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# Are Behavioral Choices in the Ultimatum and Investment Games Strategic?

by Lora R. Todorova<sup>1</sup> and Bodo Vogt<sup>2</sup>

## Abstract

This paper experimentally examines the relationship between self-reporting risk preferences and behavioral choices in the subsequently played dictator, ultimatum and investment games. The results from these experiments are used to discern the motivational bases of behavioral choices in the ultimatum and investment games. The focus is on investigating whether strategic considerations are important for strategy selection in the two games. We find that self-reporting risk preferences does not alter the dictators' offers and trusters' investments, while it significantly decreases the proposers' offers and leads to a substantial decrease in the amount trustees give back to their partners. We interpret these results as evidence that the decisions of proposers in the ultimatum game and trustees in the investment game are strategic.

**Keywords** coordination game · dictator game · ultimatum game · investment game · questionnaire · risk scale · risk preferences

**JEL Classification** C7 · C91 · D8

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## 1. Introduction

The role of individual risk attitudes in the determination of outcomes in many economic games is indisputable. Coordination games, for example, are one class of games for which it is well-known that beliefs and risk preferences jointly determine strategy choices. The dictator game, on the other hand, by its nature, is a degenerate game that removes incentives for strategic behavior. There are, however, also games for which the motivational bases of behavioral choices are still a debatable issue. The ultimatum game (Güth et al. 1982) and the investment game (Berg et al. 1995) are two examples of such games. Despite the great number of studies dedicated on analyzing them, researchers have not come to an agreement regarding the relationship between risk attitudes and behavioral choices in these games.

In this paper, we present results from a laboratory experiment that adds one piece of evidence to the discussion about the motivational bases of behavioral choices in the ultimatum game (UG) and the investment game (IG). Specifically, we examine whether decisions in these games are influenced by the act of answering a set of risk questions and use our results to draw inferences about the relationship between risk attitudes and behavioral choices in each of the studied games. For methodological reasons, we also study the behavior in the dictator game (DG). For each game, we consider two conditions—one in which subjects directly play a standard version of the corresponding game (the control condition) and one in which subjects first report their own risk preferences on a short questionnaire and then play the same game as the participants in the control condition (the treatment condition). We then compare behavioral choices in the two conditions. We stress the point that we do not argue that the risk questionnaire we use is a good method for measuring risk preferences. Rather, we are interested to study the link between the act of stating one's own risk preferences and behavioral choices in the three economic games. Standard economic theory predicts that subjects, who complete a questionnaire about their own risk preferences before playing a certain economic game, will not make different choices from those who play the game right away (internal consistency of preferences assumption). Deviations from these predictions can be

used to better understand the determinants of behavioral choices in the games we examine.

A risk questionnaire is used in this study with the purpose of investigating the relationship between risk preferences and behavioral choices in the DG, UG, and IG. This is motivated by the “unexpected” in light of the standard economic theory finding of Berninghaus et al. (2011) that states that the mere measurement of subjects’ risk preferences on a risk scale systematically alters strategic behavior in a subsequently played coordination game. Berninghaus et al. (2011) report that the proportion of subjects who choose the risk dominant strategy in the coordination game is significantly higher for subjects who have first reported their own risk preferences. After controlling for subjects’ first-order beliefs, Berninghaus et al. (2011) find that the act of stating one’s own risk preferences does not change beliefs. Within a best-response correspondence framework, this result implies that subjects had become more risk-averse after they reported their risk preferences. Behavioral arguments, such as focal points, framing and uncertain preferences offer an alternative explanation of the effect that the risk questionnaire produced on strategy choices in the coordination game.

The purpose of this study is twofold. First we aim at extending the results of Berninghaus et al. (2011) beyond coordination games in finding out how a simple, non-strategic decision situation, such as stating one’s own risk preferences influences behavior in the DG, UG, and IG. Second, we use the results from the effect that the risk questionnaire produces on behavioral choices to analyze the motivational bases of decision-making in the studied games. Specifically, we are interested in drawing inferences about the question whether decisions in the UG and IG involve strategic considerations. Our study relates to a large body of literature analyzing the determinants of strategy choices in the UG and IG.

The UG and the DG present very similar bargaining situations with one difference between them being that the passive second player in the DC is given the ability to reject the proposer’s offers in the UG. In both games, experimental results show that people strongly deviate from the predictions of the subgame perfect equilibrium. Another difference between the games is that while there is little controversy in explaining the discrepancy between the theoretical predictions and

actual choices in the DG with reference to altruism or fairness considerations, explaining the results from the UG by mere concerns for fairness turns out to be troublesome. Henrich et al. (2005) describe fairness as the readiness of people to incur personal costs in order “to change the distribution of material outcomes among others, sometimes rewarding those who act pro-socially and punishing those who do not.” Empirical findings suggest that people have preferences for being treated fairly (see e.g., Kahneman et al. 1986). Camerer and Thaler (1995), however, argue that preference for fairness is not an innate but rather a learnt manner, which is expected in social settings. The conclusion of Camerer and Thaler (1995) leaves room for speculations that behavior that seems fair might not be driven by preferences for fairness *per se* but rather be dictated by the desire to adhere to cultural and social norms.

The question whether fairness can explain the unexpectedly high positive offers in the UG was extensively studied. Fehr and Schmidt (1999) model fairness as self-centered inequality aversion. They define inequality aversion as the tendency of people to resist inequitable outcomes, often at a personal cost. They show that the results from the UG experiments could be explained by allowing subjects’ utility function to incorporate the inequality aversion preferences. The theoretical work of Fehr and Schmidt (1999) suggests that proposers in the UG make considerable positive offers because they dislike inequality and care about fairness.

