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Trust and Reciprocity with Transparency and Repeated Interactions

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The Impact of Transparency and Repeated Interactions on Trust and Reciprocity

Abstract

This paper uses data from a controlled laboratory environment to study the impact of transparency (i.e., complete information versus incomplete information) and repeated interactions on the level of trust and trustworthiness in an investment game setting. The key findings of the study are that transparency (complete information) significantly increases trusting behavior in one-shot interactions. This result persists in repeated interactions. Further, transparency appears important for trustworthiness in one-shot interactions. In addition, repeated interaction increases trust and reciprocity with or without transparency. These results suggest transparency is important in building trust in business environments such as alliances and joint-ventures which are loosely connected organizational forms that bring together otherwise independent firms. It also provides support for the Sarbanes-Oxley Act of 2002 (SOX) and similar legislation elsewhere which attempt to regain investors' trust in corporate management and financial markets by stipulating enhanced disclosures.

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The Impact of Transparency and Repeated Interactions on Trust and Reciprocity

1. Introduction

Arrow (1974) stresses the role of trust as the foundation (as a transaction cost depressant) in every economic transaction. He postulates that higher rates of investment and growth are positively associated with higher levels of trust. In a related vein, Fukayama (1995) and Prusak and Cohen (2001) emphasize the role of trust as an integral factor in the creation of social capital. Similarly, Simons (2002) reiterates the importance of trust, particularly the high cost of lost trust. He shows that a one-eighth point move on a five point scale which measures trust increases the profits of firms in his sample by 2.5 percent (an average of $250,000).

In the economics literature, researchers have been examining trust and reciprocity (trustworthiness) issues in a behavioral game context. Within the game-theory literature (Cripps et al., 2007), there has been extensive exploration and investigation of the roles of reputation and repeated interaction, as there has been in the business literature (Lui et al., 2006; Rohm and Milne, 2004). As well, the agency-theory literature has analyzed quite extensively the impact of principal-agent dealings within the firm, and the empirical phenomenon of alliances and joint ventures with various contractual parties possessing different information sets.

In this study, we create a controlled laboratory environment in which participants interact in an investment game initially presented in a one-shot setting (see for example, Berg et al., 1995; Croson and Buchan, 1999; Cox and Deck, 2006a,b). Our paper extends the Berg et al. (1995) investment game to study the impact of transparency (i.e., complete

information versus incomplete information) and reputation building through repeated interactions on the level of trust and reciprocity...

Our laboratory environment maps closely to the organizational forms of alliances and joint ventures described by Yilmaz and Kabadayi (2006) and Johnson and Grayron (2005). In particular, our experiment resembles a business context of a simple two-partner alliance with a dominant partner (who is the receiver in our experiment and decides on the profit-sharing rule). The other partner's contribution to the alliance is similar to the investment game's sender (who provides resources to the dominant partner). The synergy from an alliance relationship is captured by the tripling of the investment in our experimental design.

Our study helps us understand better the role of complete and incomplete information and repeated interactions on the trusting behavior (level of investment) of one of the alliance partners and reciprocal behavior (the level of sharing) by the dominant partners. In addition to the study of trust in the academic literature, there is anecdotal evidence in the popular press regarding the importance of the role of trust in business transactions and how the loss of trust has led to the current dystopia in the financial markets.

The key finding of the study is that transparency significantly increases trusting behavior. We show that simple organizations such as two partner business alliances will suffer from a "trust discount" when faced with a "trust deficit". On average, in one-shot interactions, senders with complete information invested 59 percent of their endowments as compared to 37 percent by senders with incomplete information. This result persists when individuals are re-matched with new partners and participate in a repeated

investment game with the same partner. In the transparent environment, individuals invest more than 72 percent of their endowments in the first round of the repeated game, while when information is incomplete, individual's investment is slightly less than 60 percent. These results show that both transparency and repeated interaction are important in eliciting from investors. The effect of repeated interaction on trust persists over repeated rounds of investment decisions.

