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The trust game behind the veil of ignorance: A note on gender differences

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Abstract

We analyze gender differences in the trust game in a "behind the veil of ignorance" design. This method yields strategies that are consistent with actions observed in the classical trust game experiments. We observe that, on average, men and women do not differ in "trust", and that women are slightly more "trustworthy". However, men's strategies are bimodal, peaking at the subgame perfect Nash equilibrium and the Pareto efficient frontier, while women's strategies are single peaked at moderate transfers. For a given high level of pro-social preferences, men send more than women. This may be linked to men willing to bear more risk than women.

JEL Classification: C72, C91

Key words: trust game, experiment, strategy method behind the veil of ignorance, gender differences

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1 Introduction

The impact of gender on economic decision-making has been studied in various contexts, including decisions under risk, in social dilemmas, and in response to competitive incentive schemes.[1] In this paper, we focus on gender effects involving trust and trustworthiness, both representing a crucial determinant of economic decisions. In a laboratory experiment, we collect each participant's strategy in both roles of the trust game. This allows us to study gender differences in trust and trustworthiness, and the relation between the two.

In the trust game, as introduced by Berg et al. (1995), two players decide in sequence. The first mover (the "sender") receives an endowment of 10 points and chooses how many to *transfer* to the second mover (the "returner"). Any amount thus transferred is multiplied by three on the way to the returner. The returner then decides how many of the received points to *return* to the sender. As sharing of the payoff generated by the sender's decision to transfer points cannot be enforced, the sender has to "trust" in the returner's decision to return some of the profit. No transaction would otherwise take place despite the fact that it could lead to a more efficient outcome. In the unique subgame perfect Nash equilibrium of the trust game, the returner will not return anything, and, therefore, the sender will not transfer anything. This is not observed in earlier experiments, whether the game is played sequentially or in a strategy method. Senders typically transfer on average around half of their endowment to returners, who often return at least some of that.[2]

The literature[3] does not identify clear gender differences in the trust game, although women tend to transfer more in either role.[4] The lack of a clear gender effect in the

[1] See Croson and Gneezy (2009) for an excellent overview.

[2] See e.g. Berg et al. (1995), Croson and Buchan (1999), Burks et al. (2003), Chaudhuri and Gangadharan (2003), and Vyrastekova and Garikipati (2005).

[3] Here we refer to the literature on gender differences in anonymous interactions, where the gender of the interacting subjects is not revealed to them. Hence, we exclude a full range of other interesting questions involving the effect of gender pairing on the behavior.

[4] Often, it is concluded that women trust more (Chaudhuri and Gangadharan, 2003, Buchan et al., 2004, Innocenti and Pazienza, 2006), and are more trustworthy (Croson and Buchan, 1999, Chaudhuri and Gangadharan, 2003, Bellemare and Kroeger, 2003, Buchan et al., 2004). However, some authors fail to find gender differences in trusting behavior (Croson and Buchan, 1999, Cox, 2002, Bellemare and Kroeger, 2003, Innocenti and Pazienza, 2006, Danielson and Holm, 2007), or observe that men trust

behavior of senders may seem surprising at first, as women are often considered to be more cooperative and more fair than men.[5] One plausible explanation is that a transfer in the trust game is perceived as a risky investment. Indeed, laboratory and field data reveal that women are, on average, more risk averse than men[6] so that gender differences in risk preferences may explain why women do not transfer more in the trust game.[7] In addition, women may be more "betrayal averse" than men.[8] Moreover, women turn out to be more pessimistic than men about the amount the returner sends back.[9]

Returners' incentives in the trust game, in turn, are easier to disentangle. In one-shot anonymous interactions, there is no way to rationalize positive returns to the sender under the assumptions of self-interested money-maximization. Any positive return points towards social preferences such as fairness, altruism, inequality aversion, and positive reciprocity (save for mistakes or boredom). So, while the sender's action can have strategic reasons and is less easy to interpret, the returner's action lends itself to disentangling pure self-interest from social preferences.

In our experiment, we confront subjects with a "behind the veil of ignorance" design, i.e. we ask them to submit both an action for the sender and a complete strategy for the returner before they know which role they play. Our study is complementary to the recent work by Buchan et al. (2008) who perform a double-blind behavioral trust experiment with each subject playing only one of the two roles, and to the work by Garbarino and

more (Buchan et al. 2008) and return more than women (Cox, 2002, albeit in a small dataset). In an internet-run experiment, Garbarino and Slonim (2009) observe that women trust less than men.

