_i^A = (1-p)^2 u^A(x_1^A, x_1^B) + (1-p)p u^A(x_1^A, x_2^B) + p(1-p) u^A(x_2^A, x_1^B) + p^2 u^A(x_2^A, x_2^B), \quad (2)$$

where x_i^j reflects the final wealth of individual j in state i. If A takes up insurance, final wealth of A is given by $y-pL$ independent of the state. Final wealth of B is state dependent and given by y with probability $1-p$ and $y-L$ with probability p . A's utility is then given by

$$U_i^{A,ins} = y - pL (1 + \alpha + \beta - p\alpha - p\beta). \quad (3)$$

On the other hand if A does not take up insurance, her wealth is state dependent as well. A's utility then amounts to $U^A = (1-p)^2 y + (1-p)p(y-\beta L) + p(1-p)(y-L-\alpha L) + p^2(y-L)$ which reduces to

$$U_i^{A,no} = y - pL (1 + \alpha + \beta - p\alpha - p\beta). \quad (4)$$

Comparing (3) and (4) reveals that buying insurance (3) or not results in the same utility level for A. Therefore, she is indifferent between taking up insurance or not if risks are uncorrelated.

3.1.2 Case 2 - Correlated risks

If risks are correlated, there are two states of the world, which affect both subjects. A loss can occur to both, A and B, or to none and A's utility is therefore given by

$$U_c^A = (1-p) u^A(x_1^A, x_1^B) + p u^A(x_2^A, x_2^B). \quad (5)$$

If A takes up insurance her utility yields $U^A = (1-p)(y-pL-\alpha^A pL) + p(y-pL-\beta^A(1-p)L)$ which reduces to

$$U_c^{A,ins} = y - pL (1 + \alpha + \beta - p\alpha - p\beta). \quad (6)$$

If A does not take up insurance, wealth of A and B equals y in state 1 and $y-L$ in state 2. Therefore, if A refrains from taking up insurance her utility amounts to

$$U_c^{A,no} = y - pL. \quad (7)$$

A's utility level is now lower with insurance than without. Thus, it is rational for A not to take up insurance if risks are correlated.

Comparing idiosyncratic and correlated risks, this simple insurance demand model shows that insurance becomes less attractive when risks are correlated among subjects. Subjects are indifferent between taking up insurance or not if risks are uncorrelated, while they do not buy insurance if risks are correlated.

3.2 Strategic interaction

So far, there was no strategic interaction between subjects, as we assumed that subject A bases her decision on the expectation that B is uninsured. This assumption can easily be relaxed to a setting where A and B strategically interact. A and B derive their utility relative to a social reference point, namely the other subject's state dependent wealth. In analogy to A, B's utility function is given by

$$U^B(x^B, x^A) = x^B - \alpha^B \max\{x^A - x^B; 0\} - \beta^B \max\{x^B - x^A; 0\}, \quad (8)$$

with $\beta^B < \alpha^B$ and $0 \leq \beta^B < 1$.

3.2.1 Case 1 - Idiosyncratic risks

Again, we first consider the idiosyncratic case. When faced with the decision of taking up full insurance, A and B take the other subject's insurance decision into account. Utility levels of A and B resulting from the four possible cases – both insured, one insured, both not insured – are displayed in Table 1. It is rational for both subjects to take up insurance and (Insured, Insured) therefore constitutes a Nash equilibrium.

Table 1: Strategic interaction and idiosyncratic risks

		B	
		Insured	Not insured
A	Insured	$U^A = y - pL,$ $U^B = y - pL$	$U^A = y - pL (1 + \alpha^A + \beta^A - p\alpha^A - p\beta^A),$ $U^B = y - pL (1 + \alpha^B + \beta^B - p\alpha^B - p\beta^B)$
	Not insured	$U^A = y - pL (1 + \alpha^A + \beta^A - p\alpha^A - p\beta^A)$ $U^B = y - pL (1 + \alpha^B + \beta^B - p\alpha^B - p\beta^B)$	$U^A = y - pL (1 + \alpha^A + \beta^A - p\alpha^A - p\beta^A)$ $U^B = y - pL (1 + \alpha^B + \beta^B - p\alpha^B - p\beta^B)$

3.2.2 Case 2 - Correlated risks

We now turn to the case of correlated risks in Table 2. This situation exhibits two equilibria (Insured, Insured) and (Not insured, Not insured). The optimal strategy now depends on the expected behavior of the other subject. Compared to the idiosyncratic case, where (Insured, Insured) was the unique equilibrium, insurance becomes less attractive in the case of correlated risks. Thus, our results from the basic model also hold with strategic interaction.

Table 2: Strategic Interaction and correlated risks

A \ B	Insured	Not insured
Insured	$U^A = y - pL,$ $U^B = y - pL$	$U^A = y - pL (1 + \alpha^A + \beta^A - p\alpha^A - p\beta^A),$ $U^B = y - pL (1 + \alpha^B + \beta^B - p\alpha^B - p\beta^B)$
Not insured	$U^A = y - pL (1 + \alpha^A + \beta^A - p\alpha^A - p\beta^A),$ $U^B = y - pL (1 + \alpha^B + \beta^B - p\alpha^B - p\beta^B)$	$U^A = y - pL,$ $U^B = y - pL$

The rationale for our theoretical results is rather simple: In the case of idiosyncratic risks full insurance of both subjects is the only way to avoid utility reducing inequality. In contrast, for correlated risks inequality can also be ruled out if both subjects are uninsured.

3.3 Generalizations

Our simple model could be generalized at least in two aspects. First, risks may not be perfectly correlated but only correlated to a certain degree. Second, in contrast to the model of Fehr and Schmidt, deviations from the income of the other subject may be evaluated in a non-linear way. With respect to the first point, note that in our setup with only two subjects and two possible outcomes less than perfect correlation can be modeled in a way that risks are perfectly correlated with a certain probability μ and otherwise uncorrelated. The payoff matrix in this case could then be easily constructed by taking the convex combination of outcomes in Table 1 and 2 for each cell for the given value of μ . This would result in two Nash equilibria, (Insured, Insured) and (Uninsured, Uninsured) where the first equilibrium with payoffs $(y-pL, y-pL)$ Pareto-dominates the second one. Nevertheless, taking up insurance for one subject is unattractive if the other subject is uninsured since $y-pL-pL(1-p)(\alpha+\beta) < y-pL-(1-\mu)pL(1-p)(\alpha+\beta)$. This shows that both subjects not taking up insurance is a stable equilibrium.

As shown by Schmidt (2012), the second point is rather complex. Schmidt analyzes insurance demand under prospect theory for different reference points. As the state-dependent incomes of the other player form a kind of reference point in the present model, the mathematical structure is rather similar. According to Schmidt (2012) insurance demand under prospect theory is very sensitive to the functional form of the value function and characterized by corner solutions if the standard value function of Tversky and Kahneman (1992) is employed. Given these complexities, we will refrain from analyzing non-linear utilities here.

4 Experimental Design

Our experiment is designed to observe insurance take-up in situations where risks are either idiosyncratic or correlated. All experimental sessions were conducted in Kiel with a total of 149

students participating. The experiment was paper-based and performed in classroom with altogether eight groups. Each session lasted about 15 to 20 minutes. Students usually knew each other in advance as they had spent a reasonable amount of time studying together. By having the chance to win more or less than their peers, subjects were likely to feel more or less satisfied with their individual outcome when comparing themselves to the others. Consequently, social comparison may influence behavior in our setting.

Subjects received an initial endowment of €10. This endowment could be lost with probability $p=0.5$ and it was possible to buy full insurance at varying premiums for this potential loss. There were two treatments. In treatment I the individual risk to lose the endowment was independent from that of the other subjects. In treatment C the risk to lose was correlated among the group, i.e. either there was a loss for everyone or no one. Four groups participated in treatment I and another four in treatment C. The groups were not aware that there existed other treatments or other groups. Since subjects decide simultaneously without any information about behavior of other subjects, each individual decision can be regarded as an independent observation. After reading out aloud the instructions, sheets were handed to the participant including the instructions and choice lists.

In order to elicit the individual willingness to pay (WTP), each participant was asked to indicate whether they would buy full insurance in a choice list consisting of ten different prices. They were told that only one of these prices was relevant for payment. This price was identical for all subjects and determined by drawing a ball from an urn. As subjects did not know which one was relevant in advance they should decide for each price as if it was relevant. The WTP in this case reflects that premium which makes a subject indifferent between taking up full insurance and no insurance at all. It equals the expected loss (i.e. €5 in our experiment) for risk neutral subjects, while it is higher (lower) than the expected loss for risk averse (seeking) subjects. Also, the higher the degree of risk aversion the higher the WTP.

The price range was between €4.00 and €6.25, see Table 5. This means that buying insurance would result, depending on the price relevant for payoff, in a sure payoff between €6.00 and €3.75, while not buying insurance for the relevant price results in either keeping the €10 or losing them. Since the price became more expensive with each step, insurance became less attractive and individuals should switch from buying insurance to not buying insurance at some point according to their risk preferences. The switching point indicates the WTP in order to be insured against the loss. Table 5 gives an overview of the experiment. The experiment involved a second choice problem identical to the one explained above. The only difference was that the loss probability is ambiguous. Details are explained in Section 5.2. A coin flip determined whether the risky or the ambiguous situation was relevant for the payoff.

Table 5: Overview of the Experiment

	Treatment I	Treatment C		
Instructions	Initial endowment $y = €10$ Individual loss with probability $p = 0.5$	Initial endowment $y = €10$ Loss for entire group with probability $p = 0.5$		
	Possibility to buy full insurance for price $c(i)$, $i=1,\dots,10$			
Private Decision Making	Ball no.	Price of insurance	Will you buy insurance?	
			YES	NO
	1	4.00		
	2	4.25		
	3	4.50		
	4	4.75		
	5	5.00		
	6	5.25		
	7	5.50		
	8	5.75		
	9	6.00		
10	6.25			
Payoff	Random determination insurance price relevant for all subjects			
	Individual determination of the state (loss or not) Individual payoff according to state and relevant insurance decision i	Determination of the state (loss or not) for the entire group Individual payoff according to state and relevant insurance decision i		
No. of participants	78	71		

5 Results

5.1 Comparison between correlated and idiosyncratic risks

Out of the 149 participants 61 have a WTP of €5. Another 36 subjects are willing to pay more than this and are considered to be risk averse, while 52 are willing to pay only less and are considered to be risk seeking. Most participants switch from buying insurance to not doing so, but some do not switch at all. At one extreme, there are 22 individuals, who take up insurance for all given prices and are therefore considered to be very risk averse. At the other extreme, there are 20 participants that are not willing to buy insurance for the lowest price offered and thus do not buy insurance at all. These have a very low WTP and are considered to be risk lovers. In treatment I 73% of the participants take up insurance at the fair premium (€5), while only 56% do so in treatment C. This

makes a difference of 17 percentage points in insurance take-up between idiosyncratic and correlated risks. It is approximately of the same magnitude as the difference in insurance take-up if the probability of losing switches from 0.1 to 0.01 (with same expected loss) reported by Laury et al. (2009).

Table 6: Insurance take-up

WTP	Overall	Treatment C	Treatment I
< €5	34.9%	43.7%	26.9%
= €5 (fair premium)	40.9%	40.8%	41.0%
> €5	24.2%	15.5%	32.1%

The average switching points from buying insurance to not buying insurance on a scale from 0 to 10 amounts to 5.38 for idiosyncratic risks and 4.14 for correlated risks. This corresponds to an average WTP of €5.35 for full insurance in case of uncorrelated risks, whereas subjects are only willing to pay €5.04 if risks are correlated. The difference in the WTP is therefore €0.31 which amounts to 6.2% of the expected loss. A Wilcoxon rank-sum test confirms that the average switching points for treatment I and C are indeed significantly different at the 1% level (z-stat = -2.638, p = 0.0083). To account for possible confounding effects, we additionally run Tobit regressions with the switching point from buying to not buying insurance as our dependent variable, and treatment as the main independent variable, see Table 7.

Table 7: Tobit regressions

Variable	Model 1	Model 2
Treatment (1 if risks are correlated)	1.620** (0.676)	2.673*** (1.018)
Gender (1 for females)	0.016 (0.671)	1.21 (0.896)
Peer group size (1 if peer group is larger than 12)	-0.128 (0.682)	-0.361 (0.683)
Culture (1 if foreign, i.e. not born in Germany)	-1.137 (1.092)	-1.442 (1.102)
Interaction (treatment x gender)		-2.225* (1.264)
Constant	5.141	4.782

Numbers in parenthesis are robust standard errors.
One, two, and three stars stand for 10%, 5% and 1% significance levels.

The variable treatment is a dummy that is one for subjects that play under correlated risks. We further include gender, peer group size, and culture as additional explanatory variables. No statistically significant effects can be found for these variables and the initial findings are supported. We further check if males and females respond equally to social comparison. Individual regressions for men and women point into the direction of gender differences in the treatment effects. To test if the treatment effect is actually different for men and women we run an additional regression that includes an interaction term - treatment x gender. Indeed the treatment effect seems to be stronger for men but is still significant for women.

Our results suggest that participants are willing to pay less for insurance if the loss occurs for the entire group than if the risk is distributed independently. This indicates that the distribution of risks is taken into account for individual insurance decisions.

5.2 Comparison between risk and ambiguity

In addition to the risky situation, where a loss occurred according to the outcome of throwing a dice, we also considered an ambiguous situation where a loss occurred when drawing a red card from a deck with an unknown proportion of red and black cards. Since the seminal work of Ellsberg (1961), it is well known that people usually prefer to bet on risky rather than ambiguous lotteries (see Camerer and Weber 1992 for an overview of the literature). In our experiment subjects were faced with the risky situation first and were then asked to decide on the ambiguous situation, i.e. every subject had to make two choices. Concerning the outcome of the difference between treatments I and C the findings are similar to the risky situation and show the robustness of the previous findings (average switching points are 5.25 for treatment C and 6.37 for treatment I, a Wilcoxon rank-sum test confirms the difference ($z\text{-stat} = -1.866$, $p = 0.0621$)).

