Does players’ identification affect trust and reciprocity in the lab?

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Abstract

Reputation mechanisms are mainly based on information sharing by traders about private trading experience. Each trader can therefore rely on his own past experience as a trader and on other traders’ past experience. The former is the direct component of the reputation mechanism and the latter the indirect component (Bolton et al., 2004a). We design an experiment for isolating the direct component of the reputation system and studying its effect on the level of trust and reciprocity in a population where agents play both roles (trustor and trustee). Our experiment consists on 3 treatments of a finitely repeated investment game (Berg et al., 1995). In the reference treatment there is no reputation mechanism at all, in treatment 1 trustees can build up a direct reputation, and in treatment 2 players can build up a direct reputation for both roles. We find that trustees’ direct reputation has a positive effect on reciprocity, but does not affect the average trust in the population. Trust is significantly higher only when players can build up a reputation in both roles. We show that the increase in trust is mainly linked to the formation of mutual trust-reciprocity relations.

Keywords: Investment game, Trust, Reciprocity, Experiment, Reputation

JEL Classification: C72; C91; D63

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1 Introduction

A growing number of transactions on the Internet are realized between two anonymous individuals with no other intermediary than an internet platform\(^1\). Such transactions strongly rely on trust and reciprocity between the involved parties. Once they have agreed on the terms of trade (e.g. a unit of good and a cash transfer), each party has to honour her part of the contract. But there is no guarantee that the seller will deliver the good on time and with the promised quality. Since the buyer has to make the money transfer before receiving the sold item, he needs to trust in the trustworthiness of the seller. In order to prevent the risk of transaction avoidance or transaction failures due to low trust, internet platforms have set up reputation mechanisms to assist buyers and sellers to achieve their transactions in a less risky environment. Reputation mechanisms can take multiple forms of personal evaluation, such as rating systems, forums or statistics about successful transactions. After each transaction, the mechanism updates the participants' reputation indicators and provides feedback about their scores on demand. Such reputation mechanisms play both the role of an assurance and the role of a sanctioning device (see Keser (2003)). First, many individuals are willing to pay to interact with a person who has a good reputation (Houser and Wooders, 2006; Resnick et al., 2006; Lucking-Reiley et al., 2007). These papers showed that for the same item, buyers on e-Bay are more likely to choose a high-reputation buyer who charges a high price rather than a low-reputation buyer who charges a low price, in order to secure their transactions. Second, the perspective of degrading the reputation of the other party acts as a credible threat: the threat of having a lower probability of favorable transaction opportunities in the future induces trustworthiness for the seller who becomes more likely to honour her part of the contract in order to keep or improve her reputation.

Because reputation mechanisms play a key role for fostering transactions in electronic

\(^1\)For example E-bay, Amazon, Craigslist . . .
markets, improving their performance requires a better understanding of their properties. In this respect experiments can prove useful to explore various aspects of these mechanisms, since today no standard reputation management system has been identified yet and no guidelines for designing efficient reputation mechanism have been proposed. Several experiments were already designed in order to address the issue of effectiveness of reputation mechanisms for fostering trust and reciprocity among individuals (Keser, 2003; Bolton et al., 2004a; Bohnet et al., 2005). The experiment by Keser (2003) relied on the investment game (Berg et al., 1995) to compare the effectiveness of two feedback forums that differ according to the depth of their memory: a short-run reputation mechanism and a long-run reputation mechanism, where the latter is similar to the one implemented on e-Bay. She found that the long-run reputation mechanism leads to substantially higher trust and reciprocity levels than the short-run reputation mechanism. In the experiment of Bolton et al. (2004b) a two-player symmetric trust game is played repeatedly by strangers. They compare a baseline treatment without feedback to a treatment with feedback for which players are informed about past decisions of the trustee. They found that introducing a feedback mechanism improves substantially the efficiency of transactions compared to the baseline treatment, because of higher trust and reciprocity. However they also observed that repeated pair-wise interactions between partners improves even more efficiency even if there is no feedback. Bohnet et al. (2005) also investigated a simple trust game but with asymmetric payoffs. They compare a so-called one-sided market transparency condition where the trustors only can observe the trustees’ past choices, to a two-sided market transparency condition, where both the trustors and the trustees observe trustees’ past actions. They found that the two-sided market transparency strongly enhances players’ reciprocity compared to the one-sided market transparency.

The underlying principle of such reputation mechanisms is private information sharing among traders about their past trading experience. This implies that traders
have access to two different information sets: the outcomes of their own past trading interactions, and the outcomes of other traders’ past interactions. The key is that through the reputation mechanism these two information sets become common knowledge. Before deciding to make a transaction an agent can therefore rely on his own past experience as a trader and on other traders’ past experience. The common knowledge property of the reputation system is therefore the outcome of the combination of these two components: the direct component which is based on private experience, and an indirect component based on others’ experiences. But such a combination of private information sets is possible only if players can be identified. Ultimately, reputation mechanism are based on the possibility of identifying individuals. Therefore, understanding how reputation affects trust and reciprocity among interacting individuals, requires in the first place an understanding of how identification as such affects these variables. An extreme case arises when a given player interacts exclusively with a single player and this fact is common knowledge. According to the results of Bolton et al. (2004a)’s experiment, this situation has the strongest impact on trust and reciprocity suggesting that identification is an imperfect substitute for repeated personal interactions (see also Cochard et al. (2004), for similar results). Still, the role of identification is unknown, since the previous experimental literature did not distinguish between the two components – direct and indirect – of the reputation mechanism. These studies rather investigated the extent to which common knowledge of past experience affects trust and reciprocity behavior, assuming non-strategic rating of market interactions. Issues, such as the weight that an individual puts on her own private information or on others’ private information remain therefore open questions. The most basic outcome of identification is that it allows a trustor to condition his current decision not only on his overall past experience, but also on the specific outcome of his past interactions with the trustee with whom he is currently matched. We conjecture that identification as such induces a dramatic change in the behaviour of trustees because they can no
longer exploit their informational advantage with respect to the trustors.

In this paper our purpose is therefore to isolate the private and non-strategic component of the reputation system which is precisely the outcome of identification. We designed an experiment aiming at identifying the effect of private reputation on trust and reciprocity within a group of individuals. This is done by allowing each individual to keep track of his past interactions with other players, each of whom is identified by a public ID. Therefore at each new round, an individual can check the outcomes of her past interactions with the player with whom she is currently matched. Players accumulate knowledge round after round and can therefore condition their current decision on more and more information about past interactions. Interestingly, they can condition their current decision not only with respect to past interactions with the currently matched player but also relatively to past interactions with other players. This means that identification may have two effects: an absolute effect and a relative effect.