[5] For instance, Eckel and Grossman (1998), Andreoni and Vesterlund (2001), Cox and Deck (2006) and Bolton and Katok (1995), show that women transfer more in the dictator game than men (although in the last paper, the difference between transfers is not statistically significant).

[6] See Eckel and Grossman (2002) and the references therein.

[7] See Eckel and Grossman (2000) and Schechter (2007). Eckel and Wilson (2004) do not find a correlation between risk aversion and behavior in the trust game, yet Chaudhuri and Gangadharan (2003) attribute their finding that men "trust" more than women to the observation that men are less risk averse than women.

[8] A subject is betrayal averse if she dislikes losing bets to a greater extent when the randomization in a lottery is due to the choice by a human subject than when the outcome is a result of randomization performed by a machine. Bohnet and Zeckhauser (2004) report that on average, women are more betrayal averse than men.

[9] Garbarino and Slonim (2009) attribute their observation that women trust less than men for nearly half to women's expected returns being lower than those expected by men.

Slonim (2009) who perform a strategy method internet-run experiment, identifying the impact of age and gender of the co-player on subjects' decision.

We observe the following. On average, men and women send the same amount in the role of sender and women return more than men, which is in line with the majority of the existing literature. However, the distribution of the amounts sent and returned differ between men and women. It is bimodal for men, peaking at the subgame perfect Nash equilibrium strategy combination (transfer 0 points, return 0 points) and at the Pareto efficient frontier (transfer the whole endowment, return at least the amount sent by the sender). In contrast, the distribution is unimodal for women, peaking at transferring half of the endowment and returning at least the amount sent by the sender. Moreover, there is a strong and significant positive correlation between subject's trust and trustworthiness for men but not for women. For a given high level of pro-social preferences, men send more than women. As we do not control for the preferences for risk taking, this observation may be linked to men willing to bear more risk than women or men being more optimistic about the amount they receive in return. Note that this conclusion says nothing about the distribution of trustworthiness across gender, only about the levels of trust, conditionally on a revealed high level of trustworthiness.

The remainder of the paper is organized as follows. Section 2 contains our experimental design, and in Section 3, we analyze our data. In Section 4, we conclude with a short discussion as to why our behind-the-viel-of-ignorance design can be useful for researchers to obtain a picture of the subjects' social preferences using the trust game only.

2 Experimental design

We conducted 14 experimental sessions at Tilburg University, The Netherlands. The subjects were 248 students of business and economics (80 female and 168 male), who participated in a circa 1.5 hour long experimental session. In all sessions both men and women participated. The trust game was administered as Task 1 in an experiment containing three tasks. Tasks 2 and 3 are irrelevant to this paper. We made sure that

the experiment participants could understand (i) that Task 1 involved a one-time decision paired to an anonymous other participant, (ii) that they would not be able to condition further events in the experiment on decisions made in this task, and (iii) that we would not inform them about their payoff in this task before the end of the experiment. Subjects were paid for participating in the trust game: the sender's endowment of 10 experimental points 1 were worth 2.5 Euro, so that the maximum amount the subjects could distribute among themselves (if the sender transferred all his/her endowment to the returner) was 7.5 Euro. Task 1 usually lasted no longer than 10 minutes.

The experiments were fully computerized, programmed, and conducted using z-Tree (Fischbacher, 2007). Upon arrival at a session, participants were randomly seated at computer cubicles separated by blinds, and instructions were read to them outloud. (Instructions are available from the authors on request.) During the experiment, communication other than via computer was prohibited. No information was provided regarding the gender of the other participant.

The trust game was played by a strategy method and all subjects were asked to submit strategies in the roles of both sender and returner. They knew that at the end of the experiment, the computer would match them randomly to one other participant in the room and determine their role. This means that every subject was paid at the end of the experiment for one decision only. Which decision it would be, was unknown to them when they submitted their strategies.[10]

[10] Our design is most closely related to the "two-role-prior-knowledge" treatment by Burks et al. (2003), and a similar design by Chaudhuri and Gangadharan (2003). In order to be clear on the similarities and dissimilarities among our and these two papers, let us note that (1) our experiment is computerized, (2) we use a single-blind procedure, (3) subjects submit strategies for the roles of both sender and returner, and (4) they are informed ex-ante that they will be paid only for one of these roles, as determined by the computer at the end of the experiment. The "two-role-prior-knowledge" treatment by Burks et al. (1) is manually run, (2) uses a double-blind procedure, and (3) let subjects submit an action for the role of sender, and, after being matched randomly another subject and learning the sender decision of this subject, they choose an action for the role of returner. (4) Subjects are then paid the payoff consequences of their actions chosen as sender and as returner. Chaudhuri and Gangadharan (1) run their experiment manually and (2) use a single-blind procedure. (3) They let subjects submit an action for the role of sender, and subsequently they are asked to report their belief about the amount that will be returned to them by the returner. After reporting this belief, they are asked to submit a strategy for the returner, while matched to another subject, but before learning the decision taken by this subject in the role of sender. (4) Subjects are paid for both roles.