Forsythe et al. (1994) use a dictator control game to test whether fairness considerations can explain the results in the UG. They find that the average allocation in the DG (20 percent) is much lower than the average offer in the UG (40-50 percent) and conclude that fairness must only be one factor that determines proposers’ choices in the UG. Güth and van Damme (1998) use a modified version of the UG in which an inactive third player is introduced. They compare results from different information conditions and conclude that proposers were not interested in fairness *per se*. They simply wanted to seem fair. Kagel et al. (1996) also find that the impression of fairness and not fairness itself motivated proposers in an UG experiment. Roth et al. (1991) and Bahry and Wilson (2006) find evidence that proposers make offers that are the best replies to actual pattern of rejections or to the norm of fairness. This result, consistent with the argument of Camerer and Thaler

(1995) that fairness is a learned manner, implies that proposers in the UG are simply being strategic.

Andreoni et al. (2003) who conducted experiments with a convex ultimatum game carried out a more explicit investigation of the relationship between risk aversion and decisions in the ultimatum game. In their game, responders are allowed to shrink the size of the pie and not simply make reject or accept decisions. Thus, the convex game is less risky to proposers than the standard game. Andreoni et al. (2003) report that about half of the subjects care only about money maximization, while the other half reveals a preference for fairness. They also find that risk aversion is important among money maximizing proposers who, realizing that the less risky convex game presents an opportunity to earn more money, exploit their bargaining power by making offers that are more aggressive. Carpenter et al. (2005) collect measures of risk aversion by survey questions and find that more risk-averse proposers offer more in the UG. This result, however, is not statistically significant<sup>3</sup>.

Consensus about the determinants of choices in general and the role of risk preferences in particular is missing also in the literature dealing with investment games. In the IG, the predictions of the subgame perfect equilibrium also fail to capture actual choices. The first part of the IG is often considered to provide a behavioral measure of trust, while the second part is assumed to provide a measure of trustworthiness. Upon careful contemplation on the motivational bases of the truster's and trustee's choices in the IG, however, it is not clear what the IG actually measures. Some of the influences on the decision-making process in the IG discussed in the literature are as follows. First, the trustee may be driven by her desire to reciprocate on the truster's trust or/and they can reflect her concerns for altruism and fairness. In this paper, we stress the importance of including also strategic considerations in the analysis of trustee's choices. The strategic aspect of trustee's decision-making, to our knowledge, has not yet been discussed in the literature and we will elaborate on it in detail in some of the following sections of the paper. Second, the truster in the IG may make her choices based on the

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<sup>3</sup> Carpenter et al. (2005) use a risk measure derived from the mean of the answers given on the following two questions: 1) they asked at what price subjects would be willing to sell a lottery ticket with a 50% chance of paying US\$0 and a 50% chance of paying US\$10; 2) they asked subjects how much they would be willing to pay for such a ticket.

expectation of reciprocation of her trust, expectation of altruistic and fairness concerns of her partner, her own altruistic motives, her attitude toward risk or any combination of the above-mentioned (see Kiyonari et al. 2006 for a discussion of possible determinants of behavior in the IG).

The trustee in the IG and the dictator in the DG face very similar behavioral choices. Both players must divide an endowment of a fixed size between themselves and another party, anyway they would prefer. The difference between the two games lies in who provides the endowment to be divided. While the trustee in the IG owes the chance to earn more on the truster, the dictator in the DG is provided the endowment directly from the experimenter and she owes nothing to the other party. The similarity between the behavioral choices that trustees and dictators are faced with is probably the reason why it has not been investigated in the literature whether the second part of the IG involves also strategic aspects (we already mentioned that the DG, by its nature, removes incentives for strategic behavior). In contrast, the uncertainty involved in the behavioral choice of the truster in the IG has attracted much attention and the question whether risk preferences are related to the decision to trust has been addressed in several experimental studies.

Eckel and Wilson (2004) measure risk in two risky choice tasks (one based on Holt and Laury 2002 and one mimicking the payoff structure of the trust game) and in a survey investigate the correlation between the different risk measures and the decision choices made in the IG. They do not find significant correlations between the risky choices and the trusting behavior. Ashraf, Bohnet, and Piankov (2006) use a measure of risk, derived from a price list procedure, and along with a number of demographic variables include it as an explanatory variable in a regression aiming to explain variations in the decision to trust. They do not find evidence that risk attitudes explain the variance in trust. Houser, Schunk, and Winter (2010) use a measure of risk based on Holt and Laury (2002) and examine whether the elicited risk preferences predict behavior in an investment game and a risk game with identical payoff structure. Their results show that risk attitudes predict decisions in the risk conditions but not in the trust conditions.

Evidence supporting the view that risk preferences predict decisions in the trust game is reported by Schechter (2007). He compares agents' actions in a

traditional trust game and in a similar gambling game and finds that higher bets in the gambling game are associated with higher investments in the IG. Johansson-Stenman, Mahmud, and Martinsson (2005) find evidence that shows stake size matters in the trust game and argue that one possible explanation of their results is that the first part of the trust game measures risk preferences rather than trust. Karlan (2005) reports results from a field experiment that indicate that the behavioral choice of the first player in the IG is determined by both trust and her propensity to take risks. He finds that subjects who invest more in the IG are more willing to take on risks.

