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# Trust, Reciprocity and the Roles of Sex, Value Orientation and Risk Attitudes in an Investment Game

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Abstract

An investment game is used to generate indices of trust and reciprocity from 182 young adults. The raw data indicate that men are more trusting than women and responders return a larger share of their resources to more trusting senders than to less trusting senders. Sex differences do not account for variation in reciprocity. When the value orientations and risk attitudes of participants are introduced into a model to account for the variation in trust they replace sex as the significant explanatory variables. When value orientations are introduced into the reciprocity model, it interacts significantly with the trust index to increase the explanatory power of the model.

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## 1. Introduction

Arrow (1974) stresses the ubiquity of trust (as a transaction cost depressant) in almost every economic transaction. He finds that higher rates of investment and growth are positively associated with higher levels of trust. Khalil (1994) argues that in market-based societies, where individuals are motivated by rational, self-interested behavior, there is a greater need for trust than in kin-based or other forms of economic organization. He notes that, "First, as economic exchange becomes less intermingled with kinship and more based on formal contractual relationships, the monitoring conducted by the kin members and the threat of ostracism almost vanish. Second, the modern judicial system, which replaces the threat system of ostracism and shunning, can not practically monitor the extensive growth of contractual agreements – even the explicit ones" (Khalil 1994, 340). Therefore the need for trust, integrity and trustworthiness seems greater in a market-based economy, where most control mechanisms are incomplete at best.

A strand of literature has been examining trust and reciprocity issues in a behavioral game context. The most common medium for this work is the trust (investment) game in a one-shot setting (see for example, Berg, Dickhaut and McCabe, 1995; Croson and Buchan, 1999; Cox and Deck, 2004). We use this version of the trust game, originally introduced by Berg et al. (1995), to study the levels of trust and reciprocity and the roles of participants' for sex and individual attributes such as value orientation and risk attitudes in accounting for variation in

trust and trustworthiness.[1] In this game two players are paired anonymously, with one player designated as the sender and the other as the receiver. Both players get a fixed initial endowment known to each other. The sender is told that she can keep the entire amount or send the whole or part of the endowment to the anonymous receiver with whom she is paired. Any amount that the sender offers to the receiver is tripled by the experimenter. The receiver is then asked to allocate the sum of the tripled amount plus his period endowment between him and the sender. The receiver is told that he is free to keep the entire amount for himself or, if he chooses, he can send some or all of it back to the anonymous sender. The game ends after this point.[2]

The literature is rich with the studies examining the role of sex in trusting and reciprocal behavior. Croson and Gneezy (2004) provide an excellent survey of experimental economics literature on the impact of sex. Several studies find mixed evidence on the role of sex in the level of trust. Eckel and Wilson (2004a), Snijders and Keren (2004) and Chaudhuri and Gangadharan (2004) find that men exhibit greater amounts of trust than women, whereas Croson and Buchan (1999), Clark and Sefton (2001), Cox (2002) and Cox and Deck (2004) find no significant effect of sex on trusting behavior. Findings of sex differences in trust games are more consistent for reciprocity levels with most studies reporting that women reciprocate more than men (see for

[1] The individual attributes of value orientation and risk attitudes are measured independently on a day prior to the day when actual experimental sessions were conducted.

[2] The resolution of this game is simple. In the one-shot version of the game, the receiver should not send any money back knowing that the game ends immediately thereafter. The sender, anticipating the receiver's decision, should send no money to the receiver in the first place. However, Berg et al. (1995), Croson and Buchan (1999) and several other studies have shown that the actual behavior is quite different from the one predicted above. The senders send on average a significant positive sum to the receiver exhibiting some "trust" in the receiver (the average percentage sent in previous studies had a range of 0.52 – 0.68). The receiver reciprocates this trust by sending some money back (the average percentage reciprocity reported in prior studies had a range of 0.25 – 0.31). By sending money back to the original sender, the receiver exhibits positive "reciprocity".

example, Croson and Buchan, 1999; Chaudhuri and Gangadharan, 2004). However, Eckel and Wilson (2004a, 2004b) in a trust game and Clark and Sefton (2001) in a sequential prisoner's dilemma found no sex differences in reciprocal behavior.

Many experimental studies (see for example, Hoffman, McCabe and Smith, 1996; Cox and Deck, 2004; McCabe, Rigdon and Smith, 2003) have shown that measures of trust and trustworthiness are highly variable and are associated with various factors such as individual preferences towards payoffs, prior experience, a player's capacity to learn more about personal characteristics of each other and social distance. In these experiments, various contextual factors associated with the structure of the experiments are manipulated to explain the variance in the levels of trust and trustworthiness.

In addition to the above factors, social preferences may also influence both trusting and reciprocal behavior. According to Croson and Gneezy (2004) this social preference is modeled in the economic literature in the form of altruism (Becker, 1974; Andreoni, 1989), envy (Mui, 1995), inequality-aversion (Bolton, 1991; Bolton and Ockenfels, 2000) or reciprocity (Rabin, 1993; Charness and Rabin, 2002). Offerman, Sonnemans and Schram (1996)introduce value orientation as a measure of other-regarding behavior in a public goods setting.

According to many social psychologists, people pursue different goals when making decisions that affect others. Preferences regarding one's own well-being relative to others' appear to vary across individuals. We predict that value orientation will have an influence on other-regarding behavior. Altruists and cooperators will function as egalitarians and care more for others' payoffs and equality of payoffs in an investment game compared to competitors and aggressors. Accordingly, value orientation will influence both trust and reciprocity.

Prior experimental economics literature (Eckel and Wilson, 2004c; Bohnet and Zeckhauser, 2004) also examines whether trust is a risky bet. According to Eckel and Wilson (2004c, 448) "While many researchers appear to accept this relationship between risk and trust, the relationship between the risk orientation of the trustor and trusting behavior has not been explicitly studied." However, recent papers by Eckel and Wilson (2004c) and Ashraf et al. (2003) conduct experiments that include behavioral risk measures and report no statistical relationship between behavioral risk measures and the decision to trust.[3] Consistent with the above literature we include in addition to sex, value orientation and risk attitudes as important explanatory variables driving trusting behavior and value orientation as an important explanatory variable driving reciprocity.

Before including value orientation and risk as explanatory variables, we find a difference in trust behavior between men and women. However, we find no significant sex effect on reciprocity. Once we augment our explanatory model of trust, both value orientation and risk are important. Similarly, when we add value orientation to our reciprocity model, it is a significant explanatory variable. On the other hand, the significance of sex in the investment game disappears when the value orientations and risk attitudes of participants are introduced. The resulting models of trust and reciprocity are now based on behavior rather than the physical characteristics of the participants.

[3] In the one-shot version of the investment game senders take a risk by sending some positive amount of money to the receivers. However, receivers face no risk when deciding how much money, if any, to return. Therefore, risk preferences will not influence the level of reciprocity.