Our decision to present the ambiguous situation after the risky one is motivated by the comparative ignorance hypothesis of Fox and Tversky (1995). According to this hypothesis, ambiguity aversion is most pronounced, if subjects can compare risky and ambiguous alternatives. We conducted a Wilcoxon signed-rank test to see whether we find a difference in the WTP between the risky and the ambiguous situations, but a statistical difference was found neither for treatment I nor for treatment C. On the one hand this comes as a surprise as participants in our experiment are faced with the risky situation first and due to the comparative ignorance hypothesis our order makes a difference between risk and ambiguity most likely. On the other hand our findings are in line with other studies which show that, in contrast to the gain domain, ambiguity aversion is not as pronounced or not present at all in the loss domain (e.g. Trautmann and van de Kuilen 2013).

6 Conclusions

A major puzzle in insurance economics is the low take-up of disaster insurance, even at subsidized premiums. Evidence for existing explanations of this puzzle is contradictory and so far, there is no convincing theory for this phenomenon. In this paper we analyzed whether social comparison can

serve as an alternative explanation. An emerging literature shows how social reference points influence decisions under risk. Linde and Sonnemans (2012) for example find that individual decision making is strongly influenced by social comparison in a way that stands in contradiction to the hypothesis of diminishing sensitivity proposed in prospect theory. Social reference points may thus influence risk taking in general and insurance take-up in particular. We examine the influence of social comparison on insurance decisions both theoretically and experimentally. More specifically, we analyze how the correlation of risks among subjects influences insurance decisions and find that in theory the presence of a social reference point makes insurance less attractive for correlated than for idiosyncratic risks if inequality aversion holds. This result is clearly confirmed by our experiment. In this sense our evidence is consistent with social preferences as modeled by Fehr and Schmidt (1999).

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Chapter 3

Gender differences in ambiguity aversion under different outcome correlation structures

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Abstract

This paper studies the impact of different outcome correlation structures on gender differences in ambiguity aversion. We conducted an investment game with two separate treatments. In the uncorrelated treatment, the outcomes of the investment game were determined individually. In correlated treatment, the outcomes of the investment game were determined collectively within a reference group. From an evolutionary perspective, men should be more concerned about *relative* outcomes, because their reproductive success mainly depended on their relative standing within society. Women, by contrast, should be more concerned about *absolute* outcomes, because their reproductive success was mainly linked to their access to resources for themselves and their children. Therefore, we predict that the type of outcome correlation structure has a larger impact on men than on women. In particular, we hypothesize that men are less ambiguity averse under an uncorrelated outcome structure. In this situation, the ambiguous alternative should be more attractive, because it potentially reduces inequality and thereby improves men's relative standing within society. Women's choices should not be significantly affected by different outcome correlation structures. Both hypotheses are supported by evidence from laboratory experiments.

Keywords: Ambiguity aversion, gender differences, risk, outcome correlation, social comparison

Introduction

Ambiguity aversion describes the tendency that individuals prefer known probability distributions over unknown probability distributions. This behavior has first been reported by Ellsberg (1961). Since then, it became an important explanation for a variety of observed phenomena, among others are the equity premium puzzle (Collard, Mukerji, Sheppard, & Tallon, 2011; Rieger & Wang, 2012) and the stock market participation puzzle (Dow & Werlang, 1992; Easley & O'Hara, 2009).

Although a general aversion against ambiguity is reported in many studies³, empirical findings about gender differences are mixed. While some studies do not observe gender differences (Banerjee, 2014; Binmore, Stewart, & Voorhoeve, 2012; Dimmock, Kouwenberg, & Wakker, 2015), others do (Schubert et al. 2000; Borghans et al. 2009; Pulford & Gill 2014). Studies reporting differences in ambiguity aversion between women and men also do not show a clear direction of the effect. Schubert et al. (2000) and Pulford & Gill (2014), on the one hand, find that women are more ambiguity averse than men in the gain domain. Borghans et al. (2009), on the other hand, report the opposite for low levels of ambiguity.

From a biological point of view, gender differences in human behavior are to be expected due to different requirements for women and men during the evolutionary past (Buss, 1989; Daly & Wilson Margo, 2001). Females produce relatively few gametes compared to the number of male gametes. For the production of an offspring, one gamete of each type is necessary. Thus, there is an excessive supply of male gametes. Due to this imbalance, female gametes are the limiting factor of human reproduction and males will compete over it (Bateman, 1948; Trivers, 1972). Because men face a higher sexual selection than women, they should be more concerned about *relative* outcomes, i.e., their relative position in society. Women, by contrast, have a higher level of parental investment and less sexual selection. Thus, they should be more concerned about *absolute* outcomes, i.e., about their access to resources for themselves and their children (Buss, 1989; Ermer, Cosmides, & Tooby, 2008). Schmidt et al. (2015) show empirically that the above outlined theoretical framework can help to explain gender differences in decision-making under risk. The authors identify the outcome correlation

³ Camerer & Weber (1992) and Trautmann & Van de Kuilen (2015) provide an overview of the literature.

structure as one variable that affects women and men differently and therefore contributes to gender differences in decision-making under risk.

The motivation of this paper is to analyze whether there also exists an effect of different outcome correlation structures on ambiguity aversion. As mentioned above, risk-taking behavior is influenced by this experimental feature and we test whether this also holds for ambiguity attitudes. To extend this field to ambiguity appears relevant, because most decisions in the real world are characterized by ambiguity rather than risk (Heath & Tversky, 1991). To our knowledge, the effect of different outcome correlation structures on gender differences in ambiguity aversion has not been studied before.

In this study, we measure participants' willingness to pay (WTP) for an investment game. The participants faced a risky lottery first and an ambiguous lottery afterwards. This feature of the experimental design is motivated by the comparative ignorance hypothesis by Fox & Tversky (1995), which states that ambiguity aversion results from a direct comparison of ambiguous and risky alternatives. The difference between the WTP for the risky lottery and the ambiguous lottery is used as an indicator for participants' ambiguity attitudes. Positive values indicate ambiguity aversion, negative values indicate ambiguity seeking, and zero indicates ambiguity neutrality. In two separate treatments, we study the effect of different outcome correlation structures on gender differences in ambiguity aversion. In the uncorrelated treatment, the outcomes of the investment game were determined individually. In the correlated treatment, the outcomes of the investment game were determined collectively within a reference group.

Based on the above outlined theory, we expect that the type of outcome correlation structure has a larger effect on men than on women. In particular, we hypothesize that men are less ambiguity averse under uncorrelated outcomes than under correlated outcomes for the following reason. Under risk, with $p = 0.5$, 50% of the group should win and 50% of the group should lose, i.e., inequality is maximal. Under ambiguity, by contrast, probabilities are unknown. Hence, it is possible and should be taken into account that the probabilities of winning and losing are not distributed equally, e.g. 10% winning and 90% losing or vice versa. This alternative reduces inequality and therefore should be more attractive for

inequality⁴ averse individuals (in our theoretical framework: men). In the correlated treatment, this effect is obsolete, because the group wins and loses together. Women caring more about absolute outcomes should be less affected by different outcome correlation structures. Thus, we have the following two hypotheses:

H1: Men are less ambiguity averse in the uncorrelated treatment than in the correlated treatment.

H2: Women's choices are not significantly affected by different outcome correlation structures.

In line with previous research, we observe significant levels of ambiguity aversion in the aggregate data set and also in both treatments individually. Analyzing the effects for men and women separately, we find that men show significant levels of ambiguity aversion in the correlated treatment, but not in the uncorrelated treatment. In line with our predictions, men's behaviour is significantly affected by the type of outcome correlation structure such that men are less ambiguity averse in the uncorrelated treatment. Women's choices are not significantly different between the two treatments.

Materials and Methods

Experimental Design

In order to study the effect of different outcome correlation structures on gender differences in ambiguity aversion, we conducted an investment game with two treatments in a between-subject design. In the uncorrelated treatment, the outcome of the investment game was determined individually. In the correlated treatment, the outcome of the investment game was determined collectively within a reference group. In order to measure ambiguity attitudes, participants were endowed with €6. Afterwards, they were asked to indicate their WTP for a risky lottery where they could win €10 Euro with a 50% chance or receive nothing with a 50% chance. Participants stated their WTP for the lottery ticket on a choice list with increasing prices ranging from €3.55 to €5.80. Then, participants were asked to indicate their WTP for an ambiguous lottery, where they could win €10 or receive nothing with an

⁴ We refer to disadvantageous inequality only.

unknown probability distribution. Again, participants stated their WTP for the lottery ticket on a choice list with increasing prices ranging from €3.55 to €5.80

At the end of each experimental session, one price for a risky or ambiguous lottery was randomly determined. This price became relevant for all subjects. Participants who did not buy the lottery ticket at the determined price kept their initial endowment of €6. Participants who bought the lottery ticket at the determined price received their initial endowment of €6 minus the purchasing price of the lottery ticket. Additionally, those participants took part in one of the following two lotteries depending on whether the risky or ambiguous lottery was chosen.

In the *risky* lottery, the experimenter rolled a six-sided die. If the result was a “1”, “2”, or “3”, the participants received €0. If the result was a “4”, “5”, or “6”, the participants received €10. In the uncorrelated treatment, this lottery was played out individually for each participant who bought the lottery ticket. In the correlated treatment, this lottery was played out only once for all participants who bought the ticket in a session.

In the *ambiguous* lottery, either red or black was determined as the winning colour by the participants. Then, one card was drawn from a deck of ten cards. The distribution of red and black cards was unknown to the participants. If the winning colour was drawn, the participants received €10. If the winning colour was not drawn, the participants received €0. In the uncorrelated treatment, this lottery was played out individually for each participant who bought the lottery ticket. In the correlated treatment, this lottery was played out only once for all participants who bought the ticket in a session.

Both experiments were conducted during tutorials at the end of the semester. Because students signed up for the tutorials and then attended them over the course of the semester, they typically have seen each other a couple of times. Thus, we expect that some kind of social structure within a tutorial group had developed. In order to allow social comparison to work, it was announced that all payments would be made publicly within a session. This procedure violates the principle of anonymity, which is typically applied in experimental economics. For our research question, however, this procedure was necessary. In the absence of social comparison, we do not expect that different outcome correlation structures impact

choices. Furthermore, participants were informed about the payment procedure before they took part in the study and participation was voluntary.

Participants & Sessions

A total of 271 participants (124 females, age = 22.36, SD = 2.35) were recruited from the student population of the Kiel University. One session was based on one tutorial group, which consisted of approximately 30 students. A total of 8 sessions was conducted. Due to multiple switching points, 12 participants were excluded from the analysis, i.e., the analysis was conducted with a total of 259 participants. In the correlated treatment, there were 136 participants (58 females) and in the uncorrelated treatment there were 123 participants (67 females).

Data Analysis

We calculate participants' attitudes towards ambiguity as the difference between the WTP for the risky lottery and the WTP for the ambiguous lottery.⁵ Positive values indicate that a participant is willing to pay more for the risky than for the ambiguous lottery, i.e., ambiguity aversion. Negative values indicate that a participant is willing to pay less for the risky lottery than for the ambiguous lottery, i.e., ambiguity seeking. Zero indicates that a participant is indifferent between the risky and ambiguous lottery, i.e., ambiguity neutrality.

We use non-parametric tests to analyse our data. All tests reported in this section are two-sided, unless stated differently.

Results

In the overall dataset, a Wilcoxon-Signed-Rank Test indicates that the WTP for the risky lottery was larger than the WTP for the ambiguous lottery ($z = 4.32$, $p < 0.001$). This holds for both treatments separately (correlated treatment: $z = 3.62$, $p < 0.001$; uncorrelated treatment: $z = 2.39$, $p = 0.02$, both Wilcoxon-Signed-Rank Tests) and implies that the participants, on average, were ambiguity averse. In the next step, we analyse the data separately for men and women and relate these findings to our previously outlined hypotheses. Results are displayed in Table 1 and Figure 1.

⁵ WTP data for the risk domain have already been reported in Schmidt et al. (2015).

H1: Men are less ambiguity averse in the uncorrelated treatment than in the correlated treatment.

We observe that men were significantly ambiguity averse in the correlated treatment ($z = 3.63$, $p < 0.001$, Wilcoxon-Signed-Rank Test), but not in the uncorrelated treatment ($z = 1.31$, $p = 0.19$, Wilcoxon-Signed-Rank Test). In line with *H1*, we find that men are more ambiguity averse under a correlated outcome structure than under an uncorrelated outcome structure ($z = 1.75$, $p = 0.04$, one-sided, Wilcoxon Rank-Sum Test). This result is displayed in Figure 1. We further investigated where this effect is coming from. Both the WTP for the risky lottery ($z = 3.27$, $p = 0.001$, Wilcoxon Rank-Sum Test) and the WTP for the ambiguous lottery ($z = 2.08$, $p = 0.04$, Wilcoxon Rank-Sum Test) were significantly larger in the correlated treatment than in the uncorrelated treatment.

H2: Women are not significantly affected by the different outcome correlation structures.