The overview of the related literature shows that the question, whether the behavioral choices of players in the UG and the IG involve incentives for strategic behavior is a delicate one with a no clear answer. We adopt a novel approach to address this question. We report the following findings. The data from the DG experiments show no difference in behavioral choices between the condition with and without questionnaire. This result indicates that subjects' preferences for fairness do not change after the act of self-reporting risk preferences. In the UG, we find that the act of stating one's own risk preferences significantly alters the distribution of the proposers' offers. Proposers who self-reported their risk preferences made on average lower offers than proposers who directly played the UG. From the findings in the DG, we know that this result is not triggered by a change in subjects' preferences for fairness. Consequently, we conclude that proposers' risk considerations change after they self-report their risk preferences and as a result, they make lower offers in the condition with questionnaire. In other words, we find support for the idea that decision-making in the UG is strategic. In the IG, there is no difference between the distribution of trusters' choices in the condition with and without questionnaire. This result combined with the results from the DG and UG implies that trusters' decisions are not driven by strategic considerations. We, however, argue that the first part of the IG involves a severe identification problem (there are many possible determinants of behavior and it is difficult to discern their marginal effects), which makes it very difficult to study the role that trusters' risk preferences play in the determination of their strategy choices by a single experiment. Our findings for the second part of the IG are mixed. Trustee

in the condition with questionnaire give on average lower return to their partners than trustees in the condition without questionnaire. This difference, albeit relatively high (17percent), is insignificant. We, however, find a significant positive correlation between the decisions of trusters and trustees in the condition with questionnaire. In contrast, the correlation between trusters' and trustees' choices is insignificant in the condition without questionnaire. We interpret these results as evidence that trustees' decisions in the IG involve strategic considerations.

The paper proceeds as follows. Section 2 presents the experimental design and procedure. Section 3 develops the research hypotheses and presents the results. Section 4 provides a discussion of the main results. Section 5 concludes.

## **2. Experimental Design and Procedure**

### **2.1. Experimental Design**

We employ a two conditions between-subject design. In one condition, subjects directly played a standard version of the dictator game, the ultimatum game, or the investment game (conditions D, U, and I). In the other condition, they first filled out a short questionnaire asking about their risk preferences and then played one of the three games (conditions Q\_D, Q\_U, and Q\_I)<sup>4</sup>. Each subjects participated in exactly one condition. Our analysis is based on comparisons of choices between conditions with and without questionnaire.

The questionnaire we use in this study is identical to the one used by Berninghaus et al. (2011). It consisted of three questions. All of them were adapted from the general risk question in the German Socio-Economic Panel Survey (SOEP)<sup>5</sup>. In the first two questions, subjects were asked whether they like taking risks and whether they always try to avoid risks, respectively. Admissible answers were "Agree," "Disagree," or "Neither agree nor disagree." In the third question, subjects were asked to determine their risk preferences with a greater precision by

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<sup>4</sup> In Condition Q\_U, only subjects in the role of a Proposer completed the questionnaire.

<sup>5</sup> The general risk question in the SOEP survey is as follows: "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: "not at all willing to take risks" and the value 10 means "very willing to take risks".

positioning themselves on a risk scale between 0 (maximal risk loving preferences) and 100 (maximal risk averse preferences). Upon completing the questionnaire in conditions Q\_D, Q\_U, and Q\_T, participants were aware of the fact that the experiment included also a second task but they were not given any information regarding the nature of that task.

Economists are generally skeptical about the use of survey questions as a tool for measuring risk preferences with their major concern being that such questions are incentive incompatible. Measures of risk-preferences derived from survey questions are also very sensitive to framing effects. The use of risk scales, however, has a long history in the psychological literature and can be traced back to the 1950s (see Grable 2008 for an overview). Until 1980s, many different scales were developed but they failed to produce consistent results. MacCrimmon and Wehrung (1986) reason that these inconsistencies are largely due to the one-dimensional nature of the questions. They argue that a more accurate risk measure would be produced if one-dimensional questions (e.g., “how risk tolerant are you”) are replaced by carefully designed psychometric questionnaires that capture the multidimensional nature of risk. MacCrimmon and Wehrung (1986) also note that most people overestimate their risk tolerance on one-dimensional scales. However, as the general risk question in the SOEP survey indicates one-dimensional risk questions are still used in some household surveys.

Because the questionnaire we use is incentive incompatible and includes only one-dimensional questions, we treat the answers given on it with caution. We recognize that most subjects can report their underlying risk preferences only with an error of whose magnitude we are unaware. We incorporate the results from the questionnaire into our analysis but we do this because we hope that they will provide some additional insights about the motivational bases of the subjects’ behavior in the DG, UG, and IG. The focus of this paper, however, is to examine the link between the risk questions and behavior in the DG, UG, and IG and to use this information for drawing conclusions about the incentives for strategic behavior in the UG and IG. That is, the fact whether subjects answered the questionnaire or not is of main interest to us and not the exact answers given on the questionnaire. We now proceed with a discussion of the three games.

In the DG, UG, and IG, subjects were randomly assigned an anonymous partner and a role—a dictator or a receiver, a proposer or a responder, and a truster or a trustee, respectively. Dictators in the DG had to divide an endowment of 10 euros between themselves and their partners in any way that they preferred. Receivers were passive players who at the end of the experiment received the amount of 10 euros that was allocated to them.

Proposers in the UG were also asked to decide how to allocate an endowment of 10 euros between themselves and their partners. In contrast to the receivers in the DG, however, responders in the UG were not passive players but rather had the ability to reject proposers' offers. Decisions in the UG were made sequentially. First, the proposers made an allocation suggestion. Responders were then informed about the offers of their partners and were asked to either accept or reject the offer they received. Pairs, for which the responder accepted the proposer's offers, received the 10 euros in portions as determined by the proposer. Pairs, for which the responder rejected the proposer's offer, did not receive the 10 euros and both partners had a payoff of zero.