Before proceeding to the data analysis, we would like to note that most authors find strategies submitted in a strategy design experiment like ours to be consistent with actions chosen in the same game.[11] So, although there might be level-effects in terms of trust and trustworthiness in a "cold" design, as in our experiment, as compared to "hot" design, where subjects choose actions rather than submitting full strategies, the qualitative results remain unchanged. We are persuaded that the balance between the additional information provided in our design justifies its choice, and can lead to new insights, as we discuss below.

3 Data analysis

We observe the following in our experiment. On average, senders transfer 53% of the endowment to the returner; 9% of the senders transfer nothing (the Nash equilibrium prediction), while 23% of senders transfer the whole endowment to the returner. The average return by the returner as a fraction of the sender's expenditure is 1.05, hence transfers made are marginally profitable. Thus, the strategies are in line with the behavior observed in the standard one-role one-action trust game experiment.[12]

When considering gender effects in sender behavior, we find that female senders transfer on average 5.0 points (std. 2.93) and male senders transfer on average 5.43 (std. 3.38). This difference is not statistically significant (Mann-Whitney U test, $p = 0.367$). However, the Kolmogorov-Smirnov test rejects the null hypothesis of equal distributions at 10% level ($p = 0.083$): male senders make extreme choices more often than female senders. See also figure 1.[13]

Observation (sender): On average, men and women transfer the same amount in the role of sender, but the distribution of the amounts transferred is concentrated more on extremes for men while women more often choose moderate values.

Returner behavior is summarized in Figure 2, which represents how many points

[11] See e.g. Brandts and Charness (2000), Sonnemans (2000), and Offerman et al. (2001).

[12] The relevant numbers in the original one-role trust game experiment by Berg et al. (1995) are 52%, 9% and 16%, and 0.89 respectively.

[13] Chaudhuri and Gangadharan (2003) find the same gender effect.

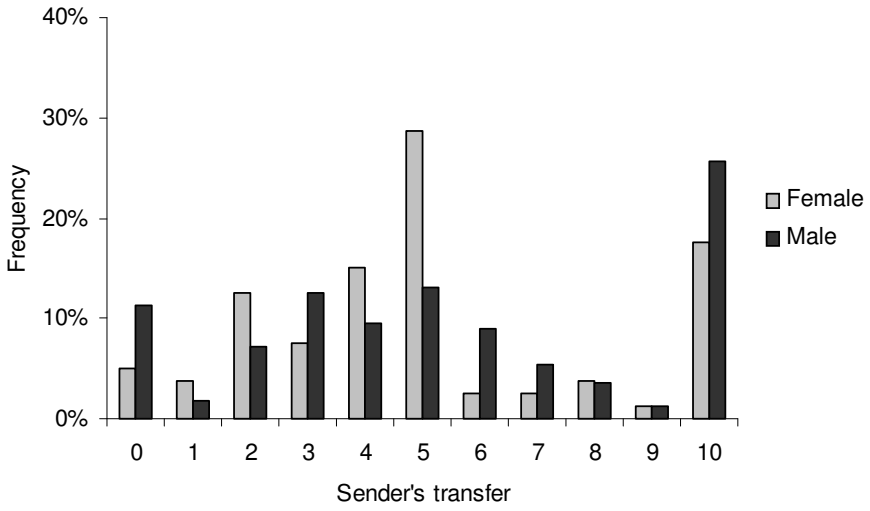

Figure 1: Sender's transfer.

senders get back relative to what they transferred, conditional on the number of points transferred. Both men and women return approximately one third of the amount received, and the fraction of returned points increases slightly with the number of points transferred by the sender - a possible indication of reciprocity, rewarding the trust (the Spearman rank-based correlation between transfer and average return equals 0.883 and 0.935 for male and female subjects respectively, with p-values of $p = 0.001$ and $p = 0.000$). Based on paired observations of average returned fraction of points for any given number of points transferred by the sender, women return significantly more than men (Wilcoxon test, $p = 0.005$); they reciprocate stronger than men.

Observation (returner): Both male and female subjects return approximately one third of the number of points that they receive, and they both show a correlation between the sender's transfer and the fraction of points the returner returns. Yet, females return on average significantly more of the received points than males.