To achieve our goal we set up an environment where each player has a chance to meet different players, and where the frequency of encounters between two players is sufficiently high to allow for direct reputation to build up. We do this by randomly pairing participants within groups of 6 players for each round and repeating the game for 30 rounds. As in Keser (2003) we rely on the investment game of Berg et al. (1995). Recall that the investment game involves two roles: the role of player $A$ (the trustor) and the role of player $B$ (the trustee) both having the same initial endowment, e.g. 10 Experimental Currency Units (ecu). Player $A$ first decides how much of his endowment ($S$) to send to player $B$. Player $B$ than receives $3S$ and can decide to reciprocate ($R$) any amount to player $A$ between 0 and $3S$. The game admits a unique subgame Nash equilibrium ($S = R = 0$), while the socially optimum is reached if $S = 10$, independently of $R$. In the case of a one-shot interaction Berg et al. (1995) found that most trustors send positive amounts and that most trustees reciprocate. However trustors do not earn significantly more than 10 ecus while
trustees earn significantly more. When the game is repeated between player pairs both the trust and the reciprocity levels increase significantly (Cochard et al., 2004; Anderhub et al., 2002; Bolton et al., 2004a). These effects are predicted by repeated game effects such as reputation building like in the sequential equilibrium (Kreps et al., 1982) but also by reciprocity theories (trustees reward higher trust with higher reciprocity, Falk and Fischbacher (2006)).

We allow our participants to play both roles (trustor and trustee), in order to let them accumulate experience with respect to each role. Playing both roles is somehow closer to real situations, since in many electronic markets individuals act both as buyers and as sellers, and therefore accumulate knowledge with respect to both roles. Burks et al. (2002) found that in a one-shot experimental investment game, playing both roles reduces subjects’ average trust and average reciprocity compared to single role playing. Their explanation is that subjects feel less responsible for their counterpart’s well being because their final payoff depends on two independent decisions instead of a single decision as in the benchmark investment game. However, we do not know if this explanation holds if the game is repeated. Allowing for both roles enables us to distinguish between reputation as a trustee and reputation as a trustor. Specifically, we consider three treatments in our experiment. In the baseline treatment (complete anonymity), players are simply randomly paired without knowing with whom. They accumulate therefore experience through repeated interactions. In a second treatment (private identification of the trustee’s role) trustees are identified. Therefore in each round each trustor knows with which trustee he is interacting, but the outcome of each interaction remains private information. This treatment allows to isolate the effect of the identification of trustees, i.e. the private reputation of the trustee. In a third treatment (private identification of both roles) both the trustors and the trustees are identified. Therefore, in any given round, each individual knows with which trustee he is interacting as well as with which trustor he is interacting. The comparison of the baseline and the second treatment allows
us to identify the effect of trustee’s identification on trust and reciprocity. The comparison of the second and third treatment allows us to capture the additional effect of the trustor’s reputation.

Why considering a two-sided reputation system where both roles are identified? In such a system trustors know that they can be matched again with the same player than in the past but possibly with opposite roles. This opens up new possibilities of assurance and sanctions. For instance a trustor who granted low trust to a trustee in a past round, might therefore be granted with low trust as well if matched again in a future round with the same counterpart when roles are reversed. Reputation for both roles thus opens the possibility to reciprocate trust by trust and to built up bilateral trust-reciprocity relationships, by acting cooperatively in both roles a possibility that is precluded in the one-sided reputation system. We expected therefore that adding the trustor’s role reputation to a system of trustee’s role reputation, would increase the level of trust, because trustors are more likely to expect that their trust will be reciprocated in later rounds.

We summarize our main findings as follows: 1) private identification of trustees increases reciprocity, 2) adding private identification of trustors increases the average level of trust, 3) private identification of trustees alone does not effect the level of trust, 4) adding private identification of trustors has no additional effect on reciprocity. Analyses at the individual level furthermore reveals that “reputation variables”, i.e. the available information about past interactions, strongly affects trust decisions, as conjectured, but has no effect on reciprocity decisions. Finally, we show that the higher trust levels observed under both roles identification can be attributed to the emergence of bilateral trust-reciprocity relationships within the population.

The remainder of the paper is organized as follows. In section 2 we describe our experimental design. In section 3 we present the results at the aggregate level. Section
4 investigates the determinants of the individual decisions. In section 5 we analyze the emergence of trust-reciprocity relations within groups. We conclude in section 6.

2 Experimental design

108 student subjects, randomly selected from a pool of volunteers from various faculties participated in the experiment\(^2\). None of the recruited subjects had ever participated in an experiment on social dilemma. We ran 6 sessions involving 18 subjects each divided into 3 treatments (2 sessions per treatment): no identification, trustees’ identification, trustors’ and trustees’ identification. In the “no identification” treatment (NI) trustors only knew that an anonymous player X of their group will receive three times the amount sent, and trustees only knew that the amount that they received was sent by an anonymous player Y of their group. In the “trustees’ identification” treatment (TI) subjects acting as a trustee were identified by a letter. Before taking their decision, trustors knew the identity (B, C, D, E or F) of the trustee with whom they were matched. To keep the identification private information for each member of the group, the identification labels differed from player to player. For example for player 1, player 2 was identified by the label B, player 3 by C, player 4 by D and so on. For player 2 in the group, player 1 was identified by the label B, player 3 by the label C, player 4 by D and so on. In the “trustors’ and trustees’ identification” treatment (TTI) each subject was identified by a unique letter, B, C, D, E or F. This letter was the same for both roles. In each round, before taking his trusting decision each trustor was aware of the identity of the trustee with whom he was paired, and each trustee knew the identity of the trustor assigned to him.

\(^2\)The experiment was conducted at the experimental lab of Montpellier, France.
Upon arriving at the lab subjects received written instructions. After reading the instructions they answered a short computerized questionnaire to check their understanding. Before beginning the experiment each subject was randomly assigned to a group of 6 players. Subjects participated in a (finitely) repeated investment game (Berg et al., 1995), played for 30 periods, in which they simultaneously played both roles (trustor and trustee, Burks et al. (2002)). In each period, each subject was randomly paired with two other players: as a trustee each subject was randomly paired with a trustor selected among the five other group members, and as a trustor he was likewise randomly paired with a trustee selected among the five other members of his group. In each of the 30 periods, the game started with allocating an endowment of 10 ecus (Experimental Currency Unit) to each participant. Thereafter, each subject had first to take a decision as a trustor. Once all the group members had taken their investment decision, each participant was informed about the amount he received as a trustee. Then he had to choose, as a trustee, how much of his received amount he wanted to return to his trustor. Once each subjects had decided how much to send back to his counterpart, a screen summed up the decisions for the current period: the amount sent and returned as trustor, the amount received and sent back as trustee and the payoff for the period. Below this data a table with the history of the past periods interactions was displayed (cf. the screenshot in the instructions). Furthermore, at any time, subjects could access to the records of their past interactions by clicking a "History" button. The records of past period decisions displayed the amounts sent as a trustor and returned by the trustee, the amount received as a trustee and sent back to the trustor, the earnings of the period and the cumulative earnings since the beginning of the game. In the TI treatment an additional column displayed the label of the trustee, and in the TTI treatment, another additional column displayed the label of the trustor.