In the IG, both trusters and trustees received a fee of 10 euros. The truster had to decide how much of her fee of 10 euros to entrust to her partner. Any amount entrusted by the truster was tripled by the experimenter and transferred to the trustee. The trustee then had to determine the amount of the tripled investment she wanted to return to the truster. At the end of the experiment, trusters received the amount of the 10 euros that they did not invest plus the part of the tripled investment that was returned to them by their partners. Trustees received their own fee of 10 euros plus the amount of the tripled investment that they did not send back to the truster. Participants in all games had perfect knowledge about how their payoffs and those of their partners were calculated.

## **2.2. Experimental Procedure**

All experiments were carried out at MaXLab, the experimental laboratory of the University of Magdeburg, between August 2011 and March 2012. Participants were recruited using ORSEE software (Greiner 2004) from a pool mostly of students from various faculties. All sessions were hand-run. The experimental instructions were

provided in German. We collected data from a total of 257 pairs which were distributed among the different conditions as follows—30 pairs in condition Q\_D, 30 pairs in condition D, 62 pairs in condition Q\_U, 56 pairs in condition U, 44 pairs in condition Q\_I, and 35 pairs in condition I.

Regardless of the game or condition in which subjects participated, they were always assigned a role and a partner using the same procedure. In all three games (DG, UG, and IG), we used a neutral labeling of the roles. In the experimental instructions, dictators, proposers, and trusters were referred to as Player 1 and receivers, responders, and trustees were referred to as Player 2. When subjects arrived at the laboratory, they were asked to draw a ball from an urn containing an even number of balls corresponding to the number of participants invited in the given session. Balls were either red or green. Balls from each color were numbered consecutively. Thus, the urn contained two balls of each number, one of which was red and the other green. Subjects who drew a red ball were assigned the role Player 1 and subjects who drew a green ball were assigned the role Player 2. Participants who drew a ball labeled with the same number were matched with each other. Subjects who played the games in the role of Player 1 and Player 2 were seated in two different laboratories in a single cabin with arrangements to ensure their privacy. At the end of the experiment, Player 1 and Player 2 were separately paid. Thus, partners who played together remained anonymous during and after the experiment. During the experiment, no communication was allowed among the participants. The written instructions were explained to the subjects also orally and they were instructed to raise their hands if they had questions that were then answered individually.

In conditions Q\_D, Q\_U, and Q\_I, immediately after filling out the questionnaire, subjects handed out their answer sheets and received the experimental instructions for the second part of the experiment. In conditions D and Q\_D, the experiment ended when the dictators made their allocation decisions. Dictators and receivers were then privately paid in accordance with their own decisions or the decisions of their partners, respectively. In conditions U and Q\_U, proposers and responders made their decisions sequentially. Subjects were paid as explained in the previous section. In conditions I and Q\_I, trusters completed their decisions on an answer sheet and handed them to the experimenter. She then carried over these

decisions into the answer sheets of the trustees together with a number corresponding to the tripled investment and distributed them to the trustees who in turn made their decisions. After this, the experiment ended and subjects were privately paid.

The duration of the experiment varied across conditions, ranging between 20 and 45 minutes. For filling out the questionnaire, no remuneration was provided. However, subjects were instructed that their answers will be used for a research project and they were asked to try to be as accurate in their answers as possible. For the participation in the three games, subjects were paid in accordance with their own decisions and the decisions of their partners. Depending on the condition and the role that subjects had, payoffs varied between 0 euro and 40 euros.

### **3. Hypotheses and Results**

We now present our hypotheses and results. The internal consistency of preferences assumption of standard economic theory states that in theoretically equivalent situations people will always choose the same alternative. We use this assumption to make predictions about the relationship between the act of stating one's own risk preferences and behavioral choices in the DG, UG, and IG: The act of stating one's own risk preferences does not have any impact on behavioral choices made in a subsequently played dictator game (Hypothesis 1), ultimatum game (Hypotheses 2), and investment game (Hypothesis 3). We test these hypotheses for dictators in the DG, proposers in the UG, and both trusters and trustees in the IG.

The experimental data from the DG, UG, and IG experiments are given in Table 1. The first row of the table reports the total number of dictators in conditions D and Q\_D, proposers in conditions U and Q\_U, trusters in conditions I and Q\_I, and trustees in conditions I and Q\_I. The number of trustees in both conditions I and Q\_I is lower than the number of trusters in the same conditions because we excluded from our analysis trustees who did not receive anything from their partners. In the next two rows, we report the mean and median choices. The mean and median dictator's and proposer's offers are expressed as a percentage of the total endowment of 10 euros. The mean and median truster's investments are expressed as a percentage of truster's show-up fee of 10 euros and the mean and median

amount trustees send back to their partner are expressed as a percentage of truster's investment. The last row of the first panel reports the p-values obtained by means of the Wilcoxon rank-sum test, which we use to test the null hypothesis that behavioral choices in the conditions with and without questionnaire are independent samples from identical continuous distributions with equal medians. For the moment, we postpone the discussion of the results depicted in the lower panel of Table 1.