## 2. The role of sex

With greater participation of women in the work force, the examination of sex differences in decision-making has increased in importance.[4] The prior literature finds mixed evidence on the role of sex in the level of trust. Croson and Buchan (1999), Clark and Sefton (2001), Cox (2002) and Cox and Deck (2004) find no significant effect of sex on trusting behavior, whereas Eckel and Wilson (2004a), Snijders and Keren (2004) and Chaudhuri and Gangadharan (2004) find that men exhibit higher level of trust than women. They attribute this difference in trust to a greater amount of risk aversion on the part of women. In the investment game, the decision on the amount sent confounds trust and risk preferences.[5] Thus differences between sexes can be attributed to either lower trust or risk aversion. If this explanation is valid, we should not observe any differences in trusting behavior between women and men if we explicitly control for risk attitudes. If sex continues to account for a significant amount of variation in trusting behavior, then the risk explanation is incomplete. However Ingram and Berger (1977) suggest that women may choose a competitive strategy for fear of falling into the *sucker* role (choosing cooperation when the other player defects). This leads to our first hypothesis stated in its null form as

*H1: The propensity to trust in the investment game is independent of the sex of the investor.*

One of the well-developed theoretical explanations for factors contributing to sex differences in social interactions is *social role theory* (Eagly, 1987). According to social role

[4] According to Powell and Graves (2002, 37) "Sex differences influence how people are disposed to behave in work settings. Females and males are similar in some ways and different in others. Despite thousands of studies, however, researchers do not agree about the scope, magnitude, or cause of sex differences."

theory, both women and men should exhibit behavior consistent with their respective roles, i.e., women being communal, reflecting concerns for others and selflessness (Wiggins, 1992) and men being agentic and dominant (Carli and Eagly, 2002). If women adhere to these roles, we would expect them to be more reciprocating than men. Furthermore, Eckel and Grossman (1998) have observed that the influence of sex is conditional on the level of risk present in the experiment. In reciprocity decisions, which involve no risk, Croson and Buchan (1999) find that women tend to be more generous and socially oriented. This result is also supported by Cox (2002) and Chaudhuri and Gangadharan (2004). Andreoni and Vesterland (2001) find that men are more likely to be either perfectly selfish or perfectly selfless, whereas women tend to be *egalitarians*, preferring to share evenly. In the context of the investment game, because both sender and receiver begin with equal endowments, we hypothesize that women will reciprocate more than men to make the allocation more equitable. The above reasoning leads to our next hypothesis stated in its null form as

*H2: The propensity to reciprocate in the investment game is independent of the sex of the responder.*

## 3. Value orientations and risk attitudes

### *3.1. Value orientations*

According to many social psychologists, people pursue different goals when making decisions that affect others. Preferences regarding one's own well-being relative to others' appear to vary across individuals. One classification distinguishes among five value orientations: aggression, competition, individualism, cooperation, and altruism. *Competitors* usually want to be better off

[5] Charness and Gneezy (2004) find a very consistent result that women invest less, and thus claim that women appear to be more risk averse than men in their financial decisions.

than their counterparts; *individualists* try to do the best for themselves regardless of the well-being of others; and *cooperators* pursue the best for themselves and others. Rare value orientations are *altruism* and *aggression* where altruists want to do the best for others, regardless of the outcome of their own well-being, while aggressors want to do worst for others, regardless of the outcome for themselves.[6] Given these value orientations, the social psychology literature includes two different hypotheses which lead to comparable predictions about how value orientation may affect trust behavior in an investment game. Both hypotheses focus on the sender's expectations.

Kelley and Stahelski (1970) conjecture that competitors and individualists misjudge the goals pursued by other individuals (because the competitor's and individualist's behavior tends to result in behavior from others that is comparable to theirs). They are unlikely to be trusting. Cooperators, on the other hand, anticipate others might have any of the three general value orientations. This leads cooperators to watch for responses from others and act accordingly. Cooperators may be trusting in a one-shot context, but will be wary in a repeated game and adapt to the behavior of others. This is described as the triangle hypothesis. Kuhlman and Wimberly (1976) conjecture that individuals tend to expect others' behavior to be the same as the behavior prescribed by their own value orientation. This is the false consensus hypothesis. The more cooperative is the individual's value orientation, the more trusting the individual will be. Accordingly, both the triangle and the false consensus hypotheses posit that the level of trust will be higher as the value orientations of people move to more cooperative from less cooperative,

[6] As explained later, the value orientation measure captures the natural ordering of the other regarding behavior.

with altruists exhibiting highest levels of trust and aggressors the lowest. This leads to our third hypothesis stated in its null form as

*H3: The propensity to trust in the investment game is independent of the investor's value orientation.*

We note that value orientation will have an influence on other-regarding behavior. Altruists and cooperators will function as egalitarians and care more for others' payoffs and equality of payoffs in an investment game compared to competitors and aggressors. Accordingly, value orientation will have a direct influence on reciprocity. Receivers with a cooperative value orientation will reciprocate more than will receivers with an individualist value orientation. The ability to recognize the origins of trust may also be influenced by an individual's value orientation. This leads to our next hypothesis stated in its null form as

*H4: The propensity to reciprocate in the investment game is independent of the responder's value orientation.*

*3.2. Risk attitudes*

James (2002) characterizes trust as a risky action taken by an agent to an economic transaction under uncertainty or informational incompleteness with the anticipation that the other agent to the transaction will not behave opportunistically (i.e., will not exploit the vulnerability that the agent has created for himself or herself by taking the risky action). Standard incremental models of trust development (Rempel, Holmes, and Zanna, 1986) suggest that trust initiators should be careful, because trust involves risk. This is especially so in a one-shot investment game where there is no opportunity to retaliate or punish. Therefore, by sending a positive amount to their receivers, individuals take a risk by placing trust in receivers to behave in

cooperative and non-exploitative ways (Ostrom and Walker, 2003). Thus, risk attitude is expected to have an impact on the level of trust, where risk seekers are likely to send more, relative to risk-averse individuals.[7] This leads to our fifth hypothesis, stated in its null form as

*H5: The propensity to trust in the investment game is independent of investor's risk preference.*

In the one-shot version of the investment game senders take a risk by sending some positive amount of money to the receivers. However, receivers face no risk when deciding how much money, if any, to return. Therefore, risk preferences have no place in a model purporting to explain reciprocity in a one-shot investment game.

## 4. Experimental design

A total of 182 subjects (100 males and 82 females) were recruited from undergraduate classes at a medium-sized university. During the recruitment phase, students were told that the experiment involves simple decision-making, and that the details would be given to them during the session. In addition, they were told that they were required to participate in two separate sessions. Each session would be conducted on a different day and each session would last on average for about two and one-half hours. They were also informed that during the course of the sessions they would earn money that would be paid to them in cash at the conclusion of each session.

[7] Eckel and Wilson (2004c) conduct experiments that include two behavioral risk measures and one survey measure of risk attitudes and report no statistical relationship between behavioral risk measures and the decision to trust. They report a weak relationship between risk measured from the survey and the decision to trust. Ashraf et al. (2003) also do not find any relationship between risk preferences revealed in a risky-choice task and trust decisions in the investment game. Bohnet and Zeckhauser (2004) find that individuals are much more willing to take risks when the outcome is due to chance than when it depends on whether another player proves trustworthy. According to Bohnet and Zeckhauser (2004), trusting may lead to betrayal costs that are shown to be above and beyond mere monetary losses.

*4.1. The first session (eliciting risk preferences and value orientations)*

In the first session, we elicited subjects' risk preferences and value orientations. This allows us to isolate intrinsic individual characteristics rather than assuming that our subjects are risk-neutral profit maximizers.