While transparency appears to be important for reciprocity in the one-shot investment game, it does not have a significant impact in the repeated game environment. Participation in the repeated game environment, however, leads to a significant increase in reciprocity in the first round of the repeated investment game independent of transparency. This indicates the importance of repeated interaction effects on reciprocal behavior. The results support the notion that transparency is important in eliciting trust and that the implications of regulatory actions, such as Sarbanes-Oxley Act of 2002, which stipulate enhanced disclosure in corporate financial reporting, will have a positive impact on the social surplus. This is important as the literature is sparse on the examination of the impact of transparency (complete disclosure of relevant information) on trust and reciprocity in a controlled laboratory environment.

2.   Literature Review, Theoretical Development and Hypotheses

Trust is defined by Robbins and Langton (2003) as the "positive expectation that another will not – through words, actions, or decisions – act opportunistically". Reciprocity is an echo of trust by the party that was trusted. This two-way interaction could be a one-period relationship between the same pair or multi-period negotiations across individuals (and generations, for such inter-generational relationships are not

uncommon in China and India). We use a variant of Berg et al. (1995) investment game

as the vehicle for eliciting data on trust and reciprocity. This game is described in detail

in section 3.

2.1. Information

Under complete information in the investment game, both the sender (investor)

and the receiver (responder) know each other's initial endowments and the investment

multiplier (technology). There is no opportunity for both parties to hide under a *veil of*

uncertainty. The amount invested signals the investor's trust and the receiver gets an

unambiguous signal and reciprocates accordingly. We introduce incomplete information

in order to price the *veil of uncertainty* in the investment game by making the

participants' endowments *random and unknown* to each other. The initial endowments

are randomly picked from a uniform distribution known by both the investor and the

receiver, where the expected value of the endowment equals the certain endowment in the

complete information condition. This modification allows us to use the unobservabilty of

each participant's endowment by the person with whom she is paired to characterize the

incomplete information environment.

In related research, Anderhub et al. (2002) and Brandts and Figueras (2003)

introduce incomplete information by controlling the probability that the sender will be

matched with a responder who may not reciprocate with certainty. They find support for

reputation formation in the incomplete information environment resulting from repeated

interaction. Bohnet and Huck (2003) study a repeated game environment in which the

investor and receiver may know or not know the history of the actions of the individuals

with whom they participate. This reflects the extent to which the environment is

transparent. With indirect reputation building, they find that trustees appear to respond more strongly to the institutional environment than trustors.

Coricelli et al. (2006) introduce an environment in which the gross-up of the investment is uncertain (the investment is either doubled or tripled). They show that uninformed responders are able to learn from the investment something about the true gross-up factor. This is reflected in the resulting reciprocity, with lower levels of reciprocity being shown to high value investors with high gross-up factors than to high value investors with low gross-up factors. Cox and Deck (2006b) introduce incomplete information on the part of the sender in a trust game in which the sender can choose to be either trusting or not trusting. In their environment there is a chance that the sender's decision is reversed by an exogenous agent after the sender has made a decision. In this incomplete environment, the frequency with which senders trust is significantly lower than the frequency with which senders trust in an environment in which they have certainty that their decision to trust is correctly relayed to the receiver.

All of the above papers introduce incomplete information into an investment game or similar environment and demonstrate that the information treatment is important. However, none of these papers directly compares the differences in trust and reciprocity between environments in which the complete and incomplete information is related to the endowments of the participants (particularly of the investor).

With incomplete information, the receiver is unable to determine the sender's actual endowment and does not know how trusting the investor actually is. Croson and Buchan (1999) suggest that trust is important in generating reciprocity. If an investor is unable to unambiguously signal her trust through her investment, she may anticipate that

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the receiver will not reciprocate in a way consistent with the actual level of trust revealed. This may lead to lower levels of trust and a lower group surplus than under complete information (similar to shirking induced by the unobservability of effort in the standard principal-agent problem, Holmstrom, 1979). This leads to the first hypothesis related to trust:

> **H1a:** *The null hypothesis is that in one-shot games, the level of trust is invariant to the information condition, while the alternative is that incomplete information will lead to lower levels of trust.*