We now combine the information from playing both roles of the game, in order to get a better understanding of gender differences, if any, in the link between trust and

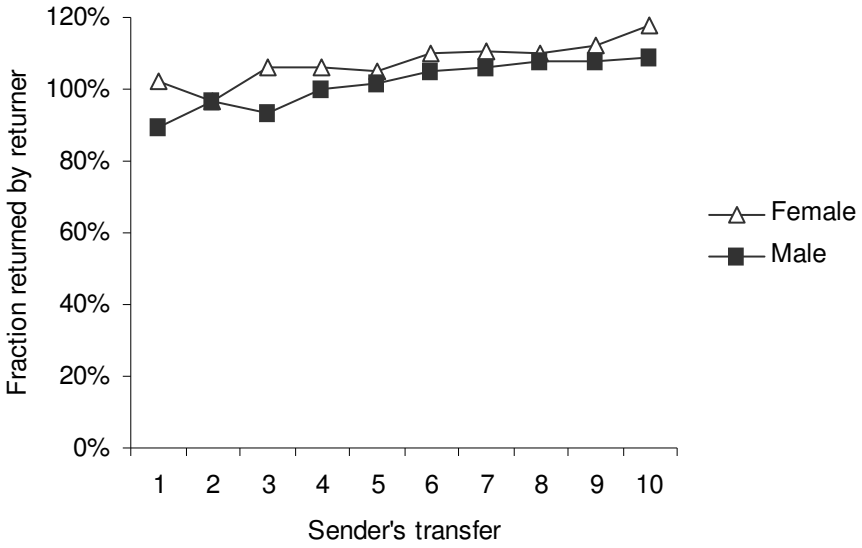

Figure 2: Fraction of points returned by the returner from the points received from the sender.

trustworthiness. A summary of all strategy combinations submitted in both roles of the trust game by men and women can be found in Figure 3. In it, a striking gender difference is evident. While the female distribution is unimodal, peaking at transfers of 5 points and returns between 33% and 50% of the tripled money received, the male distribution is bimodal. One peak lies at the transfer of 10 points and a return of between 33% and 50% of the tripled money received. The other corresponds to the theoretical subgame perfect Nash equilibrium strategy of transferring as well as returning 0 points.

We observe another strong gender difference in that only for men, there is a correlation between the amounts sent and returned. More specifically, the Spearman rank-based correlation coefficient, with a unit of observation being the individual's transfer as sender, and his/her average return as returner, is significant and positive for male subjects, and equal to 0.440 ($p = 0.000$), but it is not significant for female subjects.[14]

[14] A Tobit regression explaining trust, censoring the trust decisions at 0 and 10, reveals that for a given level of trustworthiness, the male subjects show higher trust than the female subjects. Using as explanatory variables the amount returned back as returner, gender and gender interaction with the trustee return, the interaction effect is highly significant.