We conducted the risk preference and value orientation experiments in nine sessions with groups of 12 to 26 people. Each session lasted approximately 90 minutes. Subjects earned an average of $24. At the start of each of these sessions, each subject was assigned a random ID by drawing a number from a hat that included "N" index cards numbered from 1 to N, where N is the total number of participants in the session. Subjects were instructed to keep their subject ID numbers confidential and not to share them with others. At the conclusion of each of the first experimental sessions, subjects were asked to sign up for the second experimental session by selecting from a range of different time slots.[8]

*4.1.1. Eliciting subjects' risk preferences*

To elicit subjects' risk preferences, we used the two-stage lottery mechanism developed by Becker, DeGroot and Marschak (1964). In the first stage, subjects were presented with a lottery gain prospect to win a prize of 100 laboratory francs with probability *p*, and zero with probability *1-p*.[9] Then, we elicited subjects' certainty equivalent by offering them the opportunity to sell back the lottery to the experimenter for certain cash. We asked subjects to determine the *minimum selling price* that they would be willing to accept in exchange for the chance of

[8] All 182 individuals returned to participate in the investment game. Instructions used to elicit risk preferences and value orientations are posted at http://socserv.mcmaster.ca/econ/mceel/papers/TrustRisk&VOInstructions.pdf

[9] Participants were paid at the end of their sessions and francs were converted into Canadian dollars at the rate 100 francs = 1.00 Canadian dollar.

winning the 100 francs prize with a specified probability. To determine whether subjects would be able to sell the lottery for certain cash or play the lottery, we would draw a card at random from a shuffled deck of 100 cards. These cards are printed with values from 1 franc to 100 francs. If the amount shown on the card were equal to or greater than the minimum selling price, the subject would receive the amount shown on the card; otherwise the subject would play the lottery at the specified probability. Finally, for those who played the lottery in a given trial, we draw another card from a different deck which has 100 cards, numbered from 1 to 100. If the number shown on the card drawn is equal to or smaller than the percentage chance of winning, those who played the lottery would win and receive 100 francs, otherwise they would *lose* the lottery and get paid nothing for that round.

The lottery game was played for 25 rounds. The first round presented the subjects even odds of winning100 francs. The next 24 rounds presented different chances of winning the lotteries, ranging from 5 percent to 95 percent. The sequence of the 24 rounds was the same as that used by Harrison (1986) and Kachelmeier and Shehata (1992). The expected values (EV) of the 25 lotteries presenting the opportunities to win a prize of 100 francs and their certainty equivalents (CE) plus the {EV, CE} pairs {0, 0} and {100, 100} were used to estimate the coefficients of the equation

$$EV = a + bCE + c(CE)^2$$

for each participant, using an OLS regression.[10] Following Beck et al. (1991) and Kachelmeier (1990), the sign of the coefficient *c* identifies an individual as being either risk averse (< 0), risk neutral (= 0) or risk loving (> 0). We adopted the convention that if *c* was negative and different

[10] See Kachelmeier (1990) and Beck et al. (1991, 555-557) for a discussion of this methodology.

from 0 at the 10 percent significance level using a one-tail test, the individual would be categorized as risk averse. Similarly, if *c* was positive and significantly different from 0 at the 10 percent level using a one-tail test, the individual would be categorized as risk loving. All other individuals were categorized as risk neutral.

Fig. 1 summarizes the distribution of risk attitudes of the 182 participants in this experiment. Note that the median risk attitude is in the risk-neutral category. Risk attitudes are skewed towards the risk loving end of the risk attitude range. The distributions of risk attitudes by sex differ. Of our 182 participants, 45 percent are women and 55 percent are men. Fig. 2 shows the proportion of men and women who fall into each of the three categories of risk attitude. Twice as many women than men are risk averse, 25 percent more women than men are risk neutral, while 82 percent more men than women are risk loving. The two distributions are significantly different (Pearson $\chi^2$ (2) = 8.789, p = 0.012).

[Insert Figs. 1 and 2 about Here]

*4.1.2. Eliciting subjects' value orientations*

We used the *Decomposed (Ring) Game* mechanism developed by Griesinger and Livingston (1973) and Liebrand (1984) to measure subjects' value orientations.[11] In this game, each subject was paired at random with an anonymous person from the same room throughout the course of the game. The subjects were told that neither of the two persons

[11] The *ring game* has been used extensively by social psychologists, and we believe was first introduced to economists by Offerman et al. (1996) who were studying voluntary contributions towards the provision of public goods. The sensitivity of results from this mechanism to the stakes in the game and the location of the origin of the ring are presented in Buckley et al. (2001). Papers by Carpenter (2003), Buckley et al. (2003), Burlando and Guala (2005) and Sonnemans et al. (2006) use the results of the *ring game* to understand fairness in bargaining games, investment in research and development and voluntary contributions toward public good provision.

who were paired together would receive any information about the other person's decisions during the session.

Each subject was presented with twenty-four randomized pairs of adjacent equally spaced coordinates from a circle with the origin at 0 and a radius of 100 laboratory Lira (see Fig. 3).[12] Each pair of coordinates allocates an amount of money to the decision-maker and another amount to be paid to the anonymous subject with whom the decision-maker is paired. All subjects are presented with the same choices. The horizontal axis indicates the amount of money allocated to oneself ($x$) and the vertical axis indicates the amount of money allocated to the other person ($y$). Therefore, $x^2 + y^2 = 100^2$.

[Insert Fig. 3 about Here]

The subject's payoff from this game is the sum of the amounts that she allocated to herself over the 24 choices plus the sum that the other person allocated to her. The sum of the vectors defined by each of the decision-maker's 24 choices determines a *motivational vector* whose position within the ring identifies the decision-maker's value orientation. The length of the motivational vector relative to twice the radius of the ring is a measure of the decision-maker's consistency in the identified value orientation. The mean consistency measure for our participants exceeded 0.90. This is considered to be very consistent behavior (see Buckley et al., 2001).

Based on observed preferred motivational vectors, individuals can be classified into five categories. Individuals with vectors lying between 67.5 and 112.5 degrees,

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[12] Participants were paid at the end of their sessions and liras were converted into Canadian dollars at the rate 20 liras = 1.00 Canadian dollar.

relative to the horizontal axis in the positive quadrant of the ring, are classified as *altruistic.* At the other extreme, individuals with vectors between -112.5 and -67.5 degrees are classified as *aggressive.* The middle positions are held by *cooperators,* with vectors between 22.5 and 67.5 degrees, *individualists,* with vectors between -22.5 and 22.5 degrees and the *competitors,* with vectors between -67.5 and -22.5 degrees.[13]

Fig. 4 summarizes the distribution of value orientations across the 182 participants in this experiment. Note that the median value orientation (22.4 degrees or 0.391 radians) is very close to the boundary between individualists and cooperators (45 degrees or 0.393 radians). Overall, the distribution of value orientations is bimodal and skewed towards the cooperative orientations (approximately 50 percent are above the individualist/cooperator boundary). The bi-modal character of this distribution is reflected in Fig. 5, which shows the distribution of value orientations across men and women. More than twice as many men than women display value orientations which are clearly cooperative or altruistic (65 men versus 25 women). The two distributions are significantly different (Pearson $\chi^2$ (6) = 27.347, p = 0.000) with the women's scores skewed towards the individualistic values and the men's scores skewed towards the cooperative values.