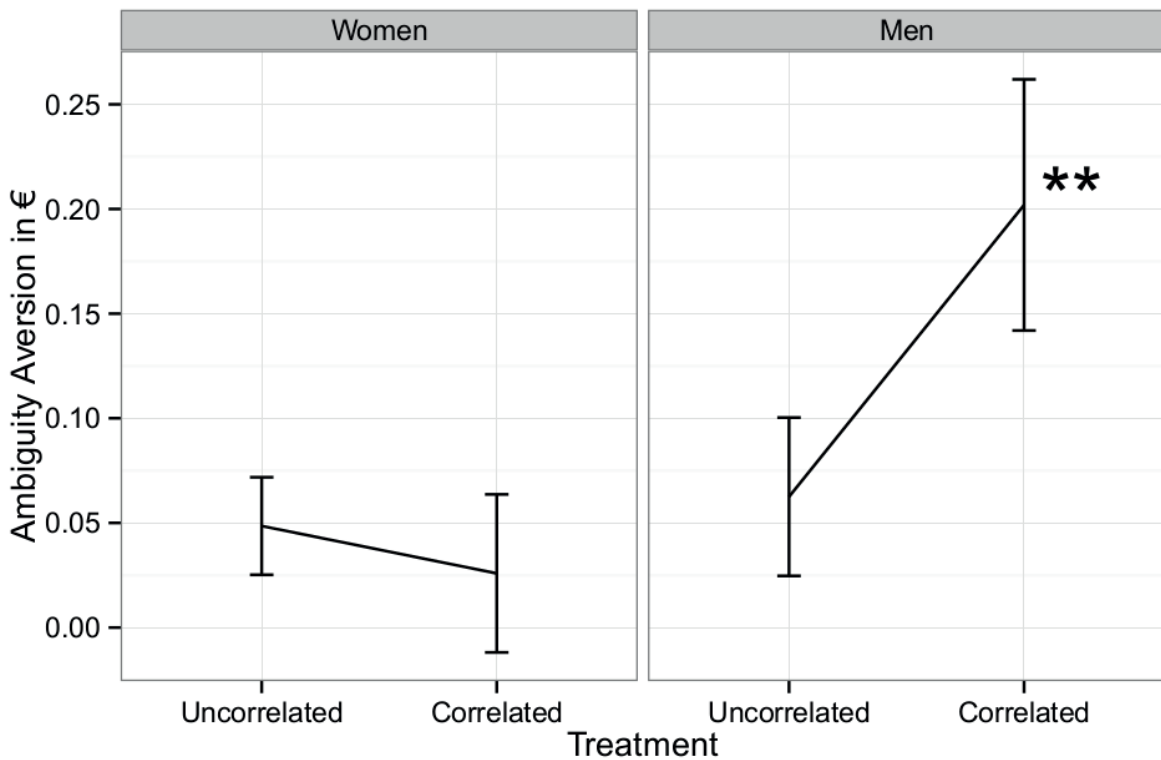
Women were significantly ambiguity averse in the uncorrelated treatment ($z = 2.01$, $p = 0.04$, Wilcoxon-Signed-Rank Test), but not in the correlated treatment ($z = 1.36$, $p = 0.17$, Wilcoxon-Signed-Rank Test). In line with *H2*, Women were not significantly affected by the type of outcome correlation structure ($z = 0.10$, $p = 0.92$, Wilcoxon Rank-Sum Test). Neither the WTP for the risky lottery ($z = 1.23$, $p = 0.22$, Wilcoxon Rank-Sum Test) nor the WTP for the ambiguous lottery ($z = 1.32$, $p = 0.19$, Wilcoxon Rank-Sum Test) were significantly affected by different outcome correlation structures.

Table 1: Mean Ambiguity aversion by treatment and gender

	Uncorrelated			Correlated		
	WTP Risk	WTP Ambiguity	AA	WTP Risk	WTP Ambiguity	AA
Men	3.86	3.80	0.06	4.34	4.14	0.20***
	(SD 0.61)	(SD 0.58)	(SD 0.28)	(SD 0.85)	(SD 0.85)	(SD 0.53)
Women	3.86	3.81	0.05**	3.93	3.91	0.03
	(SD 0.58)	(SD 0.59)	(SD 0.19)	(SD 0.49)	(SD 0.53)	(SD 0.29)

All amounts are in €. AA= Ambiguity aversion, ** = significance at a 5%-level, *** = significance at a 1%-level

Figure 1: Change in ambiguity aversion by treatment and gender. Error bars indicate the standard errors of the mean.



Discussion

Our empirical findings indicate that men are significantly affected by different outcome correlation structures, while women are not. This finding is in line with the above derived predications based on an evolutionary theory of decision-making. In the following part of the paper, these results are discussed. The first part of the discussion relates our findings to the existing literature on how social aspects influence ambiguity attitudes. This literature is related to our study, because we expect that different outcome correlation structures have an impact on choices only under social comparison. Therefore, all payments were made publicly within a session in our experiments. The second part addresses the literature on how different types of outcome correlation structures impact behaviour. Finally, potential limitations of our experimental design are outlined.

To our knowledge, the effect of different outcome correlation structures on gender differences in ambiguity aversion has not been studied. Some studies, however, investigate the impact of other social aspects on ambiguity aversion. One finding is that people are more ambiguity

averse, if their choices are announced publicly (Curley, Yates, & Abrams, 1986; Muthukrishnan, Wathieu, & Xu, 2009; Trautmann, Vieider, & Wakker, 2008). This feature of the experimental design is kept constant in our study, because in both treatments participants' choices for the relevant price were revealed publicly. Therefore, it cannot explain our findings.

Another line of research studies the impact of joint group decisions on ambiguity aversion. Results are mixed. While it has been shown that groups are more likely to behave in an ambiguity neutral manner (Keck, Diecidue, & Budescu, 2014), other studies find only a small or even no significant impact of group decision-making on ambiguity attitudes (Brunette, Cabantous, & Couture, 2010; Keller, Sarin, & Sounderpandian, 2007; Levati, Napel, & Soraperra, 2014). After a discussion of one's choice with ambiguity neutral participants, people become more ambiguity neutral (Charness, 2012; Keck et al., 2014). Our study takes a different perspective on social aspects of ambiguity attitudes, because in both treatments each participant makes an individual decision.

Moreover, the impact of competition on ambiguity aversion has been studied. Competition is a relevant factor for our study, because we hypothesize that competition among men is the driving factor underlying the observed gender difference in ambiguity aversion. Kühberger & Perner (2003) find that people are more likely to bet on a box with an unknown distribution, if this box is composed by partner with positively correlated payoffs. If the box is composed by an opponent with negatively correlated payoffs, people are less likely to bet on this box. Gender differences have not been analysed in this study.

The type of outcome correlation structures, which is applied in laboratory experiments, is often not very well documented and empirical research on this topic is limited.⁶ Chark & Chew (2015) found that people prefer positively correlated over negatively correlated outcome structures under strategic uncertainty. Furthermore, the importance of the outcome correlation structure for gender differences in behavior has been shown by Schmidt et al. (2015) and Friedl et al. (2013). In the first study, men are more prone to risk-taking behaviour under a correlated outcome structure than under an uncorrelated outcome structure. In the

⁶ Schmidt et al., (2015) provide an overview of the literature.

second study, the demand for insurance is significantly higher for uncorrelated than for correlated risks. We extend this literature to the domain of ambiguity attitudes.

Finally, potential limitations of our study should be addressed. One potential limitation of our study is the use of WTP to measure ambiguity aversion. It has been proposed that this measure overestimates ambiguity aversion due to a possible confound with loss aversion (Schmidt, Starmer, & Sugden, 2008; Trautmann et al., 2011). Furthermore, it has been reported that education has an impact on ambiguity attitudes. In particular, highly educated people tend to be less ambiguity averse (Booij & van de Kuilen, 2009). This represents a potential bias in our data, because our participants were students. It is important to mention, however, that we applied a between subject design for our main research questions. Thus, a potential confound with loss aversion or a generally reduced ambiguity aversion should be the same in both treatments.

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Chapter 4

Gender Differences in Social Risk Taking

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Abstract

Women in Western societies are typically more risk averse than men in individual risk taking decisions. In real life, however, risk taking decisions are usually made in a social context. So far, empirical evidence whether gender differences are also present in the social risk taking domain is missing. We use a controlled experiment to analyze gender differences in social risk taking. We find that inequality aversion is the main driver for risk aversion in social risk taking. Disaggregating the data for males and females shows that this effect is mainly driven by strong inequality aversion of women. Moreover, by running the experiment with non-standard subjects from an egalitarian small-scale society, our results suggest that gender differences in social risk taking are culture-specific.

Keywords: Economic experiments, Social risk taking, Gender differences, Cultural-comparative analysis

JEL-Classification: D03, D81, C93, J15, J16

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1 Introduction

There exists an extensive literature showing that women in Western societies are typically more risk averse than men (Haigh and List 2005, Charness and Genicot 2009, Croson and Gneezy 2009, Filippin and Crosetto 2016). Typically, these studies consider only individual risk taking where consequences are borne solely by the respective agent. In real life, however, risk taking decisions are usually made in a social context and may influence the well-being of others (Pahlke et al., 2015). Examples are private decisions which have an impact on other family members or professional decisions which affect colleagues or employees. Also many important decisions are taken by groups, e.g. corporate boards or parliaments.

While standard theories of decision making under risk, like expected utility (von Neumann and Morgenstern 1944) or prospect theory (Kahneman and Tversky 1979) assume that only the own payoffs of an individual determine her risk taking, recent research has investigated the role of social context (Linde and Sonnemans 2012, Vendrik and Woltjer 2007, Lahno and Serra-Garcia 2015, Gamba and Manzoni 2016, Friedl et al. 2014). Broadly speaking, this literature shows that when making individual risky decisions, a subject usually also takes into account the payoffs of peers in a way consistent with inequality aversion, in particular behindness aversion – i.e. a subject dislikes being behind a peer more than she likes or dislikes being ahead of her. It seems plausible that the social context plays an even larger role when decisions are made jointly with others (group decisions) or on behalf of others (social responsibility). Typical findings in these domains are conservatism – i.e. the group context leads to increased risk aversion (Shupp and Williams 2008, Charness and Jackson 2009, Fagerness et al. 2009, Bolton et al. 2015, Baker et al. 2008, He et al. 2012, Reynolds et al. 2011, Charness 2000, Ertac and Gurdal 2012) – and conformism – i.e. changing own behavior towards the (expected) behavior of others (Cialdini and Goldstein 2004, Daruvala 2007). While gender differences have been extensively analyzed for individual risk taking, there are hardly any studies on these issues for social risk taking. This is somewhat surprising as attitudes like conservatism and inequality aversion could well be assumed to be highly gender-specific. For example, evidence from dictator games indicates a higher degree of inequality aversion for women (Selten and Ockenfels 1998, Andreoni and Vesterlund 2001).

The present paper tries to fill this gap by analyzing gender differences in social risk taking. To do so, we employ a design similar to that of Bolton et al. (2015) where the risky decisions of a subject influence also the payoff of another individual. While Bolton et al. also find evidence in favor of inequality aversion, conservatism and conformism they do not take into account gender differences. Gender differences in risk aversion are particularly important since the increased risk aversion of women has adverse consequences for the economic outcomes of women. Well-known examples are income losses due to reduced risk taking in career choices (Bertrand and Hallock 2001, Sapienza et al. 2009) and financial investments (Watson and McNaughton 2007). These adverse consequences raise the question whether the high risk aversion of women can be mediated through policy interventions resulting in better economic outcomes. Such interventions should be particularly feasible if gender differences are culture specific and not determined by nature. An excellent summary of this nature versus nurture debate can be found in Gneezy et al. (2009).

Since it is an open question whether gender differences in social risk taking are culture-specific we perform our experiment in a Western society and also in a small-scale society. It is well known that culture plays an important role for gender differences in individual risk taking as in traditional and small-scale societies women have not been found to be more risk averse than men (Binswanger 1980, Henrich and McElreath 2002, Gong and Yang 2012, Croson and Gneezy 2009, Pondorfer et al. 2016). It has also been shown that gender differences in individual risk taking can be mediated through policy interventions. One example for such interventions are single-sex schools which have been shown to mediate gender differences in risk aversion (Booth et al. 2014, Booth and Nolen 2012).

In view of the previous research and given that (i) important risky decisions in real life are mostly taken in social situations and (ii) the relatively high risk aversion of women has adverse consequences for their economic outcomes the motivation of our paper is as follows. We ask to which extent gender differences in risk taking in social context are present and in particular what role culture plays for social risk taking. To answer our question we employ a design similar to that of Bolton et al. (2015) where the risky decisions of a subject also influence the payoff of another individual. Our main innovations compared to Bolton et al. (2015) are that we (i) explicitly analyze gender differences in social risk taking, and (ii) investigate the role of culture by running our experiment in two rather different subject pools,

German students and a sample from Papua New Guinea. Our subjects from Papua New Guinea were sampled from the Teops and are part of an egalitarian society. Therefore, analyzing their behavior in comparison to a Western sample seems ideal for studying the impact of culture on social risk taking. Moreover, the Teop society is matrilineal. Given this opposite role of gender compared to Western societies, the influence of culture on gender differences in social risk taking could be well analyzed with our two samples. The paper is organized as follows. Section 2 presents the study with standard subjects from a Western society (Germany) and includes experimental design and procedures (2.1), hypothesis (2.2), and empirical results (2.3). Section 3 contains the study with non-standard subjects from Papua New Guinea and follows the same structure as section 2. Section 4 concludes.

2 Study 1: Western society

2.1 Experimental design and procedure

We implement a simple and incentivised task for measuring risk preferences (see Eckel and Grossman 2002, Eckel and Grossman 2008).⁷ This task is particularly adequate for a subject pool with limited numerical skills (Charness et al. 2013, Dave et al. 2010). We further reduce the cognitive load so that non-literate participants can easily understand the mechanisms behind the task. To do so subjects are shown six different pairs of cards (see Figure A1 in the appendix). Each pair is physically connected by a ribbon. Each card shows different sums of money in local currency. Participants are told that they can choose one of the six pairs. Once they choose a pair, the pair is separated and both cards are put into a bag. Participants are then allowed to draw one of the two cards out of the bag and are paid according to the shown amount of money on the card. The six pairs include one safe choice where both cards show the same amount. The remaining pairs increase linearly in expected payoff and risk as measured by the standard deviation of expected payoff. Note that the last pair only increases in its standard deviation but not in expected payoff so that only risk neutral or risk seeking participants would choose it. Table 1 provides an overview of the card pairs, the payoffs associated with each possible outcome, expected payoffs, and the standard deviations of expected payoffs which were not shown to the participants.