3Instructions, as well as additional tables and graphs, are available on the website http://www.duboishome.info/dimitri/pages/index.php?page=trustIdentificationAppendix&lang=eng
4It could be the same one
At the end of the experiment subjects were paid in cash according to the amount in
ecus accumulated during the game. The conversion rate was stated in the instruc-
tions: 1 ecu = 0.03 euros.

3 Aggregate results

<table>
<thead>
<tr>
<th></th>
<th>NI</th>
<th>TI</th>
<th>TTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust</td>
<td>3.76</td>
<td>4.14</td>
<td>4.98</td>
</tr>
<tr>
<td>Reciprocity(^a) (%)</td>
<td>19.78</td>
<td>25.41</td>
<td>24.87</td>
</tr>
<tr>
<td>Net payoff as trustor(^b)</td>
<td>-1.45</td>
<td>-0.54</td>
<td>-0.49</td>
</tr>
<tr>
<td>Net payoff as trustee(^b)</td>
<td>8.97</td>
<td>8.81</td>
<td>10.45</td>
</tr>
<tr>
<td>Final payment(^c)</td>
<td>15.77</td>
<td>16.45</td>
<td>17.96</td>
</tr>
</tbody>
</table>

\(^a\) Calculated only for positive sendings, \(^b\) in ecus, \(^c\) in euros.

Table 1: Averages for each treatment

Table 1 compares average outcomes across treatments: the average amount invested
in the trustor’s role, the average percentage returned in the trustee’s role (for positive
investment), the average payoff for the trustor’s role, and the average payoff for
the trustee’s role. Result 1 states our main findings about the effects of private
identification, with respect to the benchmark condition.

We use the word identification to mean private identification or equivalently private
reputation.

Result 1

(i) Trustees’ identification significantly increases reciprocity but has no effect on
trust,

(ii) Both roles identification increases significantly average trust and average recip-
rocit,

10
Both roles identification increases significantly average trust compared to trustee’s identification only.

Average trust in the NI treatment (3.76) is lower than in the TI treatment (4.14), and the latter is lower than in the TTI treatment (4.98). The comparison between the NI and the TI treatment does not reveal any significant difference in the average level of trust\(^5\) (Mann Whitney Unilateral U-test (thereafter MW) p-value=0.409) while the average trust in the TTI treatment is significantly higher than in the two other treatments (MW, TTI vs. NI p-value=0.047, TTI vs. TI p-value=0.047). With identification (TI and TTI) the average reciprocity is significantly higher than without (MW, TI vs. NI p-value=0.066, TTI vs. NI p-value=0.066). However the difference between treatments TI and TTI is not significant (MWU p-value=0.469).

Figure 1 shows the evolution of the average level of reciprocity for each treatment. Identification has a positive effect on the reciprocity level at the beginning of the game. In the first period the average reciprocity is equal to 27.04% in the NI treatment, 36.03% in the TI treatment and 32.80% in the TTI treatment, respectively. In treatments with identification the average reciprocity in period 1 is close to one third and is significantly higher than in the NI treatment (MW, NI vs TI p-value=0.021, NI vs TTI p-value=0.032). There is no significant difference between the TI and the TTI treatments however (p-value=0.120). The TI and TTI curves follow closely the same path, while the NI curve lies clearly below the former ones.

Figure 2 reports the evolution of average trust in the three treatments. In the first period of play average trust is equal to 4.72 for the NI treatment, 4.33 for the TI treatment and 4.92 for the TTI treatment. These averages are not significantly different however (MW, NI vs. TI p-value=0.211, NI vs. TTI p-value=0.531, TI

\(^5\)Since in our experiment the group is the statistical independent unit, all the non parametric tests performed later in the article are based on the group (statistical measure for the 6 groups of one treatment vs. the same statistical measure for the 6 groups of another treatment (or the same if Wilcoxon test)).
Figure 1: Evolution of reciprocity for each treatment

dvs. TTI p-value=0.167). But with repetition of the game, the average trust in the
TTI treatment becomes larger very early compared to the two other treatments.
Indeed, from period 2 average trust in treatment TTI is slightly more than 50% of
the endowment. The average investment stays at this level until period 20 of the
game. Such a high level of average trust is never reached in the other treatments.

Result 2

(i) Subgame perfect strategies are significantly more frequently chosen under com-
plete anonymity,

(ii) “Full trust” is significantly more frequent when both roles are identified,

(iii) Average reciprocity is positively correlated to the investment level in all treat-
ments.
Figure 2: Evolution of trust for each treatment

Figure 3 reports the choice frequencies of each level of trust for the three treatments. A pair-wise one-sided Kolmogorov-Smirnov test reveals that distributions do not differ significantly (NI vs. TI p-value=0.441, NI vs. TTI p-value=0.441 and TI vs. TTI p-value=0.695). Nonetheless it is worth pointing out that in each treatment one strategy is more frequently chosen than the others. In the NI treatment “no trust” (zero investment) is the most frequently chosen strategy (25.09%), which is larger than in the TI treatment (12.78%, MW p-value=0.064) and in the TTI treatment (13.61%, MW p-value=0.074). In the TI treatment, the most frequently chosen strategy corresponds to sending half of the endowment, which represents 18.15% of

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6If we pool the data into three categories (no-trust (investment of 0), intermediary trust (investment between 1 and 9 ecus) and full trust (investment of 10 ecus), a chi-square test cannot reject the null hypothesis that distributions are independent from each other ($\chi^2= 15.021$, p-value= 0.005).

7For this test we took the average frequency of the zero investment of the 6 groups of each treatment and we applied a Mann Whitney test. We performed the same way for the investment of 5 and 10.
the choices. The corresponding frequency in the NI treatment is 11.30% which is significantly lower than in the TI treatment (MW p-value=0.067). Although the TTI treatment has a lower frequency (13.52%), the difference with the TI treatment is not significant (MW p-value=0.131). Finally, full trust (sending the whole endowment) is the most frequently chosen strategy in the TTI treatment. The difference is significant with respect to the two other treatments (MW, TTI vs NI p-value=0.010 and TTI vs TI p-value=0.071).

In the NI treatment null reciprocity represents slightly more than 40% of the trustees’ decisions\(^8\), which is significantly more than in the two treatments with identification (TI: 21.34%, MW p-value=0.013 and TTI: 21.76%, MW p-value=0.013). Comparing treatments TI and TTI the difference is not significant however (MW p-value=0.591).

\(^8\)A graph showing the frequencies of reciprocity decisions is available online, see footnote 3 for the url.
Figure 4: Average reciprocity for each investment level, in the three treatments

Figure 4 reports the average reciprocity for each level of trust. For all treatments the Spearman correlation coefficient between the investment level and average reciprocity is significantly positive (NI: 0.661 p-value=0.042, TI: 0.867 p-value=0.002 and TTI: 0.903 p-value=0.001).