[Insert Figs. 4 and 5 about Here]

*4.1.3. Risk attitudes, value orientation and sex*

Fig. 6 displays the mean value orientation measure generated by men and women in each of the three risk categories. These data show that given risk attitudes, men tend to display

[13] Alternatively, angle of the motivational vector can be expressed in radians or the value orientation index can be measured as the slope of the motivational vector, by dividing the total amount each subject assigned to her

significantly more cooperative behavior than women ($p = 0.005$ and $p = 0.020$ for risk averse and risk neutral individuals). The mean value orientation of risk-averse men is slightly above the conventional minimum cutoff for characterizing value orientations as cooperative (0.392 radians). Women, however, display a mean value orientation that is very close to someone who is characterized as a perfect individualist. Risk-neutral men are characterized by a mean value orientation that is comparable to risk-averse men. Risk-neutral women are less individualistic (moving towards cooperative), but the mean value orientation measure is still far from that of the men. Risk-loving men and women are both characterized as cooperators. The measure for the men is larger, but not significantly so ($p = 0.197$). Overall, both sex and risk attitudes are statistically significant (ANOVA, main effects, $p = 0.000$ for both sex and risk attitudes) and their interaction is not significant ($p = 0.246$). Men's value orientation measures are greater than women's, as risk attitudes go from risk aversion to risk loving, the value orientation measure increases and the relationship between risk attitude and value orientation does not differ across men and women.

[Insert Figure 6 about Here]

*4.2 . The second session (playing the investment game)*

The second experiment consisted of a series of rounds of a computer mediated investment game. In this paper we are reporting the results from only the first two rounds. Half of the participants played the role of the sender (trustor) in the first round. The participants were reassigned to different partners for the second round, during which the people who were responders in the first round took the role of sender.

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counterpart by the total amount she selected.

At the beginning of the session each subject was assigned an ID (i.e., their experimental identities) by drawing an index card from a set of shuffled cards numbered from 1 to N, where N is the total number of the students attending the session. Students were told that the ID number is private information and that they should not show it to or share it with any one. Individuals were then told to select a computer work station at which they would remain for the duration of the session. After the participants were seated, the instructions were shown on the screens of the participants monitors and read aloud then by experimenters. Subjects were given an opportunity to ask questions for clarification.

At the beginning of each decision-round, subjects were endowed with 100 laboratory euros and were told whether they would assume the role of a sender or a receiver for the round.[14] Senders were asked to make a decision about how much of their endowment they wished to invest with their paired anonymous person. They were told that they have the choice of investing some, all, or none of their endowment. They were instructed to enter this number on the appropriate place on their computer screen. This investment was multiplied by three and reported to the person with whom the sender was paired. After the receivers received this information, they decided how much of the resources they controlled (the sum of their own endowment *plus* three times any investment made by the sender) they would return to the sender.[15] Receivers entered this

[14] Participants were paid at the end of their sessions and euros were converted into Canadian dollars at the rate 100 euros = 1.00 Canadian dollar. Instructions for the investment game are posted at http://socserv.mcmaster.ca/econ/mceel/papers/TrustInvestmentGameInstructions.pdf

[15] The basic structure of the experimental setting is a variant of the trust game developed by Berg, Dickhaut and McCabe (1995).

amount onto their computer screen through their keyboards. These values were reported to the senders and the total payoffs to the senders and receivers appeared on their screens. Each participant could calculate what the other person received, but was not explicitly told this value. Individuals were then rematched and a second round of sending and responding took place. After the second round, additional rounds were played, implementing different treatments. At the end of the session, subjects completed a short questionnaire. The purpose of this questionnaire was to collect background information as well as information concerning the subjects' perceptions of the session in which they participated. Subjects were then paid privately and dismissed.[16]

## 5. Results

### *5.1. Descriptive statistics*

#### *5.1.1 Trust*

Table 1 summarizes the trust measures by sex and the sequence in which the participant was a sender in the one-shot games.[17] The conventional analysis of trust would consider order and sex as explanatory variables. An analysis of variance considering the explanatory model using sex, order and the interaction of sex and order indicates that the model is statistically significant (adjusted $R^2$ of 0.05, $F = 4.21$ and $p = 0.007$). The main

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[16] The average earnings per subject for the second session were $34 for total average earnings of $58 over the two sessions. The average earnings for the two rounds reported in this paper were about $3.25. The two rounds were completed in less than 5 minutes.

[17] Analyses of variance and hypothesis tests summarized in this section are presented in an appendix posted at http://socserv.mcmaster.ca/econ/mceel/papers/TrustAnalysisAppendix.pdf. All of the data is in an appendix posted at http://socserv.mcmaster.ca/econ/mceel/papers/Trust&ReciprocityData.txt.

effect of sex is significant (p = 0.004). Neither the main effect of Order nor its interaction with sex is significant (p = 0.558 and p = 0.072 respectively).

[Insert Table 1 about Here]

The results from this experiment are not different from others and confirm a difference in trust behavior found between men and women enrolled in university programs who participate in this trust or investment game. These data permit the rejection of H1 in favor of the alternative that there is a difference between the trusting behavior of men and women. Men are more trusting than women in this investment game.

*5.1.2. Reciprocity*

Typically, reciprocity is measured as the percent of the tripled investment returned by the responder to the sender. In these environments, only the sender has an endowment. In our environment, both the senders and responders have endowments of 100 lab euros. We report three reciprocity measures. *Simple Reciprocity* is defined as the percent of euros returned to the sender from the three times the sender's investment that is received by the responder. This has a maximum value of unity and minimum value of zero. It is possible for this percentage to be undefined if the sender invests nothing. In these cases, the response is treated as if it is zero.

Different from simple reciprocity, is *Reciprocity* measured as the percent of euros returned to the sender from the total resources controlled by the responder. This includes three times the sender's investment plus the responder's endowment. The final measure of reciprocity is *Sophisticated Reciprocity*, which is measured as the share of the total

surplus ultimately held by the sender after the responder has returned assets to the sender. Fairness in a response could be measured as the percent of the grossed-up investment returned to the sender (the Simple Reciprocity measure), the percent of the resource controlled by the responder returned to the sender (Reciprocity) or the percent of the total surplus ultimately realized by the sender (Sophisticated Reciprocity). Equity would be associated with a Sophisticated Reciprocity measure of 0.5. This may or may not be considered fair by responders.

The conventional analysis of reciprocity considers an explanatory model which would include sex, order, the level of trust displayed by the sender and their interactions. The three measures of reciprocity by order and sex are displayed in Tables 2, 3 and 4. An analysis of variance of the Simple Reciprocity measure considering the explanatory model using sex, order, the sender's trust index (the percent of the sender's endowment that is invested) and their second and third order interactions indicates that the model is not statistically significant (adjusted $R^2$ of - 0.006, $F = 0.84$ and $p = 0.554$). This suggests that there are no significant sex or order effects and that even including a measure of the sender's trust does not help to explain the variation in Simple Reciprocity.

[Insert Table 2 about Here]

An analysis of variance of the Reciprocity measure considering the explanatory model using sex, order, the sender's trust index and their second and third order interactions indicates that the model is statistically significant (adjusted $R^2$ of 0.081 and $p = 0.003$). In this analysis, only the main effect of the trust index is statistically significant in this analysis ($p = 0.000$). A test to evaluate the joint contributions of the main effects

of sex and order and all of their interactions (including interactions with the trust index) indicates that these variables and their interactions do not significantly account for variation in the dependent variable ($F = 0.55$, $p = 0.771$). The adjusted $R^2$ of the restricted model, which excludes sex and order, is 0.094, $F = 19.87$ and $p = 0.000$. This suggests that there are no significant sex or order effects and of the three independent variables, only the measure of the sender's trust explains a significant portion of the variation in the percent of resources transferred from the responder to the sender (Reciprocity).