TABLE I  
Summary statistics from the Dictator, Ultimatum, and Investment Games

Condition	D	Q_D	U	Q_U	I	Q_I	I	Q_I
	Dictators		Proposers		Trusters		Trustees	
Participants	30	30	56	62	34	44	25	35
Mean	23%	24%	43.2%	39.5%	43.1%	46.0%	132%	120%
Median	20%	20%	50%	40%	40%	50%	150%	133%
p-value	0.74		0.045 (**)		0.65		0.37	
Correlation -		-		-			0.13	0.42
p-value (one-tailed)	-	-		-			0.26	0.006 (***)

\* Significant at the 10 percent level  
 \*\* Significant at the 5 percent level  
 \*\*\* Significant at the 1 percent level

Looking first at the summery data from the DG experiments, we observe that dictators from condition Q\_D made a slightly higher average offer than dictators in condition D did. The median dictator's offers are identical in both conditions. The p-value of 0.74 indicates that dictators' allocations in condition Q\_D were not affected by the act of answering the questionnaire. Panel a) in Figure 1 also confirms this observation. It shows that the histograms of dictators' offers in conditions Q\_D and D are indeed very similar. Based on these findings, we cannot reject Hypothesis 1. We conclude that the act of stating one's own risk preference does not change subjects' preferences for fairness. This observation will be useful when we analyze the results from the UG experiments.

Proposers in the UG made an average offer of 39.5 percent in condition Q\_U, which is 3.7 percent lower than the average offer from condition U. The difference between choices in conditions U and Q\_U is more pronounced when we look at the median offer. While in condition U, the median proposer offered half of the total

prize to her partner, the median proposer in condition Q\_U was less generous and offered only 40 percent. The null hypothesis that offers from condition U and Q\_U are independent samples from identical continuous distributions with equal medians is rejected at the 5 percent level ( $p\text{-value} = 0.045$ ). This result indicates that proposers who filled out the questionnaire about their own risk preferences were more often making offers different from the equal (and presumably fair) division than proposers who did not complete the questionnaire. The difference between the distribution of proposers' offers in condition U and Q\_U is also easy to see in panel b) of Figure 1. The relative frequencies of offers between 1 euro and 5 euros are higher in condition Q\_U. Offers of exactly 5 euros, however, were made more often in condition U than in condition Q\_U. These results indicate that the act of stating one's own risk preferences significantly alters behavioral choices in the UG and we thus reject Hypothesis 2. The observation from the DG experiments that subjects' preferences for fairness do not change after completing the risk questionnaire implies that the change in behavioral choices in the UG has been induced by a change in subjects' risk considerations. That is, our data provide evidence that proposers' behavioral choices are strategic. In the next section, we will comment in more detail on the effect we observe in the UG experiments. We now look at the results from the IG.

The experimental data for trusters in the IG indicate that subjects who first answered the questionnaire offered on average a bit more than subjects who did not answer the questionnaire. The median truster in condition Q\_I invested 50 percent of her show-up fee, which is 10 percent more than the median truster in condition I. The distributions of investments in the two conditions, however, are not significantly different ( $p\text{-value} = 0.65$ ). In panel c) of Figure 1, we also observe that the relative frequencies with which investments from all magnitudes occur are indeed very similar in the two conditions. Hence, the act of completing the questionnaire did not change the distribution of behavioral choices in the first part of the IG and we cannot reject Hypothesis 3 (for trusters). We will postpone the discussion of the question whether trusters' decisions are strategic until the next section.