Following Kreps et al. (1982) and Kreps and Wilson (1982)’s arguments, trustees’ private identification may be sufficient for enhancing trust and reciprocity compared to an environment with anonymous players. Indeed it introduces a direct reputation mechanism that creates incentives for trustees to be trustworthy. Trustors who are aware that trustees have an incentive to reciprocate might therefore increase their level of trust. Accordingly we conjectured that trustees’ identification leads to

\footnote{A Mann Whitney one-sided test based on correlation coefficients by groups reveals that in the TTI treatment the correlation is significantly stronger than in the two other treatments (TTI vs. NI p-value=0.013 and TTI vs. TI p-value=0.039), while no such difference appears in the comparison between treatments NI and TI (p-value=0.242).}
higher levels of trust and reciprocity. As stated in result 1 trustees’ identification has a significantly positive effect on reciprocity but no effect on trust. This positive effect on reciprocity is present in the very first period of the repeated game, suggesting that subjects take into account the individual incentive to be trustworthy. Evolution of reciprocity is also affected by identification: without identification reciprocity decreases continuously over time while it remains at a high level under identification. However the increase in average reciprocity is not sufficient for subjects acting as trustor to become more trustful. This is line with Bolton et al. (2004a) who observed that trustors behave more trustfully when they interact in fixed pairs rather than with identified stranger trustees. Several reasons can explain such a difference. First when only trustees are identified interactions remain partially anonymous since the trustor’s investment decisions are not identified by the trustee. Second, because of the random matching procedure, the number of interaction periods for a given player pair (one trustor, one trustee) is unknown. Although the expected number of encounters is equal\(^{10}\) to 6 (at the beginning of the game), each interaction may be the last one, which can make the trustor mistrustful despite the reputation system. Finally, even if a given trustor is matched with the same trustee several times, between two successive encounters, both the trustor and the trustee accumulate experience by interacting with others and by observing various outcomes, which may influence their future behavior.

As shown by our data the average trust increases in our random matching environment when trustors are also identified. The positive effect of adding trustors’ identification is present in the very first period of play. Moreover average trust stays at a high level for most periods in contrast to treatments where trustors’ identification is not feasible. Result 2 states that equilibrium strategies are significantly more frequently chosen in the complete anonymity environment, while trustees’ identification leads to fewer equilibrium outcomes and more surplus-sharing. This result is\(^{10}\)Remember that groups are of size 6 and that the game is repeated 30 periods.
compatible with our hypothesis that trustees have an incentive for behaving more trustworthy when their decisions are privately observed by counterparts with whom they are likely to interact in future rounds. However, it is only when subjects are also identified in their trustors’ role that they act in a more efficient way, by sending larger amounts (in particular “full trust”). While several reasons may explain this outcome, we argue that adding trustors’ identification (i) allows trustors to signal their cooperative intentions to achieve a more profitable outcome in their pair, and (ii) provides trustors with a credible option to punish an untrustworthy trustee, i.e. acting in a non-reciprocal way when roles are reversed. This can be achieved if the trust decision can rely on identification variables. In the next subsection we try to evaluate to what extent subjects relied on these identification variables to take their trust and reciprocity decisions at the individual level.

4 Individual determinants of decisions

In this section we investigate the determinants of subjects’ trust and reciprocity decisions, on the basis of individual data. The key assumption underlying our experimental design is that subjects rely on available data about their counterparts when choosing the amount to send and to return. In particular, whenever trustees are identified, we hypothesize that the trustor will send a larger amount because untrustworthy trustees will not be trusted anymore in future interactions losing therefore an opportunity to make a large gain. We now try to estimate the relative weight trustors put on past observations of trustees’ decisions when taking their current trusting decision. Reciprocity decisions seem to be sensitive to trustees’ identification but not to trustors’ identification.

We performed tobit regressions with random effect separately for trust and reciprocity decisions in order to identify which variables affect each of these decisions at the
individual level\textsuperscript{11}. The general form of the model is given in (1).

\[ y_{it}^* = \beta' x_{it} + u_{it} \]  \hspace{1cm} (1)

where \( u_{it} = v_i + \epsilon_{it} \) with \( v \sim NID(0, \sigma_v^2) \) and \( \epsilon_{it} \sim NID(0, \sigma_t^2) \).

**Trusting decisions**

The tobit specification of \( y_{it}^* \) for the trusting decision is given in equation (2).

\[
y_{it} = \begin{cases} 
0 & \text{if } y_{it}^* < 0 \\
y_{it}^* & \text{if } 0 \leq y_{it}^* \leq 10 \\
10 & \text{if } y_{it}^* > 10
\end{cases}
\]  \hspace{1cm} (2)

The independent variables of the model (\( \beta \)) are the following: Sent is the amount sent to the trustee, Returned is the amount returned by the trustee, Received is the amount received from the trustor and Sent back is the amount sent back to the trustor. Those four variables are included in the model with a lag of one period (\( t - 1 \)) since the investment decision is the first stage decision of each round. For treatments TI and TTI we include two additional variables: the amount sent by the trustor to the current counterpart in their previous interaction (Sent to \( j_{t-1} \)) and the amount returned by the latter in this interaction (Returned by \( j_{t-1} \)). Finally for treatment TTI we add two more variables: the amount received as a trustor from the current trustee acting as a trustor in the previous interaction (Received from \( j_{t-1} \)) and the amount returned to the current trustee acting as a trustor in that interaction (Sent Back to \( j_{t-1} \)). The values of these variables were easily accessible to the participants simply by checking their "history" file.

\textsuperscript{11}Behavioral econometric modeling cannot avoid the issue of potential endogeneity of explanatory variables. There is no guarantee that the estimates are immune to an endogeneity bias. Therefore, when commenting the results of behavioral econometric models, one must always bear in mind that there is a potential endogeneity bias.
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<tr>
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<th>NI</th>
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<td></td>
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<tr>
<td>Sent(_{t-1})</td>
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<td>9.55</td>
<td>0.1922273**</td>
<td>5.38</td>
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<tr>
<td>Returned(_{t-1})</td>
<td>0.1667645**</td>
<td>5.24</td>
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<td>Received(_{t-1})</td>
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<td>ns</td>
<td>0.0307914**</td>
<td>2.95</td>
<td>0.0357027**</td>
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<td>Sent back(_{t-1})</td>
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<td>Sent to j(_{t-1})</td>
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<td>-</td>
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<tr>
<td>Returned by j(_{t-1})</td>
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<td>-</td>
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</tr>
<tr>
<td>Received from j(_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Sent back to j(_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.315237**</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.7217781*</td>
<td>2.03</td>
<td>0.5053225</td>
<td>1.80</td>
<td>0.2364482</td>
</tr>
<tr>
<td>Sigma u</td>
<td>1.73557**</td>
<td>6.49</td>
<td>0.7898952**</td>
<td>5.47</td>
<td>1.140862**</td>
</tr>
<tr>
<td>Sigma e</td>
<td>3.036915**</td>
<td>33.92</td>
<td>2.341619**</td>
<td>35.47</td>
<td>2.996727**</td>
</tr>
<tr>
<td>N</td>
<td>1044</td>
<td>900</td>
<td>796</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rho</td>
<td>0.2462</td>
<td>0.1022</td>
<td>0.1266</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald (\chi^2) (p-value)</td>
<td>228.03 (0.000)</td>
<td></td>
<td>450.42 (0.000)</td>
<td>560.68 (0.000)</td>
<td></td>
</tr>
</tbody>
</table>