⁷ See Eckel and Grossman (2008b) for a discussion on advantages and disadvantages of measures of risk preferences.

Table 1: Gambles, expected payoff, and risk

Gamble	Probability (%)	Option A	Option B	Expected payoff	Variance	Standard deviation
1	50/50	2.50 Euro	2.50 Euro	2.50 Euro	0.00	0.00
2	50/50	3.50 Euro	2.00 Euro	2.75 Euro	0.56	0.75
3	50/50	4.50 Euro	1.50 Euro	3.00 Euro	2.25	1.50
4	50/50	5.50 Euro	1.00 Euro	3.25 Euro	5.06	2.25
5	50/50	6.50 Euro	0.50 Euro	3.50 Euro	9.00	3.00
6	50/50	7.00 Euro	0.00 Euro	3.50 Euro	12.25	3.50

We split our sample into active and passive participants while we only record data for the former. Active participants face the risk decision in three different variations, while only one of the three decisions is randomly chosen for payment. In treatment IR participants have to state their individual risk preference without knowledge of future treatments. IR is always presented first as it has the lowest cognitive requirement to understand. This will be our within subject risk preference baseline. Thereafter, half of the active participants face treatment PCR (NCR) first and NCR (PCR) second. In both treatments active participants have to decide for another pair of cards. The chosen pair is not only relevant for the active participant but is additionally extended to a passive participant as well. Therefore participants face risk decisions under social responsibility as their chosen risk level is extended to other participants. In treatment PCR (NCR), the passive participants receives the same (the opposite) payment shown on the card that the active participant draws from the bag. Therefore, risks are positively (negatively) correlated in treatment PCR (NCR). This leads to the situation where higher risks in the PCR treatment do not influence the equality between the active and passive player (as both receive the same amount), while higher risk taking in the NCR treatment is increasing inequality as one player will gain the high amount while the other will gain the low one.

At the beginning of each session, we randomly distributed tickets indicating the role of the player (passive or active) and handed out the show-up fee to both players. Subsequently,

active players were asked to enter a private room or cabin where the decisions were made. Passive players were asked to go into another room where they received their payment for one decision an active player made. Neither active nor passive participants knew with whom they were matched in the experiment. In total, 192 university students from Germany (96 men, 96 women, age = 22.21, SD = 3.58) participated as active players in the study.⁸

2.2 Hypotheses

As stated in the introduction, previous studies which analyzed risk taking in social contexts reported evidence in favor of conservatism and inequality aversion. The social context plays a dominant role in group decisions. There is a long tradition in the social psychology literature to study group decisions under risk. A well-known finding in this literature is the so-called risky-shift phenomenon, i.e. groups take more risks than individuals (see Isenberg, 1986, for a review of the literature). The design of these experiments has been criticized by economists, in particular the lack of financial incentives. In fact, economic experiments (Shupp and Williams 2008, Baker et al. 2008, Masclet et al. 2009) with real incentives get the opposite result, namely groups are less risk tolerant than individuals. This conservatism has been observed also in other risk taking decisions where the social context plays a role. In particular, when subjects have to make decisions on behalf of others (social responsibility), solid evidence in favor of conservatism has been reported (Charness and Jackson 2009, Ertac and Gurdal 2012, Bolton et al. 2015). If we follow Bolton et al. (2015) and define social risk taking (SR) as the average of PCR and NCR we get the following hypothesis:

Hypothesis 1: Individuals are conservative, i.e. more risk averse under social responsibility ($IR < SR$).

Many studies focussing on risk taking in a social context found evidence in favor of inequality aversion. The mere existence of peers with whom subjects can compare themselves has a systematic impact on risk taking consistent with inequality aversion (Linde and Sonnemans 2012, Vendrik and Woltjer 2007, Lahno and Serra-Garcia 2014, Gamba and Manzoni 2014, Friedl et al. 2014). A possible driver for this inequality aversion is behindness aversion which means that subjects dislike being behind a peer to a larger extent than they like or dislike

⁸ See Table A2 in the appendix for details on subject's characteristics.

being ahead of her. Also for decisions under social responsibility Bolton et al. (2015) observed behavior consistent with inequality aversion.

Hypothesis 2: Individuals are inequality averse, i.e. they take less risks under negative than under positive correlated risks ($PCR > NCR$).

Finally, we test gender differences in individual and social risk taking behavior. Evidence from Western societies suggest that women are more risk averse than men in individual risk taking tasks (e.g., Croson and Gneezy 2009, Charness and Gneezy 2012).

Hypothesis 3: Women are more risk averse than men ($IR(\text{men}) > IR(\text{women})$).

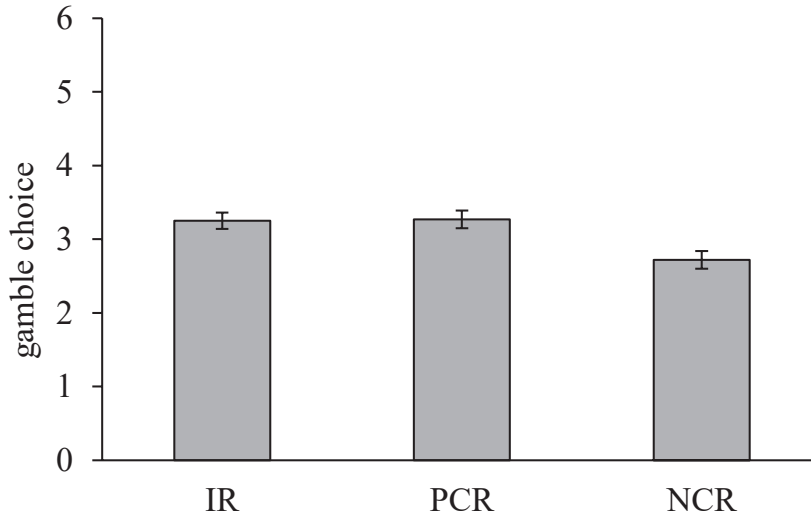
We are not aware of any systematic study which analyzed gender differences with respect to social risk taking. Nevertheless, evidence from dictator games indicate a higher degree of inequality aversion for women (Selten and Ockenfels 1998, Andreoni and Vesterlund 2001). Therefore we expect that inequality aversion in social risk taking might play a more dominant role for women than for men. This leads us to the following hypothesis:

Hypothesis 4: The main driver for gender differences in social risk taking is that women are more inequality averse in risky situations than men ($NCR(\text{men}) > NCR(\text{women})$).

2.3 Results

Our experimental design provides three main measures to describe subjects' risk and social preferences. Individual risk preferences are measured in IR. In PCR and NCR risk is extended to another subject (social risk taking). Payoffs are positively correlated in PCR and negatively correlated in NCR. Hence, we can analyze the effect of social responsibility on risk taking behavior (PCR) as well as the combined effect of social responsibility and inequality aversion (NCR). Figure 1 shows the mean gambles that subjects choose in each treatment. Table 2 lists the distribution of gamble choices in more detail.

Figure 1: Mean gamble choices across treatments in Germany
(error bars reflect ± 1 s.e.m.)



Result 1: Extending the risk to others moderately increases risk aversion.

In line with our hypothesis, extending the risk to others promotes conservatism in a Western society (Germany). We use a Wilcoxon signed-rank test⁹ to test for differences between individual (IR) and social risk taking (SR).¹⁰ The mean gamble choice significantly decreases from 3.25 to 2.99 ($p = 0.057$). Thus, we confirm findings from previous studies (Charness and Jackson 2009, Bolton et al. 2015).

Table 2: Distribution of gamble choices across treatments in Germany

Gamble	IR		PCR		NCR	
	n	%	n	%	n	%
1	16	8.33	33	17.19	62	32.29
2	59	30.73	38	19.79	39	20.31
3	46	23.96	41	21.35	35	18.23
4	34	17.71	36	18.75	24	12.5
5	6	3.13	12	6.25	11	5.73
6	31	16.15	32	16.67	21	10.94
Total N	192	100	192	100	192	100
Mean (s.d.)	3.25	(1.53)	3.27	(1.66)	2.72	(1.66)

⁹ Unless otherwise specified, we use a Wilcoxon signed-rank test throughout section 2.3.

¹⁰ Social risk taking (SR) is measured by pooling the data over PCR and NCR, that is, $0.5*(PCR+NCR)$.

Result 2: Inequality aversion is the main factor of conservatism.

To disentangle the effect of social responsibility and inequality aversion on social risk taking, we individually compare IR, PCR and NCR. We find strong evidence for more risk aversion when there is the possibility of inequality in payoffs. While the mean gamble choices in IR (3.25) and PCR (3.27) are statistically not distinguishable ($p = 0.307$), mean gamble choices decrease when risk is extended to another subject and payoffs are negatively correlated (3.25 vs. 2.72, $p < 0.001$). This also implies that the mean gamble choice in PCR is statistically different from the mean gamble choice in NCR (3.27 vs. 2.72, $p < 0.001$). Thus, it is not social responsibility per se that leads to conservatism (more risk aversion) but rather a combination of social responsibility and inequality aversion. Moreover, comparing the fraction of safe gamble choices (gamble 1, no risk at all) across treatments shows that social responsibility increases strong risk aversion (see Table 2).¹¹ In the IR treatment the fraction of safe gamble choices is 8.33 %. This fraction doubles to 17.19 % in PCR (χ^2 contingency table test, $p < 0.001$) and quadruples to 32.29 % in NCR (χ^2 contingency table test, $p < 0.001$).¹²

Result 3: Gender differences in individual and social risk taking.

Figure 2 shows mean gamble choices of men and women across treatments in Germany.¹³ We highlight gender differences within treatments and adjustment behavior of men and women across treatments.

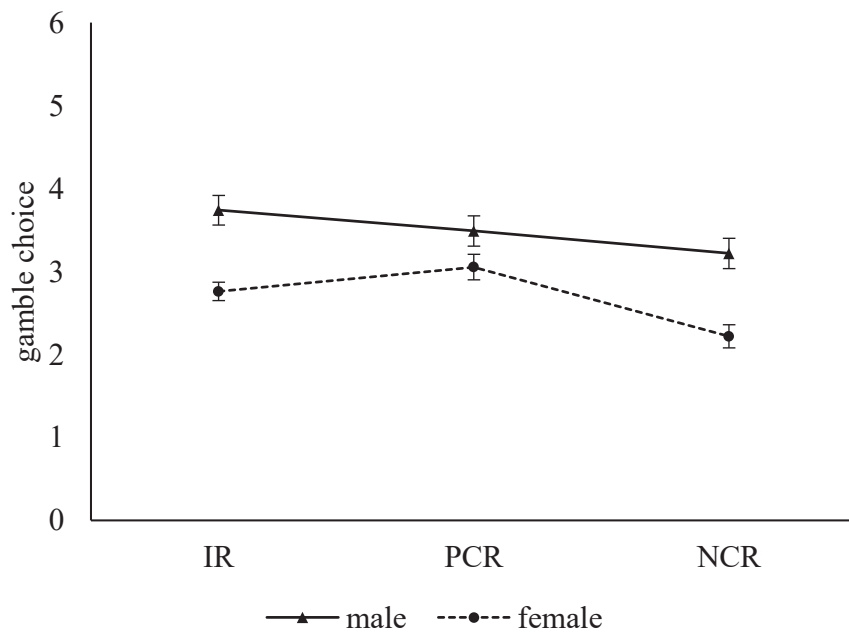
In line with previous findings, women from Western-societies are significantly more risk averse than men in the individual risk taking task (Wilcoxon rank-sum; 2.76 vs. 3.74, $p < 0.001$ for IR). Gender differences in social risk taking are on the borderline of significance when payoffs are positively correlated but large and significant when payoffs are negatively correlated (Wilcoxon rank-sum; 3.05 vs. 3.49, $p = 0.106$ for PCR; 2.22 vs. 3.22, $p < 0.001$ for NCR). Hence, women in Western societies are more risk averse and dislike inequality more than men.

¹¹ We define subjects that choose gamble 1 (no risk at all) as strongly risk averse. See Table 2 for more details.

¹² Results are robust to using a Wilcoxon signed-rank test.

¹³ Table A3 in the appendix lists the distribution of gamble choices for men and women in more detail.

Figure 2: Mean gamble choices across treatments split by sex in Germany (error bars reflect ± 1 s.e.m.)



We observe considerable differences in adjustment behavior of men and women when risk is extended to another subject. While men's mean gamble choices are linearly decreasing with social context, women's mean gamble choices follow an inverted u-shape across treatments (see Figure 2). However, men only adjust their risk attitudes downwards on a significant level when payoffs are negatively correlated (3.74 vs. 3.49, $p = 0.688$, for IR vs. PCR; 3.74 vs. 3.22, $p < 0.05$ for IR vs. NCR). By contrast, women increase (decrease) their risk tolerance when payoffs are positively (negatively) correlated (2.76 vs. 3.05, $p = 0.074$ for IR vs. PCR; 2.76 vs. 2.22, $p < 0.001$ for IR vs. NCR). Men and women indicate inequality aversion across social risk taking treatments. The mean gamble choices for both - men and women - are significantly lower in NCR than in PCR although this effect is indeed stronger for women (3.49 vs. 3.22, $p = 0.079$ for men; 3.05 vs. 2.22, $p < 0.001$ for women).

To assess the robustness of these results against potential confounds, we apply an ordered probit regression model which is presented in Table 3. The first specification only shows treatment effects (column 1). The second specification controls for the sex of the subject (column 2). In the third specification we include interaction terms between sex and treatments

(column 3). In the fourth specification we add socio-economic and demographic controls (column 4).