[Insert Table 3 about Here]

An analysis of variance of the Sophisticated Reciprocity measure considering the explanatory model using sex, order, the sender's trust index and their second and third order interactions indicates that the model is not statistically significant (adjusted $R^2$ of -0.009, $F = 0.77$ and $p = 0.614$). This suggests that there are no significant sex or order effects and that including a measure of the sender's trust does not help to explain the variation in Sophisticated Reciprocity.

[Insert Table 4 about Here]

The general conclusion is that neither sex nor order of play accounts for a significant portion of the variation that is displayed by the summary statistics in Tables 2, 3 and 4. The null hypothesis H2, that the propensity to reciprocate in the investment game is independent of the sex of the responder, is retained.

On average about 41 percent of the grossed up senders' investments are returned to senders. Senders end up with slightly more than their endowments and about 39

percent of the total surplus shared by the sender and responder. While neither the sex of the responder nor the round in which the individual took the role of the responder accounted for a significant portion of the variation in any of the reciprocity measures, the trust level of the sender accounted for a small, but significant amount of the variation in the Reciprocity measure. The more trusting is the sender, the greater is the responder's propensity to reciprocate.

### *5.2. The introduction of value orientations and risk attitudes*

#### *5.2.1. Trust*

In addition to including sex and order in the explanatory model for trust, the value orientation of the sender and the risk attitude of the sender are also included. The complete model includes all of the interactions of these four independent variables. The analysis of variance indicates that this complete model is statistically significant (adjusted $R^2$ of 0.167 and $p = 0.000$). The only first order effect in this model that is statistically significant is the participant's value orientation ($p = 0.002$). A test to evaluate the main effects of sex, order, risk attitudes and all second, third and fourth order interactions with these variables indicates that jointly these account for a marginally significant amount of the variation in trust ($F = 1.56$, $p = 0.061$). This set of variables cannot be jointly removed from the model. A test to evaluate the main effects of sex and order and all second, third and fourth order interactions with sex and order indicates that these do not significantly account for variation in the dependent variable ($F = 1.02$, $p = 0.445$). The adjusted $R^2$ of the restricted model, which excludes sex and order, is 0.165, $F = 8.17$ and $p = 0.000$. The restricted model, which includes risk attitudes, value orientation, and

their interaction, contains a significant main effect for value orientation ($p = 0.001$) and a marginally significant interaction between value orientation and risk attitudes ($p = 0.091$). This analysis supports the retention of H1, that the propensity to trust in the investment game is independent of the sex of the sender, and the rejection of H3 and H5 in favor of the alternative hypotheses that value orientation and risk attitudes affect trusting behavior in the investment game.

Table 5 presents a summary of the trust data within the context of the restricted model. The significant value orientation effect is reflected by the row total values showing trust rising as value orientation rises from the competitor/individualist range to the individualist/cooperator range to the cooperator/altruist range. The differences between 44.99 and 55.66 and between 55.66 and 68.39 are statistically significant (two tail t-test, $p = 0.047$ and $p = 0.027$). The weaker risk attitude effect is reflected by the insignificant difference between the mean trust index for risk averse and risk neutral individuals (two tail t-test, $p = 0.430$) and the significant difference between the mean trust index for risk averse and risk loving individuals and between risk neutral and risk loving individuals (two tail t-tests, $p = 0.014$ and $p = 0.000$). The significant interaction between value orientation and risk attitude is reflected by the increase of the mean trust index from 49.64 to 55 to 68.14. The trust index increases by 11 percent with a move from risk averse and non-cooperative to risk neutral and mildly cooperative individuals, and then by 38 percent with the move to risk loving and cooperative individuals. When the data are partitioned by sex and risk attitude or by sex and value orientation range, there are no significant differences between the trust indices for men and women in any

of the six cases (using two tail t-tests the p-values range from a low of 0.131 for risk neutral individuals to a high of 0.624 for competitive/individualistic individuals).

[Insert Table 5 about Here]

*5.2.2. Reciprocity*

There is no need to augment the reciprocity models with a variable which accounts for risk attitudes. The decision regarding the amount of resources to return to the sender is not a risky decision for the responder within the context of the one-shot game. Value orientations, on the other hand, may be an important determinant of the resources returned to the sender by the responder. Accordingly, the value orientation of each participant along with its interactions with order, sex and the trust index is included in the models of Simple Reciprocity, Reciprocity and Sophisticated Reciprocity described earlier.

For both Simple Reciprocity and Sophisticated Reciprocity, the resulting models again fail to account for a significant amount of the variation in these measures. For the former measure, the adjusted $R^2 = 0.004$, $F = 1.04$ and $p = 0.413$, and for the latter, the adjusted $R^2 = 0.017$, $F = 1.20$ and $p = 0.274$.

For the Reciprocity model, the addition of value orientations to the independent variables results in an adjusted $R^2 = 0.094$, $F = 2.25$ and $p = 0.007$. Only the interaction of the trust index and value orientation is statistically significant in this analysis ($p = 0.028$). A test to evaluate the contributions of the main effects of sex and order and all of their second, third and fourth order interactions indicates that sex and order do not significantly account for variation in the reciprocity measure ($F = 0.53$, $p = 0.896$). The

restricted model, which excludes sex and order has an adjusted $R^2 = 0.123$, $F = 9.44$ and $p = 0.000$. This supports the retention of H2, that the propensity to reciprocate in the investment game is independent of the sex of the responder and the rejection of H5, in favor of the alternative that the responder's value orientation will affect reciprocity.

## 6. Conclusion

The relationship that some researchers have found between trust, reciprocity and sex in the investment game appears to disappear when the value orientations and risk attitudes of participants are introduced into the analysis of trust and reciprocity. Rather than explaining variation in trust and reciprocity by sex, this variation is accounted for by variations in underlying characteristics of participants other than their sex. While there are significant differences between the distributions of value orientations and risk attitudes by sex, the patterns of differences appear to support a direct relationship between sex and trust. Men are more cooperative in this sample of participants. Men are more risk loving. Both risk loving and cooperation appear to be related to trusting behavior. Similarly, cooperation appears to be related to reciprocity. However, the analysis indicates that risk attitudes cannot be dropped from the model of trust without significantly affecting the resulting model's ability to account for variation in trust. In the case of reciprocity, sex did not account for a significant amount of its variation even before the introduction of the participants' value orientations.

Whenever possible, attempts should be made to include independent measures of the attitudes of participants in environments where the experimental design is unable to control for effects which these attitudes may introduce. By using only sex to account for

variations in trust and reciprocity, in this experiment, we minimize the role of cooperative women and of risk loving women in accounting for the variation in trust. What is surprising to us is that there was no significant effect associated with sex once value orientations and risk attitudes were considered. Perhaps this is as it should be. Ultimately we should offer models of behavior that incorporate variables which more directly capture the preferences of people, rather than simply their physical characteristics.

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Table 1.
Trust: Mean percent of endowment invested by sex and order

| | Sex | | |
|---|---|---|---|
| Order | Male | Female | Row Total |
| Trustor is a Sender First | 67.72<br>(27.00)<br>[50] | 46.71<br>(28.12)<br>[41] | 58.25<br>(29.30)<br>[91] |
| Trustor is a Sender Second | 57.16<br>(34.14)<br>[50] | 52.10<br>(27.94)<br>[41] | 54.88<br>(31.43)<br>[91] |
| Column Total | 62.44<br>(31.08)<br>[100] | 49.90<br>(27.99)<br>[82] | 56.57<br>(30.35)<br>[182] |

*Note*: Standard deviations are in parentheses and number of observations is in square brackets.