** significant at 1%, * significant at 5%, ns not significant at the 10% level

Table 2: Determinants of trust decisions

<table>
<thead>
<tr>
<th></th>
<th>NI</th>
<th></th>
<th>TI</th>
<th></th>
<th>TTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>y fitted value</td>
<td>3.2333095</td>
<td>3.8503562</td>
<td>5.1471844</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Elasticities of trust
Table 2 reports the estimates\(^{12}\) and table 3 reports the elasticity of the level of trust with respect to each independent variable, calculated at the mean value of the sample. In the NI treatment, where players interact anonymously, trustors’ current trust level depends essentially on their past behaviour. Accordingly, the only non-significant variable is $\text{Received}_{t-1}$, the amount received in the previous period. The impact of past trust (which has a elasticity of 0.55 in the NI treatment) is sharply reduced in the TTI treatment at the benefit of the variable $\text{Returned by } j_{\tau-1}$, which corresponds to the past reciprocity of the trustee with whom the trustor is matched in the current period. The variable $\text{Sent to } j_{\tau-1}$ has the second highest elasticity (and a positive impact), suggesting that the amount sent to the current counterpart in the previous interaction has a strong impact on the current trusting decision. This is further confirmed in the TTI treatment, where the trustor can observe the past behaviour of the trustee with whom he is currently matched, in both roles. Three out of four identification variables have a significantly positive effect on the current trust level. The most relevant variables are those related to the trustees’ reciprocity: the elasticities of the variables $\text{Returned by } j_{\tau-1}$ and $\text{Sent back to } j_{\tau-1}$ are 0.33 and 0.30 respectively, compared to 0.14 for $\text{Sent to } j_{\tau-1}$. This suggests that the past trusting decision towards the current trustee has a lesser impact than the latter’s past reciprocity in this past interaction, and as the current trustor’s own reciprocity when the roles where inverted.

Reciprocity decisions

The left and right censures are provided in equation (3).

\(^{12}\)Starting from the complete model of equation (1) with the variables listed in the previous paragraph, the coefficients in the table are obtained after a stepwise elimination of the non-significant variables (at the 10% level of significance).
<table>
<thead>
<tr>
<th></th>
<th>NI</th>
<th></th>
<th>TI</th>
<th></th>
<th>TTI</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef</td>
<td>Z</td>
<td>Coef</td>
<td>Z</td>
<td>Coef</td>
<td>Z</td>
</tr>
<tr>
<td>Sent</td>
<td>0.3649072**</td>
<td>5.55</td>
<td>0.0811169*</td>
<td>2.21</td>
<td>0.1766209**</td>
<td>4.02</td>
</tr>
<tr>
<td>Received</td>
<td>0.4512396**</td>
<td>24.98</td>
<td>0.3950233**</td>
<td>33.09</td>
<td>0.4271152**</td>
<td>23.26</td>
</tr>
<tr>
<td>Sent(_{t-1})</td>
<td>ns</td>
<td>ns</td>
<td>0.0947976*</td>
<td>2.53</td>
<td>0.1669563**</td>
<td>3.67</td>
</tr>
<tr>
<td>Returned(_{t-1})</td>
<td>0.0907736*</td>
<td>2.23</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Received(_{t-1})</td>
<td>ns</td>
<td>ns</td>
<td>-0.1006683**</td>
<td>-5.47</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Sent back(_{t-1})</td>
<td>0.0718362</td>
<td>1.86</td>
<td>0.2610879**</td>
<td>6.05</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Sent to (j_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Returned by (j_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Received from (j_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Sent back to (j_{t-1})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.2445932**</td>
<td>7.28</td>
</tr>
<tr>
<td>Sigma (u)</td>
<td>4.662632**</td>
<td>7.14</td>
<td>2.695087**</td>
<td>6.96</td>
<td>2.190965**</td>
<td>7.18</td>
</tr>
<tr>
<td>Sigma (e)</td>
<td>3.514015**</td>
<td>28.17</td>
<td>2.400521**</td>
<td>36.37</td>
<td>3.344225**</td>
<td>31.84</td>
</tr>
<tr>
<td>(N)</td>
<td>1044</td>
<td>1044</td>
<td>876</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Rho)</td>
<td>0.6378</td>
<td>0.5576</td>
<td>0.3003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald (\chi^2) (p-value)</td>
<td>662.89 (0.000)</td>
<td>1131.39 (0.000)</td>
<td>1125.02 (0.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** significant at 1%, * significant at 5%, ns not significant at the 10% level

Table 4: Determinants of reciprocity decisions

\[
y_{it} = \begin{cases} 
0 & \text{if } y_{it}^{*} < 0 \\
y_{it}^{*} & \text{if } 0 \leq y_{it}^{*} \leq 30 \\
10 & \text{if } y_{it}^{*} > 30 
\end{cases} \tag{3}
\]

Since the reciprocity decision is taken after the trust decision within a period we introduce as independent variables the amount sent at the beginning of the current period (\(Sent\)) and of course the amount received (\(Received\)). The other independent variables are the same as for the trust decisions’ analysis. In treatments NI and TI the subject observes the same variables. The treatments differ however because in TI the trustee knows that his decisions are observed by the trustor. In the TTI treatment trustees know the past decisions of their counterparts for both roles (\(Sent to j\), \(Returned by j\), \(Received from j\) and \(Sent Back to j\)).

Table 4 reports the estimates\(^{13}\) and table 5 reports the elasticities. The comparison

\(^{13}\)Starting from the complete model of equation (1), the coefficients in the table are obtained
Table 5: Elasticities of reciprocity