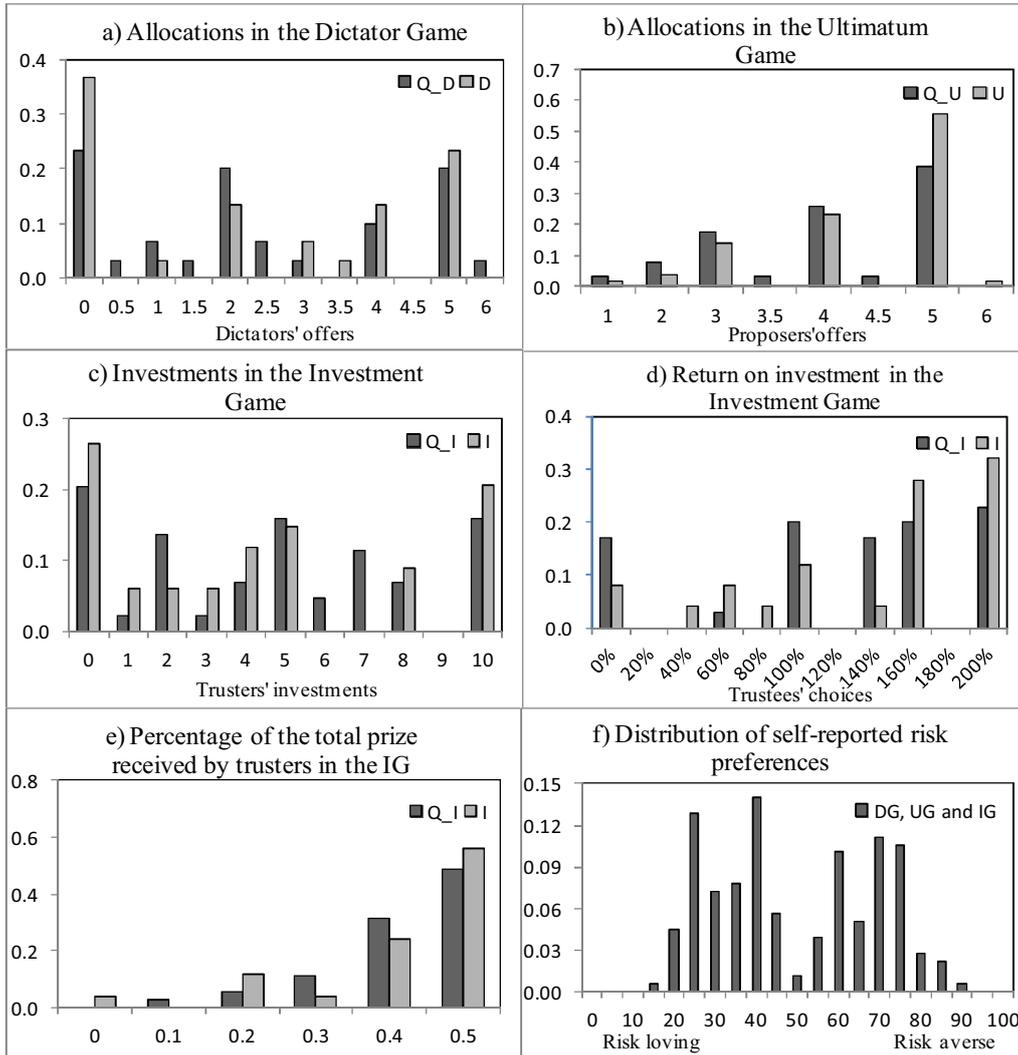


FIGURE 1.—Distribution of choices in the DG, UG, and IG

The last two columns of Table 2 summarize the experimental data of trustees' decisions. We observe that the average and median amounts returned (expressed as a percentage of the initial investments) in condition Q\_I are 12 and 17 percent, respectively lower than in condition I. This difference is large but statistically insignificant ( $p$ -value = 0.37). The sample size of trustees in both conditions is relatively small and it is difficult to draw conclusions whether the insignificant  $p$ -value is due to a lack of effect of the questionnaire on trustees' behavioral choices or it is an artifact of the small sample size. To gain some additional insights on this question, we examine the histograms of trustees choices depicted in panel d) of Figure 1. The histogram from the choices in condition Q\_I bears some resemblance

to the uniform distribution. There are choices in the interval between 0 percent and 200 percent that are never played but all choices that are played are chosen with approximately the same frequency (there is an exception at 43 percent, a choice made by a single trustee). In contrast, in condition I, there is an upward trend in the relative frequencies of trustees' choices with the peak of the distribution being at 200 percent. The different forms of the empirical distributions of trustees' decisions in conditions Q\_I and I suggest that trustees who completed the questionnaire might have had different motivational bases from subjects who did not complete the questionnaire. In an attempt to understand this difference, we look closer at the determinants of trustees' behavior.

We already argued that trustees in the IG and dictators in the DG face very similar behavioral choices. Both types of players must divide an endowment of a fixed size between themselves and another party in any way that they prefer. The difference between the two games lies in who provides the endowment to be divided. While the trustee in the IG owes the chance to earn more on the truster, the dictator in the DG is provided the endowment directly from the experimenter and she owes nothing to the other party. The behaviorally identical decision situations faced by trustees and dictators suggest that we should observe similar empirical distributions of choices made by trustees and dictators. A comparison between panel a) and panel d) of Figure 1 reveals that this is not the case. The difference in the distribution of actual choices of trustees and dictators suggest that different factors determine behavior of the two types of players.

It is interesting to observe that the empirical distribution of trustees choices (in condition I) is in fact very similar to the empirical distribution of proposers' offers in the UG (see panel b) and d) of Figure 1). To make the choices of proposers and trustees directly comparable, we first computed, for each pair in the IG, the total size of the prize or the combined amount of money received by the players (it varies with the different levels of investment made by trusters), and then we calculated the percentage of the total prize that was received by each truster. Trusters have some control over the division of the total prize by deciding how much from their show-up fee to pass on to their partners. The less they invest, the more even will the distribution of the prize for any decision of the trustees be. However, as any amount

invested is tripled the driving force behind the shape of the distribution of the total prize between the two players is in the control of trustees. In panel e) of Figure 1, we plot the relative frequency with which each possible distribution of the total prize occurred in the IG. The data depicted in panel e) is more directly comparable to the data depicted in panel b) and it confirms the impression that the distribution of proposers' offers in the UG is very similar to the distribution of trustees' choices in the IG. This observation is interesting because proposers and trustees are faced with inherently different behavioral choices. The similarity between the distributions of actual choices, however, suggests that people might perceive the two decision situations as being similar. Andreoni et al. (2003) find that half of the subjects in the UG care only about money-maximization, while the other half reveal a preference for fairness. This means that proposers who are only interested in the maximization of their own pay-off, form expectations about the expectation of their partners and make the minimal offer that they believe will be accepted. Dufwenberg and Gneezy (2000) measure beliefs in an experimental game similar to the IG and find that the amount that trustees give back to their partners is positively correlated with trustees' expectations of trusters' return expectations. It is reasonable to assume that part of the total population of trustees cares about fairness exactly as some of the proposers. Combining the results of Andreoni et al. (2003) and Dufwenberg and Gneezy (2000), it is clear that the factors motivating proposers and trustees are very similar—one part of both types of players care about fairness and make choices leading to the equal distribution of the prize, and the other part of players make choices that are the best responses to their expectations of the other party's expectations. This conclusion finds support in our data (see panel b) and e) of Figure 1).

We argued earlier in this section that proposers in the UG who answered the questionnaire make offers that are lower than the offers made by proposers who directly play the game. Also, we find evidence that trustees in the IG and proposers in the UG perceive the decision situations they face as similar. Trustees who completed the questionnaire also return less to their partners than trustees who played the IG right away and when graphed, the empirical distributions from the condition Q\_I and I take a different form. The Wilcoxon rank-sum test, however,

reveals no significant difference between the two distributions. These somehow conflicting results motivate us to investigate another aspect of trustees' behavior—namely the reciprocation of trusters' trust.