Table 2.
Simple Reciprocity: Percent of tripled investment returned by sex and order

| | Sex | | |
|---|---|---|---|
| Order | Male | Female | Row Total |
| Responder is a Sender First | 35.50<br>(32.71)<br>[50] | 38.21<br>(34.45)<br>[41] | 36.72<br>(32.89)<br>[91] |
| Responder is a Sender Second | 46.65<br>(28.49)<br>[50] | 45.14<br>(35.12)<br>[41] | 45.97<br>(31.47)<br>[91] |
| Column Total | 41.08<br>(31.03)<br>[100] | 41.67<br>(34.26)<br>[82] | 41.35<br>(32.43)<br>[182] |

*Note*: Standard deviations are in parentheses and number of observations is in square brackets.

Table 3.
Reciprocity: Percent of tripled investment plus responder's endowment returned by sex and order

| | Sex | | |
|---|---|---|---|
| Order | Male | Female | Row Total |
| Responder is a Sender First | 20.97<br>(20.98)<br>[50] | 25.09<br>(24.60)<br>[41] | 22.83<br>(22.65)<br>[91] |
| Responder is a Sender Second | 28.73<br>(21.92)<br>[50] | 28.51<br>(24.13)<br>[41] | 28.63<br>(22.81)<br>[91] |
| Column Total | 24.85<br>(21.71)<br>[100] | 26.80<br>(24.28)<br>[82] | 25.73<br>(22.85)<br>[182] |

*Note*: Standard deviations are in parentheses and number of observations is in square brackets.

Table 4.
Sophisticated Reciprocity: Percent of Total Surplus Received by Sender by Sex and Order

| | Sex | | |
|---|---|---|---|
| Order | Male | Female | Row Total |
| Responder is a Sender First | 35.69<br>(18.96)<br>[50] | 39.65<br>(20.63)<br>[41] | 37.47<br>(19.72)<br>[91] |
| Responder is a Sender Second | 41.48<br>(18.84)<br>[50] | 39.24<br>(21.45)<br>[41] | 40.47<br>(19.98)<br>[91] |
| Column Total | 38.58<br>(19.03)<br>[100] | 39.45<br>(20.92)<br>[82] | 38.97<br>(19.85)<br>[182] |

*Note*: Standard deviations are in parentheses and number of observations is in square brackets.

Table 5.
Trust: Mean percent of endowment invested by value orientation and risk attitude

| Value Orientation | Risk Attitude | | | |
|---|---|---|---|---|
| | Risk Averse | Risk Neutral | Risk Loving | Row Total |
| Competitor/Individualist VO less than or equal to 0.20 radians | 49.64<br>(27.28)<br>[14] | 43.00<br>(27.13)<br>[38] | 45.63<br>(21.05)<br>[16] | 44.99<br>(25.63)<br>[68] |
| Competitor/Cooperator VO between 0.20 and 0.60 radians | 40.80<br>(11.87)<br>[10] | 55.00<br>(28.58)<br>[22] | 69.25<br>(32.62)<br>[12] | 55.66<br>(28.35)<br>[44] |
| Cooperator/Altruist VO greater than or equal to 0.60 radians | 91.75<br>(16.50)<br>[4] | 48.86<br>(26.09)<br>[22] | 76.02<br>(30.87)<br>[44} | 68.39<br>(31.67)<br>[70] |
| Column Total | 52.50<br>(26.81)<br>[28] | 47.79<br>(27.38)<br>[82] | 68.14<br>(31.44)<br>[72] | 56.57<br>(30.35)<br>[182] |

*Note*: Standard deviations are in parentheses and number of observations is in square brackets.