All (main) results previously reported hold. According to column 1 and 2, NCR is significantly different from IR and PCR, respectively (see also Wald Tests reported at the bottom of Table 3). Moreover, the negative and significant coefficient of the female dummy in column 2 suggests that women are overall more risk averse than men. The results of column 3 and 4 confirm significant gender differences in IR and NCR and that both – men and women – significantly adjust their risk attitudes downwards from IR to NCR. However, results reported on the borderline of significance do not hold in regression analysis. There are no significant gender differences in PCR, women do not significantly increase their risk tolerance from IR to PCR, and men's risk behavior in PCR and NCR is statistically not distinguishable.

Table 3: Ordered probit regression results

	(1)	(2)	(3)	(4)
PCR	-0.03 (0.08)	-0.03 (0.08)	-0.19+ (0.12)	-0.20+ (0.12)
NCR	-0.43*** (0.08)	-0.44*** (0.08)	-0.38** (0.13)	-0.40** (0.13)
Female		-0.50*** (0.11)	-0.57*** (0.13)	-0.57*** (0.14)
PCRxFemale			0.31+ (0.16)	0.33* (0.17)
NCRxFemale			-0.13 (0.17)	-0.13 (0.18)
Age				0.03+ (0.02)
Income				0.01 (0.07)
Wald test				
<i>Treatment effects for women</i>				
IR = PCR			0.12 (0.11)	0.13 (0.12)
IR = NCR			-0.51*** (0.11)	-0.53*** (0.12)
PCR = NCR	-0.40*** (0.10)	-0.41*** (0.10)	-0.63*** (0.15)	-0.66*** (0.16)
<i>Treatment effects for men</i>				
PCR = NCR			-0.19 (0.14)	-0.20 (0.14)
<i>Gender differences within treatments</i>				
PCRxMale = PCRxFemale			-0.25 (0.16)	-0.24 (0.16)
NCRxMale = NCRxFemale			-0.69*** (0.17)	-0.69*** (0.17)
Pseudo R-squared	0.01	0.03	0.03	0.03
Log likelihood	-977.58	-961.4	-959.18	-897.98
Observations ^a	576	576	576	546

Notes. The table reports ordered probit estimates. Clustered robust standard errors in parentheses. The dependent variable is subject's gamble choice in IR, PCR and NCR, respectively (compare Table 2). The Wald tests reported at the bottom of the table are run on the null hypothesis that pairs of dummy coefficients identifying a treatment and its interaction with gender are equal to each other. + p<0.1; * p<0.05; ** p<0.01; ***; p<0.001.

^a Observations in specification (4) do not sum up to 576 due to missing values in age and income.

3 Study 2: Egalitarian small-scale society

Most explorations of social risk taking preferences are based on experiments conducted in what Henrich et al. (2010) call WEIRD (Western, educated, industrialized, rich, and democratic) societies. They make a compelling argument that these societies are relatively novel within evolutionary history and that data from non-Western small-scale societies are essential for testing hypotheses that relate to the human decision making processes.

To assess the importance of culture for gender differences in social risk taking, we additionally conducted experiments with subjects from a non-competitive and egalitarian small-scale society of Papua New Guinea. This set-up enables us to compare behavioral patterns of standard university subjects from a Western society and non-standard subjects belonging to a non-Western small-scale society.

The experiments in Papua New Guinea were conducted among the Teops which form a unique language group of Bougainville Island. Teop residents live in coastal villages that vary in size from 50 to 200 people. Their subsistence is based on horticulture and pig husbandry, supplemented by fishing, hunting and foraging (Regan and Griffin 2005).

Formal (centralized) institutions for the enforcement of legal rules are largely absent in Papua New Guinea. This means that social life is regulated almost exclusively by social norms (Bernhard et al. 2006). Teop is one of the societies of Polynesia/Melanesia whose social structure is organised around tribes and clans, and where these social norms are guarded by Big Men. Moreover, Teop people use a variety of levelling institutions to reduce inequality. These include strong norms of sharing and reciprocity allowing wealth to spill over to the rest of the community.

Another unique feature of Teop society is matrilineality. Women's social position in Bougainville culture has its origin in land. The matrilineal kinship structure gives women considerable power over material resources and activities that are economically and ritually important. Women's prerogative over land includes defining land boundaries, giving permission to hunt or to harvest timber, and the exclusive right to veto decisions on land-related matters. While male relatives have rights to ownership, their rights are limited and conditional on female relatives' permission (Saovana-Spriggs 2003).

3.1 Experimental design and procedure

We applied the same protocol in both societies following the same procedures as closely as possible. Due to the field setting in Papua New Guinea, the experimental procedures marginally differ in some aspects between the two societies. Firstly, we randomly recruited adult subjects from the Teop population in advance and asked them to come to a central space in the village (school, church or community places). Village heads and our local assistants helped us recruit the subjects in the villages. No more than two persons were recruited from the same household to minimize contamination between subjects. Secondly, while the instructions were written in Germany, we explained the protocol face-to-face to subjects in Papua New Guinea. The protocol was read out in Tok Pisin which is the universal language in Papua New Guinea.¹⁴ This was done to maximize comprehension of subjects. Thirdly, payoffs between Papua New Guinea and Germany are not comparable in terms of purchasing power parity.¹⁵ The average payoff in Papua New Guinea (Germany) is about 40 (10) percent of the daily wage rate. However, the higher payoff in Papua New Guinea is justified because people could not do their subsistence activities when participating in the experiment. In order to motivate people taking part in the experiment, we had to guarantee that the average payoff exceeds potential earnings from subsistence activities. Moreover, since the protocol was explained face-to-face to participants in Papua New Guinea, the experimental sessions took roughly twice as long. In total, 156 people in Papua New Guinea (76 men, 80 women, age = 39.05, SD = 13.10) participated as active players in the study.¹⁶

3.2 Hypothesis

Due to the strong norms of sharing in our small-scale society basically all decisions are made in a social context as also individual gains spill over to others quickly. Therefore, contrary to subjects from Western societies we do not expect a difference between IR and SR.

Hypothesis 1: Social responsibility does not affect risk attitudes in egalitarian small-scale societies (IR = SR).

¹⁴ Local assistant translated the protocol into Tok Pisin. Different assistants translated the instructions back into English, so we could check for accuracy.

¹⁵ Table A4 in the appendix provides an overview of the card pairs, the payoffs associated with each possible outcome, expected payoffs, and the standard deviations of expected payoffs for the Papuan sample.

¹⁶ See Table A2 in the appendix for details on demographic and socio-economic characteristics of Teop subjects.

In this small-scale society our treatments PCR and NCR that differ in inequality of payments should, in contrast to Western societies, have no impact on behavior. This is because we expect that inequalities in payments are levelled out ex post due to strong social norms of sharing.

Hypothesis 2: Inequality in payoffs has no effect on risk taking in egalitarian small-scale societies (PCR = NCR).

Finally, we test gender differences in individual and social risk taking behavior. Findings from rural and traditional societies, cannot replicate the verdict of systematically different risk preferences of women and men found in WEIRD societies (e.g., (Binswanger 1980) (Henrich and McElreath 2002) (Croson and Gneezy 2009) (Gong and Yang 2012) (Pondorfer et al. 2016)). Given the equal status of men and women in egalitarian societies compared to the more gender segregated environment in WEIRD-societies, we put forward the following hypotheses.

Hypothesis 3: No gender differences in individual and social risk taking in egalitarian small-scale societies

3.3 Results

Figure 3 shows the mean gambles that subjects choose in each treatment. Table 4 lists the distribution of gamble choices in more detail.

Figure 3: Mean gamble choices across treatments in Papua New Guinea (error bars reflect ± 1 s.e.m.)

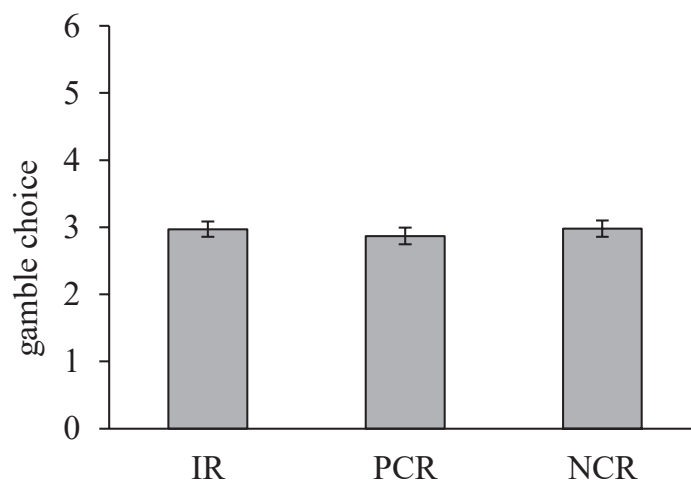


Table 4: Distribution of gamble choices across treatments in Papua New Guinea

Gamble	IR		PCR		NCR	
	n	%	n	%	n	%
1	32	20.65	40	25.64	35	22.44
2	27	17.42	30	19.23	23	14.74
3	38	24.52	31	19.87	46	29.49
4	34	21.94	27	17.31	23	14.74
5	19	12.26	21	13.46	20	12.82
6	5	3.23	7	4.49	9	5.77
Total N ^a	155	100	156	100	156	100
Mean (s.d.)	2.97	(1.42)	2.87	(1.53)	2.98	(1.50)

^a Note that we failed to record the individual gamble choice (IR) of one subject.

Result 1: Extending the risk to others does not increase risk aversion in egalitarian societies.

Extending the risk to others does not affect risk attitudes in an egalitarian small-scale society (Papua New Guinea). We use a Wilcoxon signed-rank test¹⁷ to test the differences between individual (IR) and social risk taking (SR).¹⁸ In Papua New Guinea the mean gamble choice marginally decreases from 2.97 to 2.92 ($p = 0.818$). Thus, we show that conservatism in risk taking under social responsibility is not a universal feature in human societies.

Result 2: Inequality aversion is the main factor of conservatism in WEIRD-societies but has no effect in egalitarian small-scale societies.

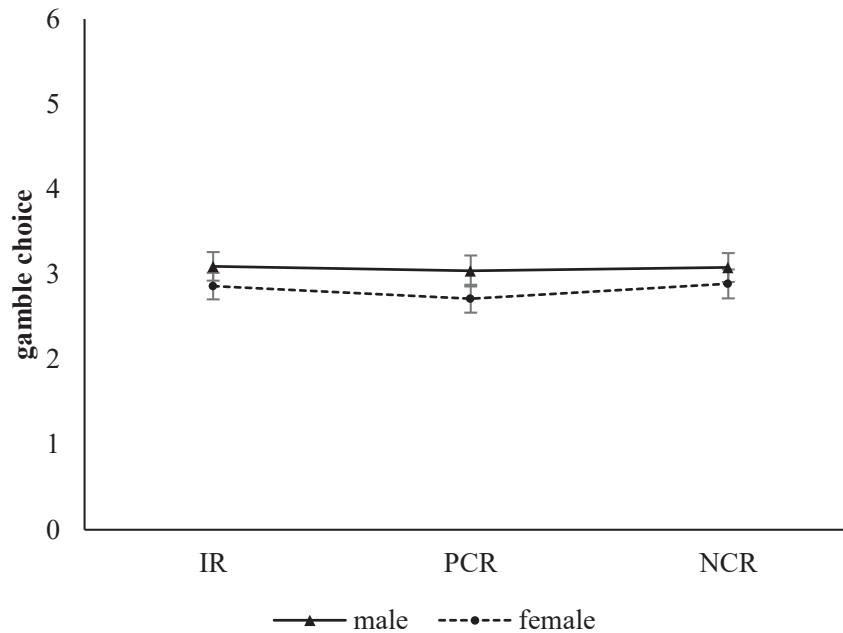
In Papua New Guinea we observe no significant differences across treatments. The mean gamble choices in IR (2.97), PCR (2.87) and NCR (2.98) are almost identical, suggesting that in an egalitarian society individual risk taking equals social risk taking and that inequality aversion has no effect in this context (2.97 vs. 2.87, $p = 0.615$; 2.97 vs. 2.98, $p = 0.948$; 2.87 vs. 2.98, $p = 0.615$). This holds also for strong risk aversion. About 20 to 25 % of subjects

¹⁷ Unless otherwise specified, we use a Wilcoxon signed-rank test throughout section 3.3.

¹⁸ Social risk taking (SR) is measured by pooling the data over PCR and NCR, that is, $0.5*(PCR+NCR)$.

choose the safe gamble (gamble 1, no risk at all) in each treatment (these differences are statistically not significant in all cases).¹⁹

Figure 3: Mean gamble choices across treatments split by sex in Papua New Guinea (error bars reflect ± 1 s.e.m.)



Result 3: No Gender differences in individual and social risk taking in egalitarian small-scale societies.

Figure 3 shows mean gamble choices of men and women across treatments in Papua New Guinea.²⁰ We highlight gender differences within treatments and adjustment behavior of men and women across treatments. The data for Papuan men and women follows an egalitarian pattern. We find no evidence for gender differences in the individual risk taking task nor in the tasks when risk is extended to another subject (Wilcoxon rank-sum; 2.86 vs. 3.09, $p = 0.367$ for IR; 2.71 vs. 3.04, $p = 0.214$ for PCR; and 2.89 vs. 3.08, $p = 0.418$, for NCR).

Extending the risk to another subject leads to no adjustment of risk taking behavior, neither for men nor for women. All tests of treatment effects within gender are not significant.²¹

¹⁹ χ^2 contingency table test; IR (20.65 %) vs. PCR (25.64 %), $p = 0.140$; IR (20.65 %) vs. NCR (22.44 %), $p = 0.291$; PCR (25.64 %) vs. NCR (22.4 %), $p = 0.668$.

²⁰ Table A3 in the appendix lists the distribution of gamble choices for men and women in more detail.