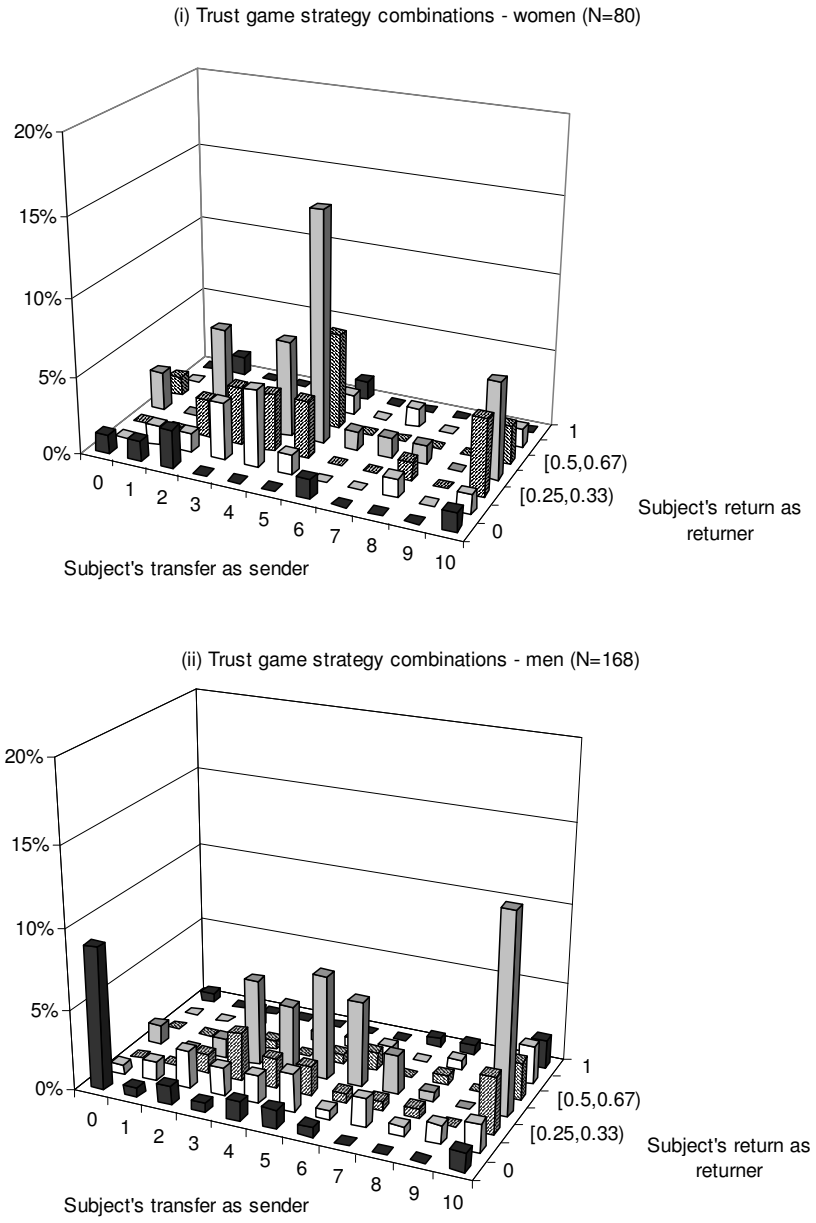

Figure 3: Trust game strategy combinations submitted by (i) women, and by (ii) men.

Observation (trust and trustworthiness): Trust and trustworthiness are positively correlated in male but not in female subjects. For a given high level of trustworthiness, male subjects show higher trust than women.

In this way, by combining the strategies submitted in the role of sender and returner, we find that the same propensity to pro-social behavior in men and women is paired with a different extent of trust demonstrated by transfers in the trust game. Given the same high level of revealed trustworthiness, men trust more than women. Based on the findings in the literature, this trust premium is likely to be traced to gender differences in factors like risk aversion or betrayal aversion.

4 Discussion

In this paper, we have studied gender differences in the trust game. We have done so using a strategy method behind-the-veil-of-ignorance design, i.e. we asked subjects to submit strategies before they know which role they play.[15] This approach is loosely connected to John Rawls' (1971) veil of ignorance which he advised to be placed between the decision maker and the society for which he/she designs a just income distribution. In this way, the decision maker has to choose the income distribution without knowing his/her own position in society.[16] In our experiment, we have not found strong gender effects in terms of the average level of trust and trustworthiness. However, we have observed a substantial gender difference in the distribution of strategies. In particular, men's trust and trustworthiness tend to be strongly positively correlated in contrast to women's.

This finding may have implications for experimental methodology in general. In the literature, a mix of motivations is recognized to shape sender behavior in the trust game, going beyond positive reciprocity and the belief in the other player's positive reciprocity. Distributional preferences, attitudes to risk, and betrayal aversion may also influence subjects' choices. A transfer made in the trust game is expected to confound several

[15] Previously, this method has been used by Vyrastekova and Garikipati (2005) when studying the role of beliefs for trust. Burks et al. (2003) and Chaudhuri and Gangadharan (2003) used a similar design.

[16] See e.g. experiments by Frohlich and Oppenheimer (2004).

aspects of individual's preferences. A researcher interested in disentangling them might have to confront her subjects with several games, leading to logistical constraints dictated by the experimental method. Such considerations can be particularly relevant in the field, where it is impractical to explain, train and perform several different games, as the researcher is constrained by the subject pool size and the spill-over effects across the various games.[17]

Our paper proposes that the combined information from both strategies of the game allows to discriminate between a high level of "trust" stemming from purely strategic decisions and one stemming from pro-social orientations. Subjects showing high trust, but returning zero in the role of a sender, can be identified as strategic money maximizers with optimistic beliefs about the amount returned. On the other hand, subjects showing higher trust and high returns in the role of a sender are those with pro-social motivations intertwined with trust. Low trust decisions can also be explained more closely, when accounting for the sender decisions. Low trust accompanied by low returns can help us to identify money-maximizing individuals with pessimistic beliefs about the trustworthiness of others, while low trust accompanied by high returns indicates pro-socially oriented individual with pessimistic beliefs about the trustworthiness of others.

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