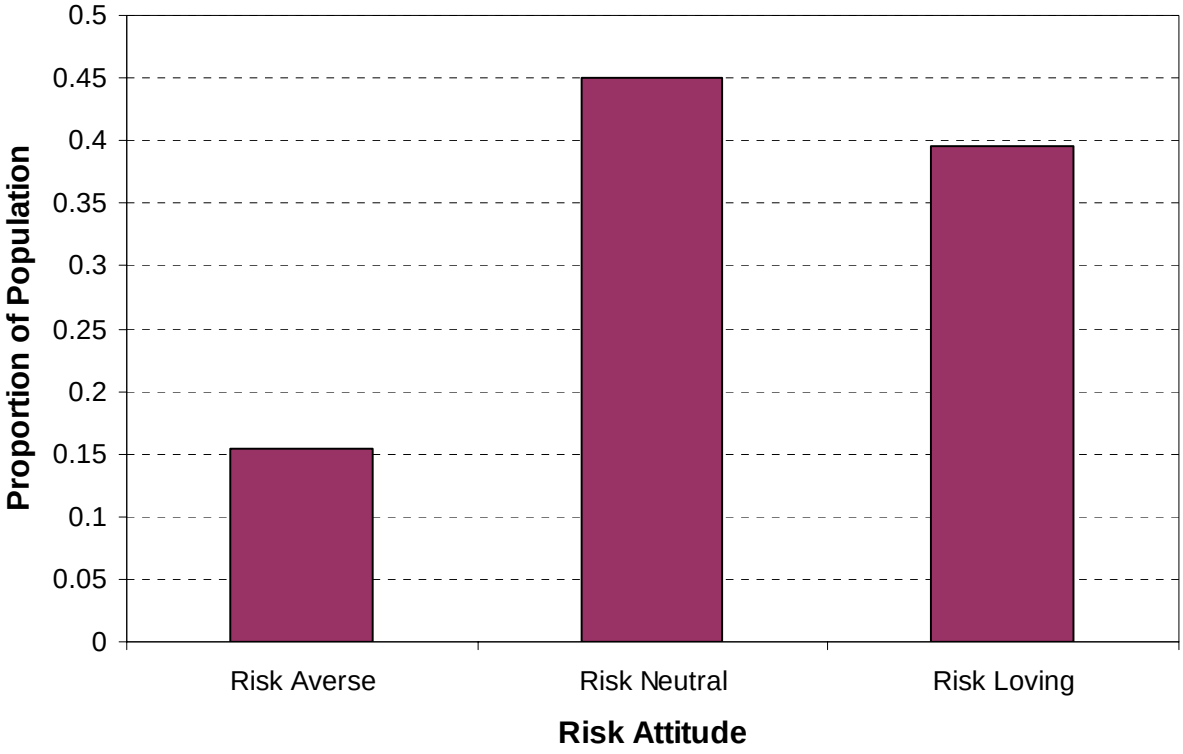



**Fig. 1. Distribution of risk attitude**

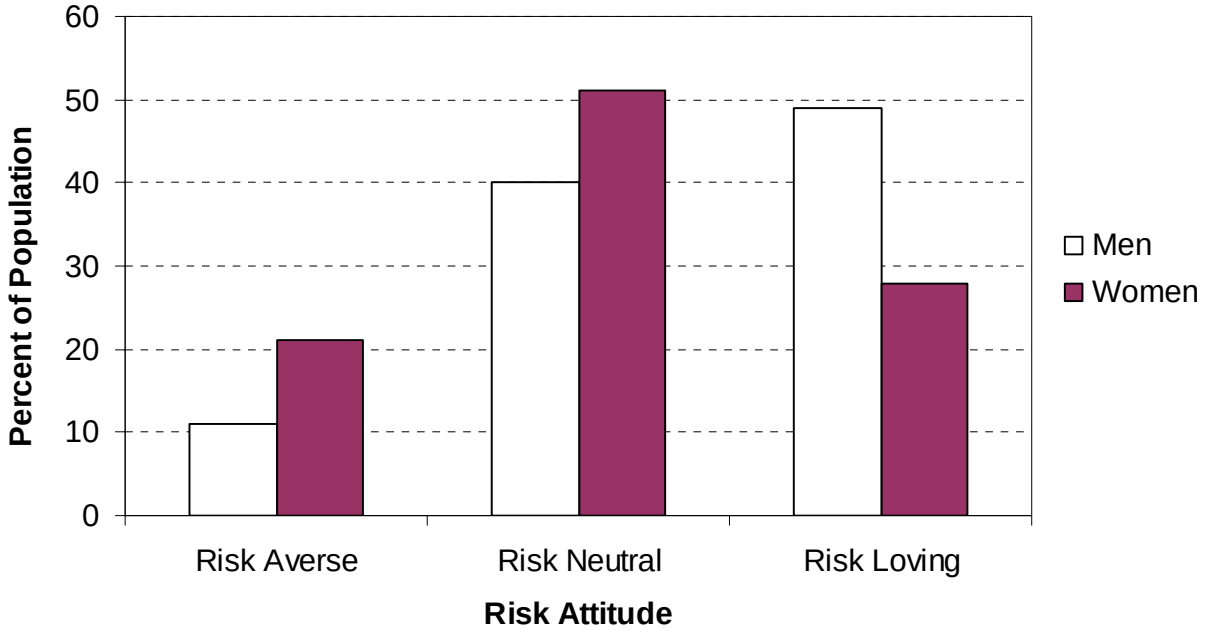
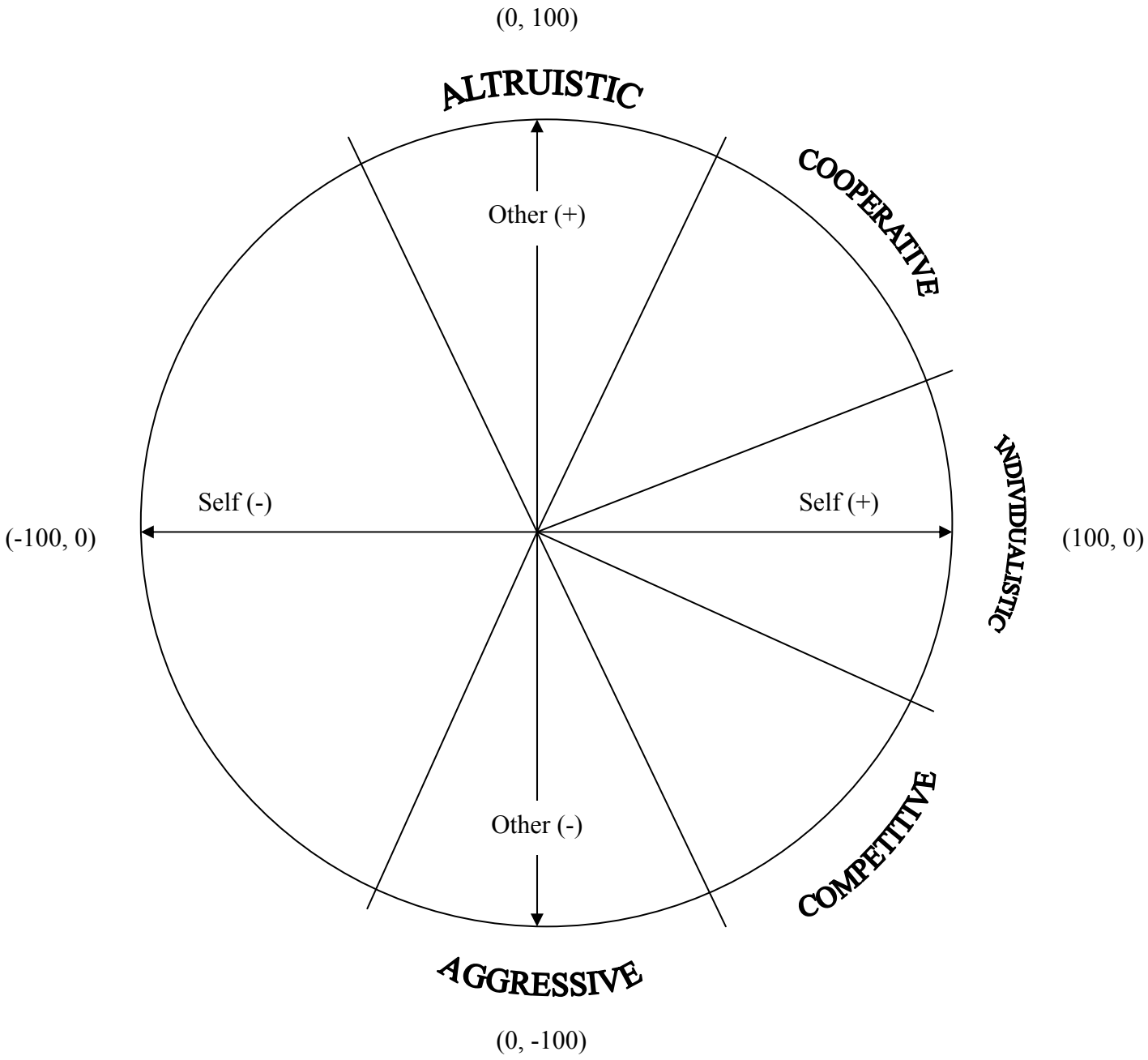



**Fig. 2. Risk attitude by sex**




## Fig. 3. The value orientation ring

*Notes*: Individuals with vectors lying between 67.5 and 112.5 degrees are altruistic, with vectors between 22.5 and 67.5 degrees are cooperative, with vectors between -22.5 and 22.5 are individualistic, with vectors lying between -67.5 and -22.5 are competitive and with vectors between -112.5 and -67.5 are aggressive.