²¹ For Papuan men: IR (3.09) vs. PCR (3.04), $p = 0.857$; IR (3.09) vs. NCR (3.08), $p = 0.965$; PCR (3.04) vs. NCR (3.08), $p = 0.996$.

For Papuan women: IR (2.86) vs. PCR (2.71), $p = 0.606$; IR (2.86) vs. NCR (2.89), $p = 0.917$; PCR (2.71) vs. NCR (2.89), $p = 0.485$.

Table 5 presents results of an ordered probit regression using the same model specifications as in Table 3 above. Since the Papua data was collected in the field with non-standard subjects, the specifications slightly differ in some aspects. First, instead of income, we use a wealth index for the Papuan sample (measured by the number of assets households own). We think this measure provides better information about the specific wealth level of Papuan subjects. Further, we add education as control in the Papuan sample. Finally, we include village-fixed effects in all specifications. Estimation with village fixed effects only exploits variation within villages and eliminates all village-level heterogeneity (e.g., village economy, village leadership, village geography, or demographic composition). We think that this is necessary in order to receive unbiased treatment effects.

In no specification of the Papuan sample we find significant treatment effects. (see Wald test at the bottom of Table 5). The regression results also show that women in Papua are not significantly more risk averse than men and that both – men and women – do not adjust their risk preferences towards others.

Table 5: Ordered probit regression

	(1)	(2)	(3)	(4)
PCR	-0.07 (0.12)	-0.07 (0.12)	-0.03 (0.18)	0.05 (0.18)
NCR	0.01 (0.12)	0.01 (0.12)	-0.01 (0.18)	0.03 (0.19)
Female		-0.14 (0.09)	-0.13 (0.16)	-0.11 (0.16)
PCRxFemale			-0.07 (0.24)	-0.16 (0.24)
NCRxFemale			0.03 (0.24)	0.00 (0.25)
Age				0.00 (0.00)
Wealth				-0.05 (0.03)
Middle education				0.17 (0.14)
Higher education				0.16 (0.23)
<hr/>				
Wald test				
<i>Treatment effects for women</i>				
IR = PCR			-0.11 (0.16)	-0.11 (0.16)
IR = NCR			0.03 (0.16)	0.02 (0.16)
PCR = NCR	-0.08 (0.13)	-0.08 (0.13)	0.13 (0.17)	0.13 (0.17)
<i>Treatment effects for men</i>				
PCR = NCR			0.03 (0.19)	0.02 (0.20)
<i>Gender differences within treatments</i>				
PCRxMale = PCRxFemale			-0.20 (0.17)	-0.11 (0.16)
NCRxMale = NCRxFemale			-0.09 (0.17)	-0.27 (0.17)
<hr/>				
Village fixed effects	Yes	Yes	Yes	Yes
Pseudo R-squared	0.02	0.02	0.02	0.02
Log likelihood	-779.57	-778.56	-778.46	-760.78
Observations ^a	467	467	467	458

Notes. The table reports ordered probit estimates. Clustered robust standard errors in parentheses. The dependent variable is subject's gamble choice in IR, PCR and NCR, respectively (compare Table 4). The Wald tests reported at the bottom of the table are run

on the null hypothesis that pairs of dummy coefficients identifying a treatment and its interaction with gender are equal to each other. All specifications include village fixed effects as controls. + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; ***; $p < 0.001$.

^a Observations in specification (4) do not sum up to 467 due to missing values in age and education.

4 Conclusion

Gender differences in individual risk taking have emerged in many experiments conducted in Western societies and have been discussed extensively in the literature (see e.g., Eckel and Grossman 2008b, Croson and Gneezy 2009, Bertrand 2011, Charness and Gneezy 2012, Filippin and Crosetto 2016). As most risky decisions are not taken in isolation the present study analyzes gender differences in social risk taking. In our Western subject pool, we reproduce the usual results of previous studies, i.e. we find evidence in favor of conservatism, inequality aversion and conformism. Since we observe a significant difference between social and individual risk taking only for negatively but not for positively correlated risks, we conclude that the main driver for conservatism in social risk taking is inequality aversion. Disaggregating the data for males and females shows that this effect is mainly driven by strong inequality aversion of women. Gender differences in social risk aversion thus emerge from a combination of higher individual risk aversion and higher inequality aversion of women.

Our results concerning inequality aversion are in line with previous experimental results from dictator games. The studies of Andreoni and Vesterlund (2001), Dickinson and Tiefenthaler (2002), Selten and Ockenfels (1998) and Dufwenberg and Muren (2006) find that men choose efficient allocations while women are more inequality averse, and thus, prefer the equal split more often than men. In a recent meta-study of dictator games, Kamas and Preston (2015) confirm these differences and find that women are almost twice as likely as men to be inequity averters.

In contrast to the results in our Western sample, in the small-scale society of Papua New Guinea we find (i) no differences between individual risk taking and social risk taking, and (ii) no gender differences within treatments. Concerning point (ii), also previous experimental studies conducted in rural and traditional societies cannot confirm the verdict of gender differences in individual risk taking (e.g., Binswanger 1980, Henrich and McElreath 2002). Even experimental work conducted in societies where the roles of women and men are mirror

images in specific aspects of social norms provides only mixed results. Gneezy et al. (2009) observe gender differences in competition but not in risk preferences among the patriarchal Maasai in Tanzania and the matrilineal Khasi in India. The fact that we find no gender differences in inequality aversion in our Papuan sample is in line with previous experimental studies that applied dictator games across different small-scale societies. Henrich et al. (2006) find no significant gender difference in the dictator game offer across these societies.

Result (i) can be rationalized as follows. The tribal small-scale society of Teop is based on the egalitarian principle which is defined as a society's intolerance for inequality. Equality is promoted by direct, individual access to resources and economies based on immediate rather than delayed return. Moreover, small-scale societies use a variety of levelling institutions to reduce inequality (see e.g., Woodburn 1982, Boehm 1997, Boehm 1993). These include strong norms of sharing and reciprocity allowing wealth to spill over to the rest of the community (see e.g., Hill et al. 1993, Godoy et al. 2001, Gurven et al. 2000). Unequal resource allocations are ex-post leveled out in Papua New Guinea, and therefore individual decisions do not differ substantially from those made in a social context.

All these findings presented above suggest that gender differences in individual and social risk taking cannot unequivocally be attributed to nature. Rather such differences may also be culture specific and evolve during socialization.

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Appendix

Figure A1: Gamble choices for the German subject pool













Tick	Pair	Card 1	Card 2
1			
2			
3			
4			
5			
6			

Table A2: Subject characteristics (for Germany and Papua New Guinea)

	Papua New Guinea			Germany		
	All subjects	Men	Women	All subjects	Men	Women
	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)
Age (years)	39.05 (13.10)	41.73 (13.64)	36.58 (12.15)	22.21 (3.58)	22.84 (3.86)	21.62 (3.22)
Wealth (index)/Income ^a	4.06 (1.87)	4.05 (1.82)	4.08 (1.92)	3.11 (0.95)	3.20 (1.00)	3.03 (0.89)
	percent	percent	percent	percent	percent	percent
Education						
Low educated	6.5 %	8.0 %	4.9 %	-	-	-
Middle educated	87.7 %	86.7 %	88.8 %	-	-	-
High educated	5.8 %	5.3 %	6.3 %	-	-	-
Observations ^b	156	76	80	183	88	95

^a The wealth index is defined as the sum of assets owned. We consider the following six assets: torch, lamp, chair, generator, mobile phone, radio. In Germany, income was measured on a scale from 1 to 5.

^b Note that some of the socio-economic variables do not sum up to the total number of experimental observations in both societies (156 in PNG and 192 in GER, respectively). In Papua New Guinea, two (one) observations for age (education) were not recorded. In Germany, nine participants did not answer questions about income and age.

Table A3: Distribution of gamble choice across treatments and societies split by sex (upper part: German sample; lower part: Papuan sample)

Germany													
Gamble	IR				PCR				NCR				
	male		female		male		female		male		female		
	n	%	n	%	n	%	n	%	n	%	n	%	
1	6	6.25	10	10.42	17	17.71	16	16.67	23	23.96	39	40.63	
2	26	27.08	33	34.38	14	14.58	24	25	14	14.58	25	26.04	
3	18	18.75	28	29.17	21	21.88	20	20.83	20	20.83	15	15.63	
4	12	12.5	22	22.92	16	16.67	20	20.83	15	15.63	9	9.38	
5	5	5.21	1	1.04	5	5.21	7	7.29	6	6.25	5	5.21	
6	29	30.21	2	2.08	23	23.96	9	9.38	18	18.75	3	3.13	
Total N	96	100	96	100	96	100	96	100	96	100	96	100	
Mean (s.d.)	3.74	(1.75)	2.76	(1.08)	3.49	(1.78)	3.05	(1.51)	3.22	(1.78)	2.22	(1.37)	

Papua New Guinea													
Gamble	IR				PCR				NCR				
	male		female		male		female		male		female		
	n	%	n	%	n	%	n	%	n	%	n	%	
1	13	17.11	19	24.05	17	22.37	23	28.75	14	18.42	21	26.25	
2	16	21.05	11	13.92	14	18.42	16	20.00	11	14.47	12	15.00	
3	16	21.05	22	27.85	15	19.74	16	20.00	25	32.89	21	26.25	
4	17	22.37	17	21.52	15	19.74	12	15.00	13	17.11	10	12.50	
5	10	13.16	9	11.39	9	11.84	12	15.00	7	9.21	13	16.25	
6	4	5.26	1	1.27	6	7.89	1	1.25	6	7.89	3	3.75	
Total N ^a	76	100	79	100	76	100	80	100	76	100	80	100	
Mean (s.d.)	3.09	(1.46)	2.86	(1.37)	3.04	(1.58)	2.71	(1.47)	3.08	(1.47)	2.89	(1.53)	

^a Note that we failed to record the individual gamble choice (IR) of one female subject.

Table A4: Gambles, expected payoff, and risk (for Papua New Guinea)

Gamble	Probability (%)	Option A	Option B	Expected payoff	Variance	Standard deviation
1	50/50	5.00 Kina	5.00 Kina	5.00 Kina	0.00	0.00
2	50/50	7.00 Kina	4.00 Kina	5.50 Kina	2.25	1.50
3	50/50	9.00 Kina	3.00 Kina	6.00 Kina	9.00	3.00
4	50/50	11.00 Kina	2.00 Kina	6.50 Kina	20.25	4.50
5	50/50	13.00 Kina	1.00 Kina	7.00 Kina	36.00	6.00
6	50/50	14.00 Kina	0.00 Kina	7.00 Kina	49.00	7.00

Gambles increase linearly in expected payoff and risk as measured by the standard deviation of expected payoff. 1 Kina ~ 0.3 Euro.

Chapter 5

Self-image concerns as a commitment device to explain strong reciprocity

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Abstract:

Using variations of dictator and impunity games, this paper shows that small changes in the information structure that should not have an effect on the emotional reaction to a situation can have dramatic effects on the probability of strong (negative) reciprocal behavior. This casts doubt on the viability of emotions as a commitment device that has been used so far in to explain, for instance, the existence of strong reciprocity in rejections of ultimatum game offers. In contrast, the results are consistent with the idea of self-image preservation driven by moral sentiments.

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1. Introduction

It is still a puzzle in economics and related fields to explain how human societies manage to initiate and maintain cooperation. Reciprocity and reputation have been identified as two fundamental factors for cooperation (Axelrod and Hamilton, 1981; Alexander, 1987). In small scale societies it is possible to track individual behavior and, thus, reputational concerns might suffice to create incentives for cooperation. However, this cannot explain cooperative behavior in one-shot situations as they happen in larger and dispersed societies such as those we live in today. Strong reciprocity was proposed to explain cooperative behavior despite a lack of reputation. A strong reciprocator is willing to invest resources for rewarding fair and punishing unfair behavior even if this is costly and provides no direct benefit (Fehr et al. 2002). The main cause for strong reciprocity in the negative domain (punishment) is being treated “unfair”. There are two alternative explanations for why being treated unfair results in an action that has no direct benefit to the reciprocator. One is negative emotions and the other self-image concerns. A main purpose of this paper is to show experimentally that emotions are unlikely to be the main driver for strong reciprocal behavior by a series of dictator and impunity games. In order to do so, this study covers original ground in its experimental setup; it has the first dictator game with a “private” option to reject the offer to be tested against the impunity game; it has the first impunity game where the rejected amount is not destroyed, only to reappear in the experimenters pocket, but instead is physically destroyed to control for efficiency concerns; and it has the first impunity game where the rejected amount is not destroyed but sent back to the proposer making it such that a rejection of an unfair offer is actually benefitting the proposer. I believe that it has also the first impunity game that asks for expectations of rejections. The results indicate that emotions cannot explain behavioral patterns between treatments and a more likely explanation is moral self-image concerns. One interpretation of my results is that the emergence of morality in human development gave a beneficial evolutionary advantage by serving as a commitment device for strong reciprocal behavior, thereby fostering cooperation.

The remainder of this paper is organized as follows: in section 2, I present the theory of emotions as a commitment device. In Section 3, I present the experimental design. In Section 4, the Data is presented and hypothesis tested. Finally, Section 5 discusses the results and Section 6 provides concluding remarks.

2. Emotions as a commitment device

It has been shown that cooperation is more likely to evolve and persist if a sufficient number of strong reciprocators are present (Fehr and Gächter, 2000). Yet rational agent theory would predict that no-one would be willing to invest resources to reward fair and punish unfair behavior without a direct benefit from it. This can be anticipated and hence punishment for non-cooperating would not be a credible threat. One way to make the threat of punishment credible is by use of a commitment device that changes or limits the option set of an actor. The commitment device would make sure that an actor follows through on her promise or threat even at those times when she would rather not. If the actor makes the commitment action public, this changes the situation from cheap talk to a serious threat of punishment that can lead to compliance.