<table>
<thead>
<tr>
<th></th>
<th>TI</th>
<th>TTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent</td>
<td>0.148414</td>
<td>0.3102793</td>
</tr>
<tr>
<td>Received</td>
<td>2.168241</td>
<td>2.261884</td>
</tr>
<tr>
<td>Sent t-1</td>
<td>0.1748927</td>
<td>0.2970837</td>
</tr>
<tr>
<td>Returned&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Received&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.5571709</td>
<td>ns</td>
</tr>
<tr>
<td>Sent back&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.4210846</td>
<td>ns</td>
</tr>
<tr>
<td>Sent to j&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Returned by j&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Received from j&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Sent back to j&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-</td>
<td>0.4217729</td>
</tr>
<tr>
<td>y fitted value</td>
<td>2.2574325</td>
<td>2.8214672</td>
</tr>
</tbody>
</table>

of the NI and TI treatments reveals that the determinants of the reciprocity decisions differ. In the NI treatment the variables that are specific to the current round have the strongest impact on reciprocity (Sent and Received), while variables that capture past interactions have a weak (Returned<sub>t-1</sub> and Sent Back<sub>t-1</sub>) or non-significant (Sent<sub>t-1</sub> and Received<sub>t-1</sub>) impact. Note that for treatment NI the econometric model predicts a negative percentage returned which prevents calculating the elasticity for this variable. In the TI treatment the independent variable Received has a crucial impact on the current reciprocity decision. The main difference with the NI treatment is that the variable Sent back<sub>t-1</sub> has a much stronger impact (the elasticity is 0.42). Our interpretation is that the trustee attempts to make his reciprocity decisions coherent over rounds, possibly in order to maintain or increase his reputation. This is further illustrated by the analysis of the TTI treatment where the independent variable Sent back becomes non-significant while the independent variable Sent back to j<sub>t-1</sub> becomes now relevant and highly significant instead with the same level of elasticity as Sent back in the TI treatment (0.42). As in the TI treatment the current reciprocity decision is affected by past reciprocity, but with respect to the same player who is now identified instead of the whole population. The trustee therefore after a stepwise elimination of the non-significant variables (at the 10% level of significance).
seeks consistency of his reciprocity decisions conditional on the trustor with whom he interacts.

5 Trust-reciprocity relationships

The results of the previous section showed that subjects take into account direct reputation variables in treatments TI and TTI for taking their trust decision with respect to their current counterpart. These findings seem to indicate that identification plays an important role in the emergence of trust-reciprocity relationships within a group of players. In order to investigate more precisely this statement, we propose a definition of trust-reciprocity relationships and identify such relations in our data and study their properties.

We define a trust-reciprocity relationship as a mutually profitable relationship between a trustor and a trustee. Applied to our data, such a relation is formed between trustor $i$ and trustee $j$ if and only if both players obtain on average a positive (net) profit from their interaction. The (net) profit of trustor $i$ in round $t$ is the amount returned by trustee $j$ in excess of the amount sent by $i$, and the (net) profit for trustee $j$ in period $t$ is the amount received from trustor $i$ minus the amount returned to $i$. We take into account only repeated interactions between a trustor and a trustee, i.e. $i$ must have interacted at least twice with $j$. Taking the average profit implies that the relation between players may have evolved over time. We do not impose a positive profit for each round where the player pair $ij$ has interacted (with $i$ as trustor and $j$ as trustee). Notice that the relation is “trust-oriented”. Since players have both roles in the game, a given pair of players may form zero, one or two trust-reciprocity relations. Formally, we consider (ex-post) that a trust-reciprocity relation has been formed between trustor $i$ and trustee $j$ if and only if:
\[\pi_{i,ij} = \frac{1}{n} \times \sum_{\tau=1}^{n} (-s_{ij,\tau} + r_{ji,\tau} \times 3s_{ij,\tau}) \geq 0\]

and

\[\pi_{j,ij} = \frac{1}{n} \times \sum_{\tau=1}^{n} (3s_{ij,\tau} \times (1 - r_{ji,\tau})) \geq 0\]

subject to \(n > 1\) and \(s_{ij} > 0\) \hspace{1cm} (4)

where \(n\) is the number of periods trustor \(i\) and trustee \(j\) have interacted together, \(s_{ij,\tau}\) is the amount sent by \(i\) to \(j\) in interaction \(\tau\) and \(r_{ji,\tau}\) is the reciprocity (in percentage of the (positive) received amount) returned by \(j\) to \(i\) in interaction \(\tau\).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>(\bar{s}_{i,ij})</th>
<th>(\bar{r}_{j,ij})</th>
<th>(\bar{\pi}_{i,ij})</th>
<th>(\bar{\pi}_{j,ij})</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure</td>
<td>3.81</td>
<td>10.53</td>
<td>-2.43</td>
<td>10.05</td>
<td>76.54</td>
</tr>
<tr>
<td></td>
<td>3.76</td>
<td>15.76</td>
<td>-1.75</td>
<td>9.26</td>
<td>68.33</td>
</tr>
<tr>
<td></td>
<td>3.95</td>
<td>15.12</td>
<td>-1.92</td>
<td>9.83</td>
<td>66.48</td>
</tr>
<tr>
<td>Success</td>
<td>3.59</td>
<td>45.85</td>
<td>1.45</td>
<td>5.75</td>
<td>23.46</td>
</tr>
<tr>
<td></td>
<td>4.78</td>
<td>44.07</td>
<td>1.62</td>
<td>7.95</td>
<td>33.67</td>
</tr>
<tr>
<td></td>
<td>6.70</td>
<td>40.70</td>
<td>2.00</td>
<td>11.40</td>
<td>33.52</td>
</tr>
<tr>
<td>Unilateral</td>
<td>3.42</td>
<td>45.90</td>
<td>1.42</td>
<td>5.42</td>
<td>85.71</td>
</tr>
<tr>
<td></td>
<td>4.53</td>
<td>45.39</td>
<td>1.79</td>
<td>7.28</td>
<td>68.42</td>
</tr>
<tr>
<td></td>
<td>5.13</td>
<td>38.30</td>
<td>1.18</td>
<td>9.08</td>
<td>40.00</td>
</tr>
<tr>
<td>Bilateral</td>
<td>6.09</td>
<td>47.33</td>
<td>1.87</td>
<td>10.30</td>
<td>14.29</td>
</tr>
<tr>
<td></td>
<td>5.92</td>
<td>42.52</td>
<td>1.62</td>
<td>10.23</td>
<td>31.58</td>
</tr>
<tr>
<td></td>
<td>7.52</td>
<td>44.91</td>
<td>2.71</td>
<td>12.32</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Table 6: Trust-reciprocity relationships that failed and those that succeeded, for each treatment

Table 6 summarizes our findings about trust-relationships across treatments. Columns 3 to 6 indicate the average amount sent (\(\bar{s}_{i,ij}\)), the average amount returned (\(\bar{r}_{j,ij}\)), the average profit of the trustor (\(\bar{\pi}_{i,ij}\)) and the average profit of the trustee (\(\bar{\pi}_{j,ij}\)). The last column reports frequencies\(^{14}\). The first row corresponds to relationships that have failed and the second row to successful relationships. The latter category

\(^{14}\)In each treatment 180 relations (36 players that can form 5 relations each) can potentially be formed if every subject in a group interacts with each other subject in both roles. In the NI and TTI treatments one subject who acted as trustor never met one of the members of his group. Therefore for these treatments the total number of possible links is only 179 instead of 180.
is further split into two sub-categories: unilateral relationships and bilateral relationships. A bilateral relation in a pair corresponds to the existence of two unilateral links.

We state result 4 with respect to the benchmark (NI) for which trust relationships might occur only on a random basis.