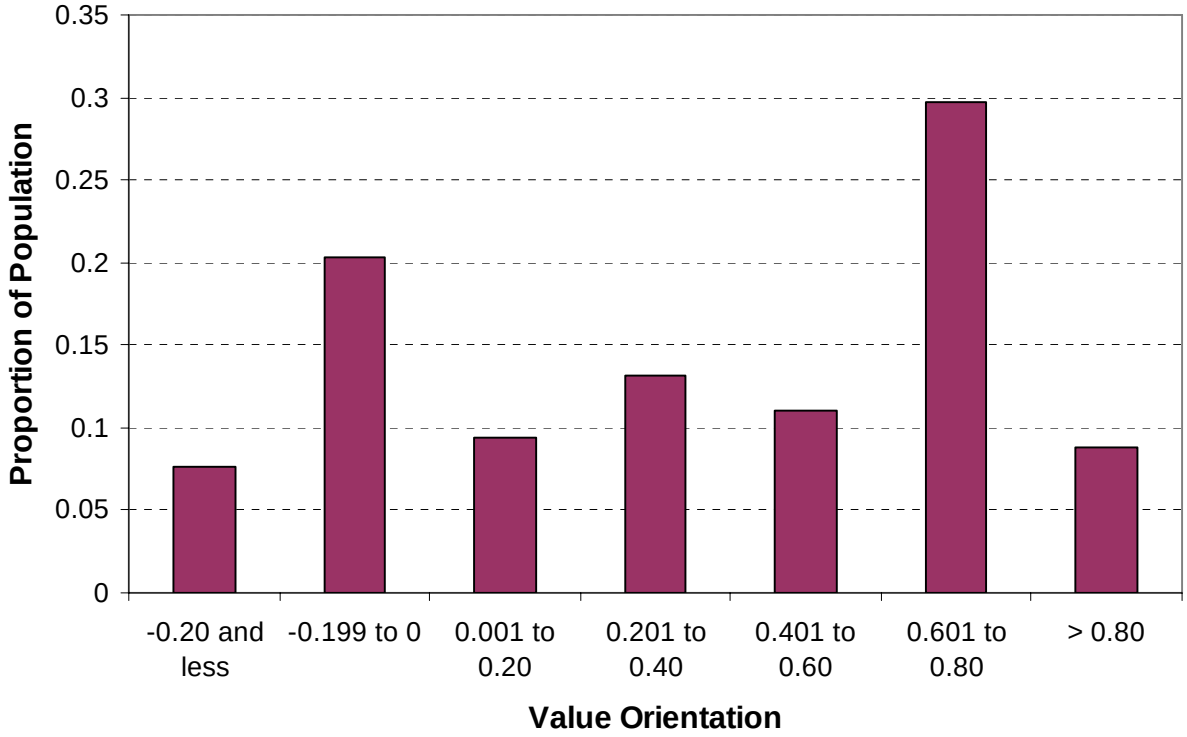



**Fig. 4. Distribution of value orientation**

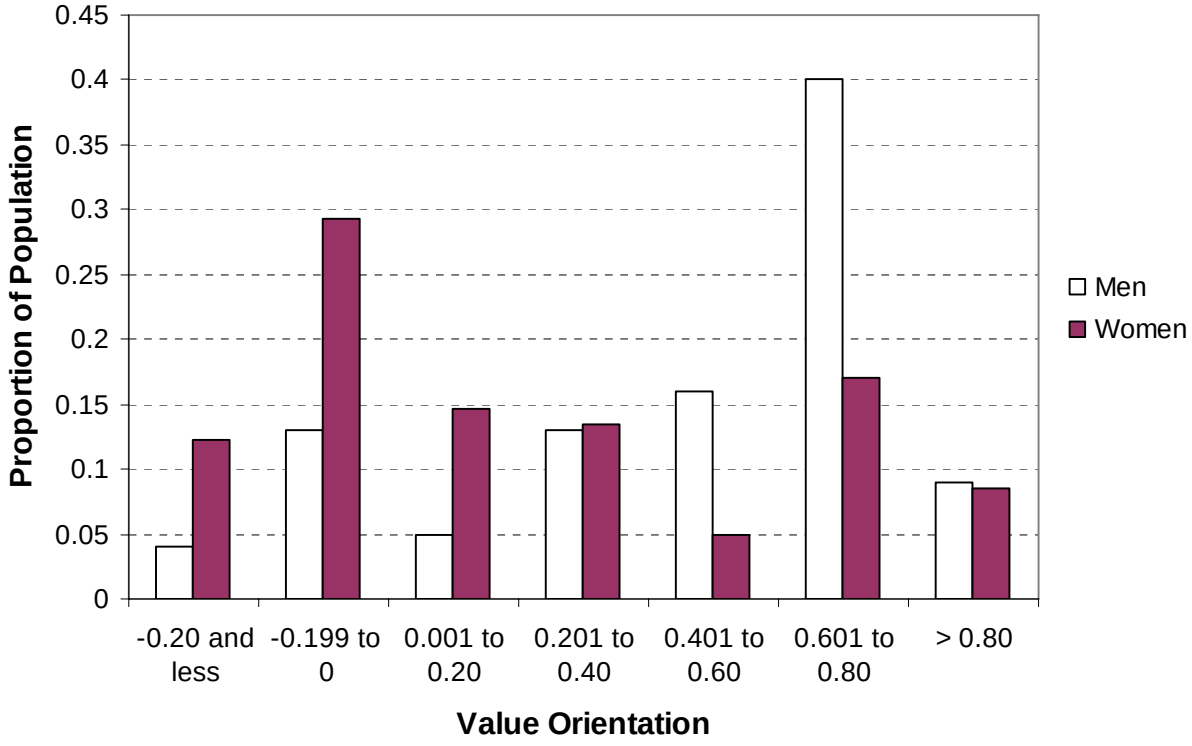



**Fig. 5. Value orientation by sex**

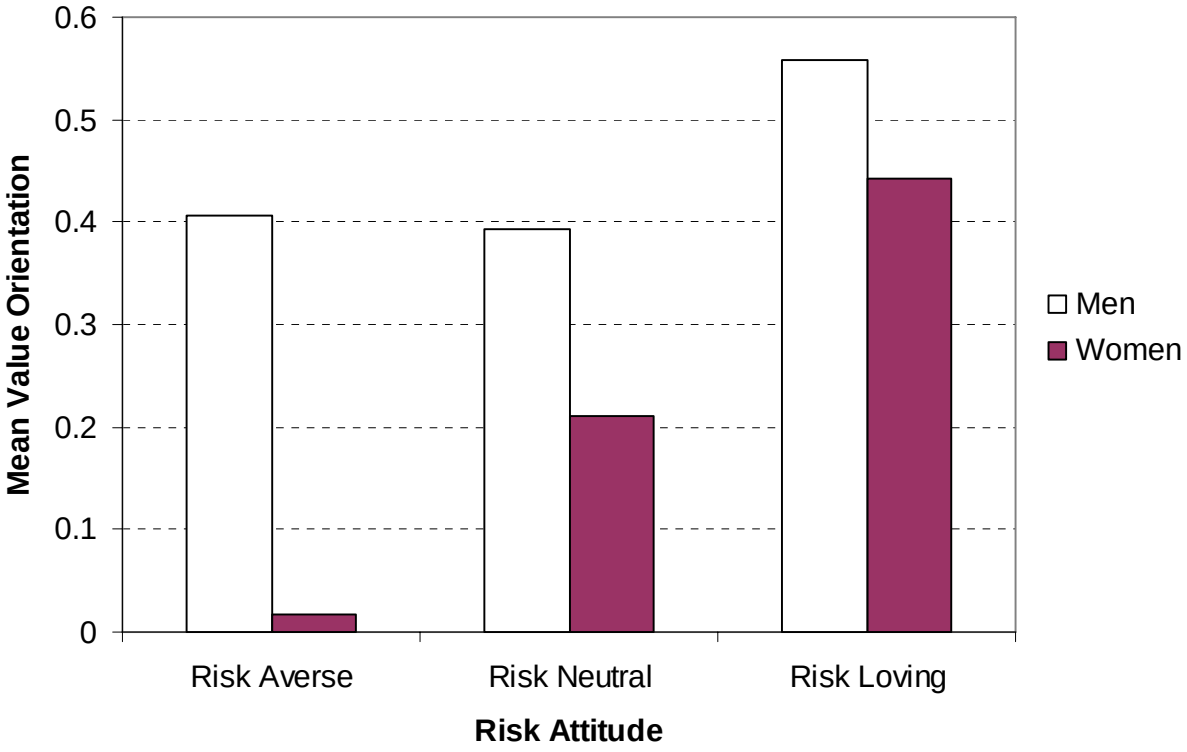



**Fig. 6. Mean value orientation by sex and risk attitude**