Berg et al. (1995) address the question on whether being trusted by someone makes the trusted more trustworthy by studying the correlation between the amount invested by trusters' and the amount returned by trustees (expressed as a percentage of the show-up fee and the tripled investment, respectively). Berg et al. (1995) do not find significant correlation between the choices of trusters and trustees and reason that the trustee's decision is not affected by how much she is trusted by her partner. Snijders and Keren (1999) and Dufwenberg and Gneezy (2000) use similar designs and also fail to find significant correlations. We calculated the Spearman correlation coefficients between trusters' and trustees' choices (expressed as a percentage of the show-up fee of 10 euros and the tripled investment, respectively) in condition I and Q\_I. These correlations together with their p-values are presented in the last two rows of Table I. In condition I, consistent with the results of previous studies, we find no significant correlation. In contrast, in condition Q\_I, the positive correlation of 0.42 is significant at the 1 percent level and indicates that trustees who answered the questionnaire reciprocate the trust bestowed on them by their partners. Based on our findings about the behavioral choices of trustees in conditions Q\_I and I, we argue that our experimental data provides some evidence that trustees' decisions include also strategic elements.

To supplement our analysis about the role of risk preferences in the DG, UG, and IG we now discuss how the answers, given for question three of the questionnaire, relate to behavioral choices in the three games. The distributions of self-reported risk preferences on the risk scale in the DG, UG, and IG are statistically identical. We pool the data from the three games together and plot the resulted empirical distribution in panel f) of Figure 1. The empirical distribution of self-reported risk preferences is approximately symmetric around 50. Slightly more subjects scored a value less than 50 on the scale (54 percent), where values to the left of 50 are associated with higher risk tolerance. This result is different from the results of Holt and Laury (2002) who find that the majority of people are risk-averse. MacCrimmon and Wehrung (1986) note that most people overestimate their

risk tolerance on one-dimensional scales. Hence, the difference between our results and those of Holt and Laury (2002) should come as no surprise.

We already briefly discussed that incentive incompatible questionnaires and one-dimensional questions might not provide a reliable measure of risk preferences. However, it is interesting to analyze how the correlations between self-reported risk preferences and behavioral choices in the DG, UG, and IG relate to our findings. In Table II, we report all Spearman correlation coefficients along with their p-values.

Table II  
Correlations between self-reported risk preferences and behavioral choices in the  
DG, UG, and IG

Condition	Q_D Dictators	Q_U Proposers	Q_I Trusters	Q_I Trustees
Correlation	- 0.01	0.41	- 0.23	0.24
p-value (one-tailed)	0.31	0.0005 (***)	0.069 (*)	0.08 (*)

\* Significant at the 10 percent level

\*\* Significant at the 5 percent level

\*\*\* Significant at the 1 percent level

In the DG, the correlation coefficient is insignificant. This result is in line with the intuition that risk preferences do not determine behavior in the DG. We find a positive correlation between self-reported risk preferences and offers in the UG, which is significant at the 1 percent level. Because higher scores on the risk scales are associated with higher risk- aversion, a positive correlation in the UG means that more risk-averse subjects tend to make higher offers. The positive correlation in the UG confirms our previous results that risk preferences are important for choosing offers in the UG. In the IG, there is some evidence that self-reported risk preferences are negatively correlated with trusters' investments (meaning that more risk-averse subjects invest less) and positively correlated with trustees' choices (meaning that more risk averse subjects return more to their partners). These correlations, however, are significant only at the 10 percent level.

## 4. Discussion

In this section we discuss some possible explanations of the effects that the act of stating one's own risk preferences produces on behavioral choices in the UG and IG.

In the UG, we find that proposers who answered the questionnaire made lower offers than proposers who did not answer the questionnaire. There is, however, a significant positive correlation between the answers given on the questionnaire and offers made in the UG, suggesting that more risk-averse subjects make higher offers. We explain these results by the following argument. The act of answering the questionnaire makes subjects think about risk. When they are presented with the UG, they probably try to evaluate how risky each possible offer is by making expectations about the actions of their partners. Making small offers, such as 10 or 20 percent of the total endowment, involves high risk because small offers might be perceived as offensive or unfair by responders who might be willing to punish the greedy proposers by rejecting these offers. Rejecting small offers is attractive for proposers because in this way they can punish their partners, without incurring too high personal costs. Offers higher than 20 percent but less than that of equal division make the cost of rejecting for responders substantial and proposers might think it is reasonable to assume that such offers will be seldom rejected. Offering 50 percent of the total endowment involves almost no risk but this strategy is not very profitable for the proposers. The most attractive strategy for proposers therefore is to make offers between 20 percent and 50 percent. This is exactly what we observe in condition Q\_U where the median offer is 40 percent. The act of answering the questionnaire might be interpreted as a catalyst that makes proposers realize their bargaining power and as a result take a full advantage of it. In contrast, proposers who did not answer the questionnaire are less aware of their bargaining power and make higher and safer offers. This explanation is consistent with the results of Andreoni et al. (2003) who find that proposers offer less in a convex ultimatum game in which they have more bargaining power than in the standard ultimatum game.