Hirshleifer (1987) and Frank (1988; 2004) proposed emotions like anger and disgust as commitment devices which have received wide popularity in recent years. One example (by Fehr and Gächter, 2000) describes a situation during the 1970's oil crisis resulting in long queues in front of gas stations. Multiple outbursts of violence occurred when drivers retaliated towards others that cut inside the queue. The actual negative drawback of having to wait a bit longer when others cut in the queue is in no proportion similar as being charged with physical assault. The explanation why people disregard their own private benefit in such a manner would be that emotions take over from rational thinking when people perceive themselves as being treated unfair. Emotions are therefore useful to restrict the action space in social dilemmas to prevent short term maximization which can be beneficial in the long term (Ross and Dumouchel, 2004). Fehr and Gächter (2000) show in an excellent manner that high level of cooperation in a public good game can be reached and sustained when there is a chance for punishment even if this punishment has no direct benefit to the punisher himself. The existence of strong reciprocators is enough to deter free riding usually seen in such environments. They further relate punishment decisions to negative emotions such as anger.

A related strand of literature that comes to a similar conclusion asks why actors reject small but positive offers in the ultimatum game (first proposed by Güth et al. 1982). In the ultimatum game two actors are matched anonymously. One actor is the "proposer", whose role is to divide a sum of money between the two actors. The second actor is the "receiver" that can either accept the proposed split or reject it which will leave both actors with nothing.

Again, rational agent theory would predict that once faced with a low but positive offer, the receiver will accept. In the end, little is better than nothing. Experimental data, however, differs greatly from this expectation. In fact, many receivers do not accept small but positive offers and a large share of these “unfair” offers are rejected by receivers even at the cost of earning nothing (see Roth, 1995; Camerer 2003; and Güth and Kocher, 2014 for reviews). Several reasons have been proposed to explain these rejections, (in part summarized by Güth et al. 2014) such as negative reciprocity (Gintis, 2000; Bowls and Gintis, 2004; Cox and Deck, 2005); inequity aversion (Loewenstein et al. 1989; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000); spite (Kirchsteiger, 1994; Levine, 1998); self-image concerns (Straub and Murnighan 1995); outside-image and reputation concern (Ma et al. 2012) and negative emotions such as anger (Sanfey et al. 2003; Xiao and Houser 2005; Tabibnia et al. 2008).

One interesting ultimatum game variation used to test many of these explanations is the so called impunity game proposed by Bolton and Zwick (1995). Similar to the ultimatum game, one actor (the proposer) has to split a sum of money between her and another actor (the receiver). The receiver can either accept the offered split or reject it. In the impunity game a rejection means that only the receivers share is destroyed leaving the proposers share untouched, hence the name impunity game. A number of studies use different variations of this game and even though rejection rates are smaller than in the ultimatum game, the vast majority of authors find substantial amounts of rejections of positive but “unfairly” small offers (See e.g. Güth and Huck, 1997; Fukuno and Ohbuchi, 2003; Greiner, 2004; Garrod, 2009; Güth et al. 2014; Kritikos and Tan, 2016²²). The rejection of unfair offers in a situation where this only means that the responders share is affected rules out many of the above mentioned explanations for rejections as their main driving force. Especially the study by Yamagishi et al (2009) makes a persuasive argument that rejections of unfair offers are mainly driven by negative emotions. In their study, Yamagishi and coauthors use what they call a “private impunity game.” This is a version of the impunity game where the proposer knows that the receiver can reject his offer but also knows that she will not be informed about that decision. Their results show that they cannot observe a significant difference in rejection rates between a normal impunity game and the private impunity game. A rejection in such a setup rules out any other regarding motives. An extension of this result comes from Ma et al.

²² Only reported in an earlier working paper version

(2012) who replicate these results in a double blind fashion controlling for outside image or reputation concerns towards the experimenter. Yamagishi et al. (2009) conclude that emotional responses are the key to solving a commitment problem. Emotions allow actors to disregard their immediate incentives to receive a reputational benefit that can pay off in the long run. This emotional commitment device seems strong enough to overwrite rational behavior even in situations where such a reputational benefit is actually not possible. Support for this notion comes from Xiao and Houser (2005) who show that expressing anger by writing messages reduces rejection rates (in ultimatum games) and from Takagishi et al. (2009) who show that rejections in impunity games trigger activation of the right anterior insula which is related to experiencing negative emotions such as disgust and anger similar to results for the ultimatum game of Sanfey (2003) and Tabibnia et al. (2008).

The literature did an excellent job in stripping down the ultimatum game into its essential elements. Somewhat surprisingly, rejections of unfair offers are still a regular observation even in the double blind private impunity game. This version of the impunity game differs only slightly from the dictator game, first introduced by Daniel Kahneman and co-authors (1986a) and transformed into a simpler two person version starting with Forsythe et al. (1994). In the dictator game receivers can't refuse the offer from the proposer and have to accept it and the proposer does not know about an option to reject her offer as there is none.

Implicitly, a participant can always refuse to be paid and leave the lab without payment. While there is anecdotal evidence of receivers rejecting their offered share in dictator games, it has, to my knowledge, never been reported or analyzed. In the meta-analysis by Engelman (2011) for example, there is no mention of possible refusal of payments as most studies simply don't pay much attention to the receivers' decision. This is the first study that implements an explicit private option to reject earnings in a dictator game. It is important to note that the proposer does not know about this option to reject as otherwise this would be similar to the private impunity game.

Without the studies on private impunity games, checking if actors will accept offers in the dictator game would largely be considered a waste of time and money. Why would someone reject free money anyway? Yet, if the implication of the emotions as a commitment device theory holds true, we would expect similar high rejection rates between the dictator game with such an option and the private impunity game. The only difference between these two games

is that the proposer either knows or does not know about the option of the receiver to reject her offer. If negative emotions like anger and disgust are the driving factor for rejections in so far as that they overwrite rational behavior, the decision of the receiver to accept or reject the offer should not be influenced based on the proposer knowing about this option or not. Either she is angry about the unfair offer, or not.

There is another way to test the emotions as a commitment device theory. Going back to the original impunity game (with full knowledge), the theory proposes that emotions overwrite rational behavior to a point that unfair offers are rejected even when a rejection is neutral towards the proposer and self-damaging to the receiver. It is possible to change the game, so that a rejection is not neutral towards the proposer but actually beneficial. This is done by not destroying the offer if it's rejected but sending it back to the proposer and by doing so increasing her income²³.

If negative emotions such as anger are the reason for a rejection in the impunity game then we would assume that in a situation where a rejection means that the receiver does not only hurt herself but does also benefits the proposer (whom she is angry at) would result in less rejections than when the proposer does not benefit from a rejection.

3. Experimental Design

3.1 Procedure

The experiment was conducted with 480 students²⁴ of a general student population at a German university. The experiment was programmed in Ztree (Fischbacher, 2007) and sessions lasted around 15 minutes with 10 to 20 subjects in each session. Average payment was €7.80 including a €3 show up fee. Average age was 23.9 years and 45% of the participants were female. No pilot studies were conducted and I report all data from experiments conducted for this study.

Payment was done in a double blind variant related to Hoffman et al. (1994). Subjects were told that one experimenter, who is not directly engaging with them, will put their payment in sealed envelopes while another experimenter that doesn't know the amount in the envelopes will distribute them. They were further informed that they will be matched with another

²³ Which technically makes it something different then an impunity game

²⁴ Not including the control treatment *Urn* with further 64 students

participant in the room without getting to know who exactly. Finally, they were informed that they would be randomly assigned one of two roles. Following the experimental decisions, participants had to complete a brief survey with questions regarding participants' demographic information (gender, age, their subjective assessment of relative financial resources, field of study, etc.) as well as questions regarding competitiveness, trust and happiness. After receiving the envelopes subjects could leave the lab.

3.2 Treatments

To test if emotions are likely drivers of rejections of unfair offers in the ultimatum game, I use two pairs of games each designed to be tested against each other, as well as one additional control treatment. All games are played between subjects without role changes and with complete anonymity. While proposers do a one shot decision on how much to offer, receivers state the highest offer they would reject in a strategy method fashion (Selten, 1967). Studies find only minor differences between the strategy method and one shot decisions (Oxoby and McLeish, 2004; Brandts and Charness, 2011). To give the emotions as commitment device theory its fair chance, there are two pairs of games. In the first pair there should not be a difference between treatments if emotions are the main reason, while in the second there should be a difference.

3.2.1 Private Impunity Game vs Dictator Game with private rejection option

In the first pair of games the proposer does not receive the information that the receiver has the option to reject the offer in the private impunity game. In effect this resembles moving from the private impunity game (treatment: *IGprivate*) towards a dictator game with proposer ignorance of a rejection option (treatment: *DictatorG*) for the receiver²⁵. The proposer receives €10 and has the option to distribute any amount (in increments of €1) between herself and the receiver. While the proposer decides how much to share, the receiver decides on a choice list if she would reject any of the possible offers, ranging from €1 to €10. After matching the offer and the corresponding rejection, an acceptance leaves both players with

²⁵ Unfortunately, the experimental literature has not yet come up with a clear definition for the difference between decisions where the result is not communicated and decisions where the counterpart has no knowledge about the fact that the actor has the option. In game theory this would fall under incomplete and imperfect information which is not very intuitive. One idea would be to call it option ignorance and outcome ignorance. When the information of other players is concerned it would be other-regarding outcome ignorance and other-regarding option ignorance.

payouts as offered by the proposer, while a rejection would leave the receiver only with her show up fee and leave the proposer's share unaffected. The difference between the two treatments is that, in *DG* only the receiver knows that she can reject, while in *IGprivate* both players know about this option. However, the proposer is not informed about the actual decision of the receiver in both the treatments.

By giving the option to reject, some participants could feel inclined to reject because of an experimenter demand effect or reject out of curiosity. I control for this by an additional treatment in which participants draw a ball from an urn, with values ranging from €0 and €10, and get paid accordingly (treatment: *Urn*). Participants know the different values but not the actual distribution. Before drawing the ball and learning their outcome, participants have to state the highest "offer" they would reject, similar to the *IGprivate* and *DictatorG* treatments. It differs in the sense that while being within the same subject pool, this treatment was done in pen and paper.

3.2.2 Impunity Game destroy vs Impunity Game send back

The second pair of games is similar to the original impunity game. The first difference is that in both treatments the receiver, as well as the proposer, knows about the option and the outcome of a rejection. In this regard these games are standard impunity games. The difference to the standard impunity game is, that in the first game the money is physically destroyed (treatment: *IGdestroy*) while in the second game the rejected offer is not destroyed, but send back to the proposer (treatment: *IGsendback*). Therefore, after matching the offer and corresponding rejection, an acceptance leaves both players as offered by the proposer, while a rejection would leave the receiver only with her show up fee and the proposer's share is either not affected in *IGdestroy* or restored to €10 in *IGsendback*.

The reason to physically destroy the rejected offer in *IGdestroy* is that in the standard impunity game, rejected offers vanish into thin air which could, rightly, be assumed by receiver to go back into the researcher's pockets. Therefore, rejected offers are destroyed by devaluating post stamps with the same amount that got rejected by the receiver. Half of each worthless post stamp is sent back to the receiver, the other half to the proposer. The devaluation of the stamps was done in private so no 'thrill of destroying' or 'curiosity of how this works' was present. Both players were informed about this procedure. The destruction of the rejected amount is done to control for efficiency considerations, as a rejection where the

rejected amount vanishes into thin air is not completely clear with regard to its welfare implications. Further, the stamps are physical proof for the proposer that the receiver has rejected the offer in *IGdestroy*, while this proof is given by receiving the full endowment in *IGsendback*. Also note that technically *IGsendback* is not an impunity game as the proposer is not immune to actions of the receiver.

Finally, the last difference between the treatments is that after proposers have decided on their offer, their expectations of the average rejected offer of receivers are recorded. This guess is incentivized by earning €1 extra for correct guesses. As proposers in the *DictatorG* treatment do not know about an option to reject, it is only recorded for the treatments *IGprivate*, *IGdestroy* and *IGsendback*. Table 1 shows an over view of all treatments and variables.

Treatment/Decision	Urn	DictatorG	IGprivate	IGdestroy	IGsendback
Responder	n=64	n=60	n=60	n=60	n=60
Proportion of rejecting subjects	0.02	0.07	0.27	0.37	0.42
Mean rejection in €	0.02	0.12	0.62	0.83	1.08
Proposer	-	n=60	n=60	n=60	n=60
Guess of mean rejection in €	-	-	0.68	1.13	1.42
Offer in €	-	2.37	2.82	3.28	3.10

Table 1: Result overview of 5 treatments and 4 variables

4. Data analysis

4.1 Responder behavior

First, I analyze the data from the control treatment *Urn* to make sure that there is no inherent joy or excitement from rejecting free money as well as no experimenter demand effect to reject. From 64 participants, recruited from the same subject pool as the rest of the participants, one subject rejected a drawn value of 1€ euro while another rejected any amount higher than 5€. The remaining 62 participants accepted any amount drawn. This is evidence that rejections in the impunity and dictator treatments are unlikely to be driven by curiosity or by an experimenter demand effect.

The next question to answer is if rejections of offers are primarily driven by emotions such as anger. To do so, I compare rejection rates and levels between the treatments *DictatorG* and *IGprivate*. The difference between these two treatments is very subtle. In *DictatorG*, the proposer has no knowledge that the responder has the option to reject while in *IGprivate* she knows of the option but is not informed of the result. If rejection decisions are driven by anger, this information asymmetry for the proposer should not have a large effect on the receiver and should not cause major differences between the two treatments. Figure 1 Figure 1 shows the bar chart of mean rejection rates for the four treatments. The average rejection rates for subjects is 0.12€ for *DictatorG* and 0.62€ for *IGprivate*. Figure 2 shows the cumulative distribution of rejection levels for the four treatments. This difference is significant on the 1% level (Wilcoxon rank-sum test, $P(Z < 2.96) = 0.003$). The proportion of subjects that do reject an offer is 0.07 for *DictatorG* and 0.27 for *IGprivate* which also differs on the 1% level (Test of Proportion, $\Pr(Z < 2.94) = 0.003$). This strongly suggests that the rejection rates are different for the two treatments, which speaks against emotions as prime cause for rejections.