Result 3

(i) Trustees’ identification increases the frequency of trust-reciprocity relationships in the population with respect to the benchmark,

(ii) Trustors’ and trustees’ identification increases the average trust level in trust-reciprocity relationships

(iii) Trustors’ and trustees’ identification favors the emergence of bilateral trust-reciprocity relationships, characterized by high levels of trust and reciprocity.

We first distinguish successes and failures, before comparing bilateral to unilateral relationships.

Successes and failures

23.46% of the links that could potentially be formed in the NI treatment have been effectively formed, it is less than in the TI treatment (31.67%, $\chi^2 = 3.024$ p-value=0.082) and less than in the TTI treatment (33.52%, $\chi^2 = p$-value=0.035).

Since in the NI treatment relationships can be formed only by chance, average trust should not differ between successful and unsuccessful relationships, which is confirmed by a one-sided Wilcoxon test (thereafter WCX\textsuperscript{15}, p-value=0.281). In the

\textsuperscript{15}As for the Mann Whitney tests, the Wilcoxon tests are performed on the group as the individual data.
two treatments with identification, trust relationships can be established voluntarily, leading to a significant higher level of trust in successful relationships (WCX, TI p-value=0.031, TTI p-value=0.016). Furthermore, both roles identification leads to an even higher average trust in the formed links than trustee’s role identification alone (MW p-value=0.013). The positive effect of identification, for successful links, is specific to trust, the level of reciprocity being not affected by both roles identification (TTI) compared to single role identification (TI) (MW p-value=0.350).

Bilateral vs. unilateral links
Since in the NI and TI treatments bilateral links cannot be voluntarily established there is no reason for average trust to be higher in bilateral relations than in unilateral relations. In both treatments the average trust in bilateral relations is not significantly different from the average in unilateral ones (WCX, NI: p-value=0.500 and TI p-value=0.125). In the TTI treatment bilateral relationships can be deliberately created between population’s members. 60% of the observed links are bilateral which is significantly more than in the NI and in the TI treatment (NI: 14.29%, \( \chi^2 = 21.32 \) p-value<0.001 and TI: 31.58%, \( \chi^2 = 9.5 \) p-value=0.002). Average trust in bilateral relationships is higher than in unilateral ones (7.52 against 5.13), a significant difference (WCX p-value=0.063). Average reciprocity is also significantly higher in bilateral than in unilateral relations (WCX p-value=0.063). Although trustors’ identification does not affect average reciprocity at the population level (result 1) it does so in bilateral relationships. Therefore, the average net profit of subjects acting as trustor in the TTI treatment is significantly higher in bilateral relations than in unilateral relations (WCX p-value=0.031), which is not the case in the other treatments (p-value=0.250 and 0.313 respectively in NI and TI). The average net profit of subjects acting as trustee is also higher in bilateral relations in the TTI treatment (WCX p-value=0.061).
Evolution of trust-reciprocity relationships

In this sub-section we analyze the level of trust and reciprocity in the first and in the sixth\textsuperscript{16} interaction between the two members of the unilateral/bilateral relationships. The average investment in the first interaction\textsuperscript{17} of unilateral links is respectively equal to 4.88 in the TI treatment and 5.31 in the TTI treatment, a non-significant difference (MW p-value=0.188). In the bilateral relations observed in the TTI treatment average investment is higher (6.79), and significantly larger compared to the unilateral links of the TI treatment (MW p-value=0.041) and to the unilateral links of the TTI treatment (WCX p-value=0.063). At the sixth interaction the average investment for unilateral links is nearly equal in the TI and TTI treatments (5.00 for the TI treatment and 4.8 for the TTI treatment) but in bilateral links average trust has strongly increased (9.03). As a result, the average trust in the sixth interaction for bilateral links is significantly higher than in unilateral links (MW TTI bilateral vs. TI unilateral p-value=0.002, WCX TTI bilateral vs. TTI unilateral p-value=0.063). Between unilateral links in both treatments the difference is not significant (MW p-value=0.500).

The evolution of average reciprocity in links is quite different. In the first interaction the average according to the type of link and the treatment is not significant\textsuperscript{18}. In the sixth interaction, for unilateral links in both treatments we observe a significant decrease (TI (41.13%) WCX p-value=0.078; TTI unilateral (28.47%) WCX p-value=0.050) whereas in bilateral relationships average reciprocity has not decreased (42.99%, WCX p-value=0.313).

The criterion we have adopted for identifying trust-reciprocity relationships between individuals is close to the one used in the literature related to endogenous network

\textsuperscript{16}The six interactions correspond to the expected number of interactions between a trustor and a trustee in the 30 periods repeated game.
\textsuperscript{17}Graphs showing the evolution of trust and reciprocity in unilateral and bilateral links are available online, see footnote 3 for the url.
\textsuperscript{18}TI (49.25%) vs. TTI unilateral (44.54%), MW p-value=0.242; TI vs. TTI bilateral (43.79%), MW p-value=0.268; and TTI unilateral vs. TTI bilateral, WCX p-value=0.500.
formation (see Jackson and Wolinsky (1996)). Based on this criterion our experimental data shows that the direct reputation implemented by way of private identification is a key feature for trust-reciprocity relationships to emerge. As expected trustees’ identification leads subjects to form unilateral links. In these links average trust is higher than in relations that have failed to form. But more interestingly we observe the formation of mutual trust-reciprocity relationships, in treatment TTI. The analysis shows that in bilateral links average trust and average reciprocity are both significantly higher than in unilateral links and of course higher than in relations that have failed to form. Furthermore, with repetition of the game, trust tends to increase in bilateral relations but not in unilateral relations. Reciprocity on the other hand remains stable in both treatments. In 15 out of 23 bilateral relationships the trustor sent his whole endowment after a few interactions with the trustee. These results show that both roles identification clearly favours the emergence of mutual cooperation within trust-reciprocity relationships.

6 Conclusion

Bolton et al. (2004b) wrote: “Trust and trustworthy behavior is neither wholly a matter of social norms and morality nor entirely a matter of institutional design”. In other words trust and trustworthiness might strongly be affected by the social environment in which agents interact. For example, playing both roles decreases average trust and reciprocity (Burks et al., 2002), and providing public information feedback about past actions increases trust and reciprocity (Berg et al., 1995; Keser, 2003; Bolton et al., 2004b, 2005; Bohnet and Huck, 2004; Bohnet et al., 2005). Our experiment was designed to investigate the effects on trust and reciprocity of private information feedback about past choices of counterparts. We chose an experimental setting capturing some of the key features of “real life situations”: repeated random interactions and experience in both roles (trustee and trustor). Allowing for trustees’
identification introduces a direct reputation mechanism which provides an incentive for trustees to act in a more reciprocal way. Since trustors are aware of these incentives, they tend to be more trustful when identification is feasible. Cochard et al. (2004) and Anderhub et al. (2002) showed indeed that repetition favors both trust and reciprocity in fixed pairs of players having a single role. In these papers players’ identification is however exogenous, since they are arbitrarily matched at the beginning of the repeated game, and know that they will always interact with the same counterpart and observe his decisions.