In the IG, we do not find evidence that self-reporting risk preferences influences trusters' choices. The results from the UG suggest that the act of completing the risk questionnaire changes subjects' risk consideration. The failure

of the risk questionnaire to alter the distribution of trusters' choices could then be interpreted as evidence that trusters' decisions are not related to risk preferences. This conclusion, however, might be incorrect because of at least two reasons. First, it is not straightforward to determine what investments will be attractive for subjects with different levels of risk aversion. It is often assumed in the literature that less risk-averse people will be willing to invest more in the IG (see e.g. Schechter 2007). But this assumption is not easy to justify. Ahmed (2011), for example, examines whether the return (which trusters earn on their investment) as a proportion of the investment in the IG is increasing with the investment. He finds that marginal effects of investment are constant. That is, whatever amount trusters invest, they earn on average the same return. If a trustor could somehow expect this, as soon as she decides to put some of her show-up fee at risk, she will always be better off when she invests higher amounts and whatever her risk preferences are she will probably prefer to invest more than less. This is just an example, but it illustrates an important point—different assumptions about the returns that might be expected for different levels of investment can make the same behavioral choice attractive for both risk-loving and risk-averse individuals. A second difficulty in discerning the motivational bases of trusters' behavior arises from the fact that too many factors influence choices in the first part of the IG. Trusters in the IG may make choices based on the expectation of reciprocation of their trust, expectation of altruistic and fairness concerns of their partner, their own altruistic motives, their attitude toward risk, or any combination of the above-mentioned. This means that if we are able to somehow manipulate the subjects' risk preferences or risk considerations (for example, by making them report their risk preferences on a questionnaire), it will still be difficult to expect a specific effect on trusters' choices because we do not know how risk preferences interact with the other determinants of behavior and whether these other determinants stayed constant after the manipulation of risk preferences. To sum it up, we believe that because of the specific nature of the first part of the IG, it is very difficult to find strong experimental evidence that risk preferences are important determinants of trusters' behavior.

In the second part of the IG, we find that the median choice in condition Q\_I is 17 percent lower than the median choice in condition I. This difference is

considerable (although statistically insignificant) and one argument that can explain it is as follows: Trustees who completed the questionnaire realized that the decision of trusters' involves uncertainty and the risk of making losses. They also realized that trusters' make their investment decisions with the full awareness of the risk they face. Trustees then might conclude that trusters' at the time of making their choices are prepared to incur some losses on their investments but are willing to run this risk in order to take the chance of earning high returns. In other words, trustees might guess that trusters' return expectations are lower than a return associated with an equal division and as a result do not feel any moral obligation to give too generous returns. In contrast, trustees who did not complete the questionnaire are thinking less about the expectations of their partners and as a result, they give on average higher returns. This reasoning resembles very much the reasoning we used in explaining the results from the UG. This is not by chance, because as we already argued, we find some evidence in our data that trustees in the IG perceive their decision situation as similar to the way proposers in the UG perceive their decision situation (see e. g. panel e) and b) of Figure 1, or the discussion in Andreoni et al. 2003 and Dufwenberg and Gneezy 2000). As we find that behavioral choices in the UG are strategic, it follows from the latter argument that trustees' choices in the IG might also be driven by some strategic considerations. Another result from the second part of the IG is that we find evidence that trustees in condition Q\_I, but not in condition I, care about reciprocation. We reason from all these observations, that trustees' decisions involve strategic considerations.

## **5. Conclusion**

In this study, we focus on two types of goals. First, we are interested in extending the result of Berninghaus et al. (2011) such that strategic behavior in a coordination game is systematically altered by the act of reporting one's own risk preferences to three further games—the dictator, ultimatum, and investment games. Second, we explicitly address the question, whether behavior in the UG and IG is strategic or is entirely driven by other nonstrategic considerations.

We use an experimental design based on two conditions between-subject comparison. In one condition, subjects' only task was to play one of the three games

we consider. In the other condition, subjects first stated their own risk preferences on a short questionnaire and then they played one of the games. We hypothesize that the act of self-reporting risk preferences will not alter behavioral choices in the subsequently played economic games (internal consistency of preferences assumption). This hypothesis finds no support for the coordination game experiment reported by Berninghaus et al. (2011). Our analysis of the DG, UG, and IG show that self-reporting risk preferences does not alter dictators' offers and trusters' investments, while it significantly decreases proposers' offers and leads to a substantial decrease in the amount trustees' give back to their partners.

Our results from the DG experiments show that the act of completing the risk questionnaire does not influence subjects' preferences for fairness. Combining this finding with the results from the UG experiments, we conclude that the change in the proposers' offers triggered by the act of self-reporting risk preferences is induced by a change in the subjects' risk considerations. In other words, our experimental data indicate that behavioral choices of proposers in the UG are strategic. In the IG, we do not find a significant difference between the empirical distributions of trusters' choices in the conditions with and without questionnaire. This result implies that decisions in the first part of the IG are not strategic. We, however, also offer an alternative explanation of our findings. We argue, that because of the specific nature of the decision situation trusters' face in the IG (i.e., there are many factors that influence behavioral choices), it is difficult to specify in what way risk preferences would relate to trusters' decisions, were they important for the determination of behavioral choices. That is, there is a nontrivial identification problem in the first part of the IG. Our experimental design does not explicitly address this identification problem and it might, therefore, be inappropriate to study the relationship between risk preferences and trusters' choices.

In the second part of the IG, along with the result that, self-reporting risk preferences substantially decreases the amount trustees send to their partners, we also find that only trustees who self-reported their risk preferences on the questionnaire show concerns for reciprocation. We also argue that trustees in the IG and proposers in the UG perceive the decision situations they face as similar. Our conclusion is that the behavioral choices of trustees include also strategic elements.

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