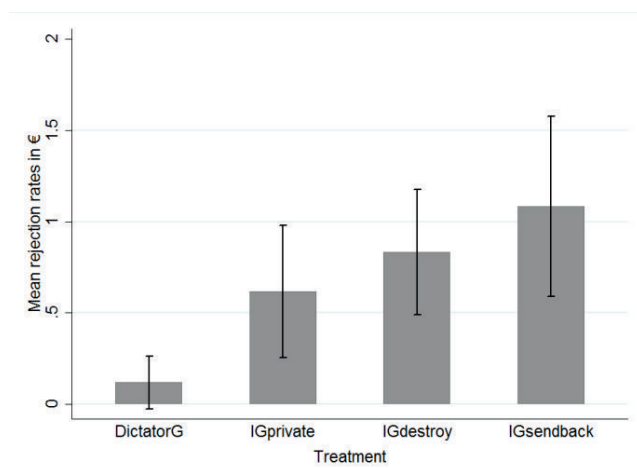


Figure 1: proportion of rejecting subjects by treatments

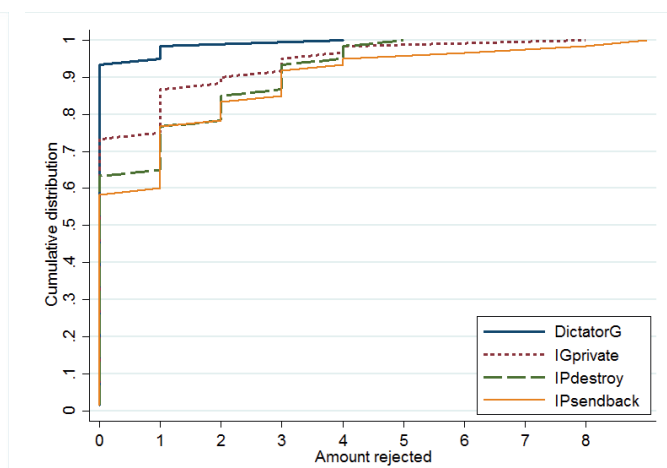


Figure 2: Cumulative distribution of rejection levels between treatments

The comparison of *IGdestroy* and *IGsendback* can be used as a further robustness check. As the treatment names suggest, in *IGdestroy* the rejected offer is destroyed while it is sent back to the proposer in *IGsendback*. This means that if emotions play a crucial role in the rejection decisions we would expect less rejections in *IGsendback* as in this treatment a rejection is actually rewarding the proposer by giving her money back. However, as can be seen in Figure 1, the proportion of subjects that reject is higher in *IGsendback* (0.37) than in *IGdestroy* (0.42), though not on a significant level (Test of Proportion, $\Pr(Z < 0.56) = 0.575$). Also, the

rejection level (seen in Figure 2) is not significantly different (Wilcoxon rank-sum test, $P(Z < 0.50) = 0.617$) between *IGdestroy* (0.83€) and *IGsendback* (1.08€). Since treatment effects are higher (though not significant) for *IGsendback* than for *IGdestroy*, when actually a significant effect in the opposite direction is expected. Therefore it can be taken as further evidence against the emotions as a commitment device theory for being an explanation for rejection of unfair offers in the ultimatum game.

Running a regression with all treatments taken as dummy variables (omitting *IGdestroy*) leads to similar results compared to the pairwise comparisons. The dependent variable is the level of rejections over treatments. Control variables are Male (1), Age (in years), Psy or Econ (1 if psychology or economics student), Competitiveness (1 low, 5 high), Relative rich (1 less wealth, 5 more wealth), Happy (1 unhappy, 10 very happy) and high trust (0 if no trust, 1 if trust). In *DictatorG* there are significantly less rejections of low offers. Not surprisingly, being a psychology or economics student significantly reduces rejection rates. Both students are trained in experiments and are more likely to know about the rational agent theory. The variable *happy* recording happiness on a scale from 1 (unhappy) to 10 (very happy) is significant on higher rejection rates.

Variable:	Coefficient	Robust Std. Err	P > t
Reject			
DictatorG	-0.511	0.186	0.007
IGprivate	-0.078	0.258	0.762
IGdestroy	Omitted	-	-
IGsendback	0.318	0.320	0.320
Male	0.122	0.190	0.522
Age	0.030	0.025	0.217
Psy or Econ	-0.458	0.177	0.010
Competitiveness	-0.063	0.071	0.373
Relative rich	-0.063	0.082	0.443
Happy	0.081	0.036	0.024
High trust	-0.011	0.176	0.949
Constant	-0.148	0.689	0.830

Table 2: OLS regression with Robust Standard Errors

4.2 Proposer and combined behavior

Next, I check if proposers recognize treatment differences. Note that in *DictatorG* the proposer does not know about the option to reject so there is no data for guessing the rejection level. Average guesses for rejection levels are depicted in Figure 3. Similar to the actual

rejection levels of the receivers, the proposers expect receivers to reject more in *IGsendback* (1.42€) compared to *IGdestroy* (1.16€). Even though the difference is not significant, if anger would be responsible for rejections, proposers should actually guess higher rejections in *IGdestroy*, which can be taken as further evidence against emotions as commitment devices. The only significant treatment differences for guesses on rejection levels can be observed between *IGprivate* and *IGsendback* (Wilcoxon rank-sum test, $P(Z < 2.45) = 0.013$). The actual offers of proposers are shown in Figure 4. Offers are lowest in *DictatorG* and highest in *IGsendback*. Only the difference between these two treatments is significant (Wilcoxon rank-sum test, $P(Z < 2.199) = 0.028$).

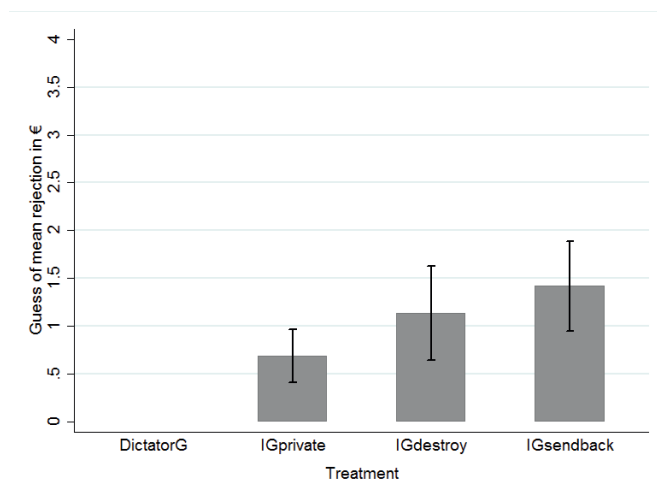


Figure 3: Guess of mean rejection level by treatment

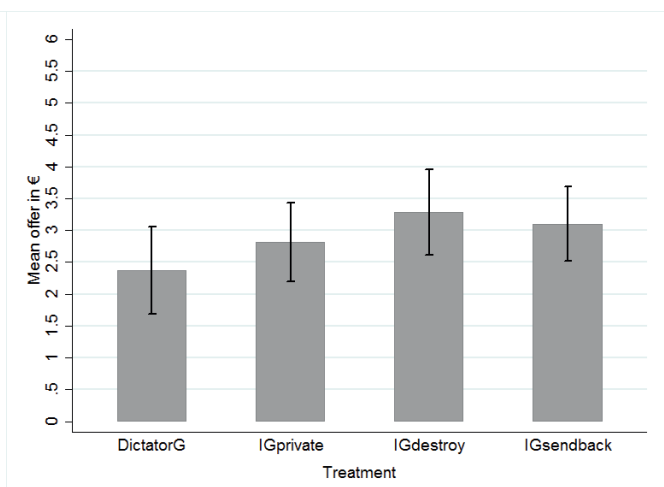


Figure 4: Proposer offer by treatment

Both, responder rejections and proposer rejection guesses follow similar patterns. The order of treatments is the same but proposers slightly overestimate the willingness to reject (differences between reject and guess reject: *IGprivate* (0,06€); *IGdestroy* (0,30€); *IGsendback* (0,34€)). Even though proposers (rightly) expect higher rejection rates in *IGsendback*, they offer lower amounts than in *IGdestroy*, making a rejection more likely. It seems that proposers are, to some degree, more willing to accept rejections when the offer is returned to them. The last comparison is between the average offers and average rejection decisions. The higher the difference between these two the more a responder earns on average. The differences for the treatments are: *DictatorG* (2,20€), *IGprivate* (2,20€), *IGdestroy* (2,45€), *IGsendback* (2,02€). This means that average earnings for the receiver are highest in *IGdestroy* (lowest in *IGsendback*) due to the combination of higher (lower) offers and lower (higher) rejection rates.

5. Discussion

Strong reciprocity is very important for cooperation in human societies. One game that is widely used to test (above others) negative reciprocity is the ultimatum game. Literature is still ambiguous about the main driver of rejections of unfair offers in the ultimatum game is. This paper can exclude most probable candidates that have been suggested so far.

First, I use the impunity game which leaves the proposer immune to actions of the receiver. It therefore rules out *negative reciprocity* (Gintis, 2000; Bowls and Gintis, 2004; Cox and Deck, 2005); *inequity aversion* (Loewenstein et al. 1989; Fehr and Schmidt, 1999, Bolton and Ockenfels, 2000); and *spite* (Kirchsteiger, 1994; Levine, 1998) as possible causes for rejections. Further, neither the proposers nor the experimenters know which receivers rejected an offer; this rules out an influence of outside-image and reputation concerns (Ma et al. 2012). The difference in rejections between the *DictatorG* and the *IGprivate* strongly speak against negative emotions such as anger as the main cause (Sanfey et al. 2003; Xiao and Houser, 2005; Tabibnia et al. 2008; Takagishi et al. 2009; Yamagishi et al. 2009; Ma et al. 2012). It is important to note that this study does not dispute that small “unfair” offers cause negative emotions, but my results suggest that it is doubtful that these emotional differences are a good predictor for behavior.

If punishment, by putting some money to the waste (due to efficiency concerns of the proposer), drives the results, we would expect higher rejections of offers in *IGdestroy* compared to *IGsendback* in which case efficiency is not reduced by rejecting.

Some studies suggest that rejections of “unfair” small offers in the ultimatum game could be caused by a desire for punishment against the proposers or a threat to the receiver’s self-esteem (Kahneman, Knetsch, & Thaler, 1986b; Pillutla & Murnighan, 1996). Although, this study gives evidence to exclude revenge as the main driver, the self-image concern theory might be a major part to the story.

The main difference between a normal dictator game and an impunity game without feedback is that in a dictator game the receiver is purely passive, whereas she engages in an active fashion to accept or reject the offer in an impunity game. When a situation is framed in a passive way, that one has been treated unfairly but there is nothing that one can do about it, it is not a threat to one’s self-image. When facing the decision of actively accepting or rejecting

an unfair offer, this could be seen as participation in and acceptance of an unfair deal. Such a view, of one's participation in an unfair deal, could indeed challenge one's self-image and lead to more rejections. The treatment *DictatorG*, where the participant has to make an active action, has the advantage that the proposer does not know that the receiver does have this option. This could be used as moral wiggle room to convince oneself that, as the proposer did not know about this option, the offer is not part of an unfair deal. This moral wiggle room disappears in *IGprivate*, where the proposer knows about the rejection option and, therefore, explains the drastic increase in rejection rates between the two treatments.

This goes in line with findings of Straub and Murnighan (1995), who find that receivers in ultimatum games accept lower offers when the pie size to be distributed is unknown to them. Not knowing if one is treated fair or unfair has two effects. It could induce caution on rejections so as not to punish actually fair proposers and gives moral wiggle room for self-image preservation. It helps accepting a low, probably unfair, offer by giving an option that it might not be unfair after all. Güth and Tiez (1988) find that low offers violate norms of fairness and Dunn et al. (2010) propose an internal self-esteem explanation for rejections in ultimatum games. While not actually measuring self-esteem, the authors claim that rejecting an unfair offer maintains positive self-regard and accepting an unfair offer lowers positive self-regard. Unfortunately, all these studies use the ultimatum game, so they are not able to distinguish if the punishment part of the rejection is not the main driver, which this study does.

6. Conclusion

Removing the knowledge of the proposer about a rejection option of the receiver has a large effect on the rejection behavior in the impunity game. In the dictator game with the reject option (*DictatorG*), there are almost no rejections of low and unfair offers. This contrasts with a relatively high rejection rate in a private impunity game (*IGprivate*). As the two treatments should not differ in the amount of anger towards an unfair offer by the receiver, this causes doubt about the idea of emotions as a commitment device. This theory cannot account for the large effect caused by a minor information structure change. The fact that there are no observable differences in rejection rates between an impunity game, where the rejected offer is sent back to the proposer (*IGsendback*) and a normal Impunity Game (*IGdestroy*), where emotions clearly should produce a difference, further strengthens this conclusion. I argue that

actively accepting or rejecting an unfair offer, is seen as participation in and acceptance of an unfair deal which is a threat to one's self-image; thus, explaining the differences in rejection rates.

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Eidesstattliche Erklärung

Ich erkläre hiermit an Eides Statt, dass ich meine Doktorarbeit „Decision Making in Social Contexts“ selbständig und ohne fremde Hilfe angefertigt habe und dass ich alle von anderen Autoren wörtlich übernommenen Stellen, wie auch die sich an die Gedanken anderer Autoren eng anlehrenden Ausführungen meiner Arbeit, besonders gekennzeichnet und die Quellen nach den mir angegebenen Richtlinien zitiert habe.

Kiel, 7. Septemberz 2017
Andreas Friedl