Our main objective was to isolate the effects of trustees’ identification in a population where players encounters are random. We found that trustees’ identification positively affects average reciprocity but has no impact on trust itself. Even if identified trustees have a stronger incentive to be reciprocal, on average trustors do not behave in a more trustful way, although there is considerably more variability. Such variability is precisely induced by observability: trustors send more to reciprocal trustors and less to the non-reciprocal ones. When both roles can be identified we observed an increase in both trust and reciprocity compared to the case of anonymous interactions. Why does bilateral identification foster trust and reciprocity? We tried to show that a central reason is the emergence of trust-reciprocity relationships which are characterized by high efficiency - due to higher trust - and profitable interactions both for the trustor and the trustee, i.e. both of them obtain an extra payoff in addition to their endowment. Compared to the evolution of trust and reciprocity within unilateral relations, in bilateral relations trust tends to increase over time although the relative shares of the surplus for the trustor and the trustee remain stable\textsuperscript{19}. We tentatively conclude therefore that the identification of both roles, by allowing the formation of mutual trust-reciprocity relationships, favors efficiency and cooperation between subjects in a repeated trust situation.

\textsuperscript{19}These evolutions can be viewed on figures available online, see footnote 3 for the url. These figures depict unilateral and bilateral links based on at least six interactions between a trustor and a trustee.
With respect to Bolton et al. (2004b)'s, these findings show that institutions matter for shaping trust relations among strangers. Of course, trust and reciprocity are primarily a matter of social preferences. Depending on the treatment both self-regarding and other-regarding preferences (conditional and/or unconditional) may be at work in our experiment. However, as our results show identification affects both observed reciprocity and trust, even though there might be several motives in the background. To some extent, simultaneity of both roles might have affected our results. A subject who was disappointed in his trustor's role in some period might have indirectly reciprocated negatively in his trustee's role in the same period. It is plausible that such attitude is more likely under anonymous interactions than under identified interactions. More generally, both roles playing could also have led to “compensating behavior”, as observed by Burks et al. (2002), although our repeated interactions framework allows also for inter-temporal compensation. In future research, we intend to get more insights about both roles playing by alternating roles on a random basis. It is also of interest to increase the number of repetitions in the game for a better identification of the trust-reciprocity relationships. Finally, another interesting extension is to make past trust and/or reciprocity decisions public information. Disclosing private information about trust and reciprocity can have ambiguous effects at the population level. Reciprocal trustees might be more trusted and non-reciprocal less so. Similarly low trust trustors might be weakly reciprocated.
References


A Instructions (treatment TTI)

General

From now on the set of participants is split into 3 groups of 6 persons by randomly assigning each participant to a group. The composition of the 3 groups will remain unchanged throughout the experiment. By no means you will be able to identify the other members of your group. Similarly, the other members of your group won’t be unable to identify you.

The experiment consists of successive periods. In each period you will have to assume two different roles: sender and receiver. In each role you will interact with a randomly selected member of your group. As a sender you will interact with one of the 5 other members of your group, which will be randomly selected by the computer program. Similarly, as a receiver you will interact with one of the 5 other members of your group, which will be randomly selected by the computer program. Due to the random matching procedure, note that it can happen that you interact with the same person for both roles. This random assignment procedure will be repeated in each new period.

Each of the five other members of your group will be identified by a letter (B, C, D, E or F) which will be always the same throughout the experiment, which will allow you to know the identity of the person with whom you interact. Similarly, you will be identified by a letter allowing other members of your group to know that they interact with you. At the end of each period your computer screen will display your decisions for the period, the decisions of the persons with whom you interacted, your earning for that period (in ecu, the experimental currency unit) and your total earning since the beginning of the experiment.

At the end of the experiment, your total earning will be converted into euros. The conversion rule of ecus into euros will be detailed at the end of the instructions.

Progress of a period

Decisions

At the beginning of each period, each participant has a capital endowment of 10 ecus. Each period involves three stages.

Stage 1

In this stage you act as a sender. You must decide how much of your 10 ecus you send to the receiver which was randomly assigned to you. You can decide to send 0, 1, 2, . . . , 8, 9 or 10 ecus. The amount earned by the receiver is equal to three times the amount that you decide to send.
Example: You decide to send 5 ecus to E, in which case E earns $3 \times 5 = 15$ ecus.

Stage 2

In this stage you act as a receiver. You will earn three times the amount sent by the sender which was randomly assigned to you. You must decide how much of your earning you want to send back to your sender. You can decide to send back 0, 1, 2, \ldots, $x$ ecus, where $x$ is the amount of ecus that you received.

Example: C sent 7 ecus to you, which provides you with an earning of $3 \times 7 = 21$ ecus. You must decide how much of these 21 ecus you want to send back to C. You can send 0, 1, 2, \ldots, 19, 20, or 21 ecus.

Stage 3

Once all members of your group have taken their decision as a receiver the results are displayed. Your computer screen will show:

- the amount of ecus that you have sent to your receiver, with his identification letter
- the amount of ecus sent back by him
- the identification letter of the sender with whom you interacted, the amount of ecus that he sent to you as well as the amount of ecus that you received from him
- the amount of ecus that you decided to send back to your sender
- the total earning for the period

The data for past periods will be available at any time by clicking the “History” button. On the history screen the columns “Receiver”, “Sent” and “Returned” correspond to your sender role, while the columns “Sender”, “Received” and “Returned” correspond to your receiver role.

Earnings

Your earning at the end of the experiment will be equal to the sum of your earnings over all periods. Your total earning will be displayed after each period in the history screen, in the column “accumulated earning”.

The earning of each period is calculated as follows:

Earning of the period = endowment (10 ecus) - amount sent + amount returned by the receiver + amount received (by the sender) - amount returned to the sender.

Final earning = earning of period 1 + earning of period 2 + \ldots + earning of the last period.
Example 1: As a sender you interact with C, and you decide to send 5 ecus. As a receiver you interact with E who decides to send 2 ecus, and therefore you receive 6 ecus. You decide to send back 3 ecus to the receiver. In stage 3 you are informed that C sent back 8 ecus. Your total earning for this period is: \(10 - 5 + 8 + 6 - 3 = 16\) ecus.

Example 2: As a sender you interact with B, and you decide to send 9 ecus. As a receiver you interact with D who decides to send 6 ecus, and therefore you receive 18 ecus. You decide to send back 15 ecus to the receiver. In stage 3 you are informed that C sent back 10 ecus. Your total earning for this period is: \(10 - 9 + 10 + 18 - 15 = 14\) ecus.

**Final details**

The experiment involves 30 periods. The amount of ecus that you accumulate over the 30 periods will be converted into euros according to the conversion rule: 100 ecus = 3 euros. As an example, if you earn 500 ecus, your earning will be 15 euros that will be paid out in cash at the end of the experiment.

Before the experiment starts you must fill in a short questionnaire on your computer screen, to check that you understand correctly the instructions.