Cox (2007) and Cox et al. (2008) argue that actions that are inconsistent with the predictions of the self-regarding preferences model can be motivated by social norms for reciprocating the intentional actions of another. They find that an attribution of intentions is a significant motive for behavior in experimental two-person extensive form games. In the investment game under incomplete information, in which the sender's initial endowment is assigned randomly, the sender who is stingy may get the benefit of the doubt from the responder. The responder may be more likely to interpret what appears to be a low level of trust (investment divided by the expected endowment) as a greater level of trust (investment divided by an endowment below the expected endowment). In this case, the investor may be viewed as more trusting than she actually is. On the other hand, if the investment divided by the expected endowment is taken at face value, and if trust is important in generating reciprocity (Croson and Buchan, 1999), this may result in less reciprocity than in a complete information environment. This leads to our first hypothesis related to reciprocity:

H1b: *The null hypothesis is that in one-shot games, the level of reciprocity is invariant to the information condition, while the alternative is that the level of reciprocity may differ with incomplete information relative to complete information.*

2.2. Repeated Interactions

Most investment activities and business transactions are conducted on an ongoing basis rather than as one time encounters. In a repeated interaction environment, one's reputation may be an effective a priori control on ex-ante opportunism. We conjecture that in a repeated multi-period investment game, subjects may attempt to create incentives that induce the other party to cooperate (which is how we have defined *building reputation*). Sending credible signals to their counterparts is likely to influence them to adopt strategies that enhance cooperation and lead to Pareto-superior outcomes (see Kreps et al., 1982; Fudenberg and Maskin, 1986; Fudenberg and Levine, 1992; Eckel and Wilson, 2003). Given this conjecture, we extend the one-shot investment game to a repeated game. This reputation building mechanism (the repeated interaction), is expected to encourage the sender to trust more in order to influence the receiver to honor the increased trust with greater reciprocity. This leads to the second hypothesis, stated in two parts:

H2a: *The null hypothesis is that the level of trust is invariant to opportunities to build reputation, while the alternative is that trust will increase within the context of a repeated game relative to a one-shot game.*

H2b: *The null hypothesis is that the level of reciprocity is invariant to opportunities to build reputation while the alternative is that reciprocity will increase within the context of a repeated game relative to a one-shot game.*

It should be pointed out that under the homo-economicus assumption the predicted behavior is the same in any finitely repeatedly game with a known endpoint as in the one-shot game. However, our unknown endpoint means that even with homo-economicus other behavior could be in equilibrium depending on the beliefs that players hold. It is the existence of such beliefs that we conjecture may lead to different equilibria in the one-shot and repeated games. We are indebted to an anonymous referee for alerting us to this behavior.

The relation between trust (and reciprocity) and repeated interactions is also impacted by situational variables, Church et al. (2005). Contexts, such as the state of information in the environment, may affect trust and reciprocity. In particular, changing individual endowments over time makes it difficult for a sender to unambiguously display trust to a receiver. This leads to a third hypothesis, stated in two parts:

H3a: *The null hypothesis is that in repeated investment games, the level of trust is invariant to the information condition, while the alternative is that the level of trust may differ with incomplete information from that with complete information.*

H3b: *The null hypothesis is that in repeated investment games, the level of reciprocity is invariant to the information condition while the alternative is that the level of reciprocity may differ with incomplete information from that with complete information.*

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3. Experimental design

A total of 132 subjects were recruited from undergraduate classes at a medium-sized university. During the recruitment phase, the students were told that the sessions in which they would participate would involve simple decision-making, and that the details would be given to them during the session. They were also informed that during the course of the session they would earn money that would be paid to them in cash at the conclusion of the session.

3.1. The investment game

The session in which each individual participated consisted of a series of periods of a computer mediated investment game. In this paper we are reporting the results from ten periods played with complete information and from ten periods played with incomplete information. No participants were included in both information treatments.

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. Subjects 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 to them by the experimenters. Subjects were given an opportunity to ask questions for clarification.

In addition to the treatment of game type (one-shot game or repeated game), information was also a treatment variable. The endowment that senders and receivers

had each round was either fixed at 100 laboratory euros (L€) or it was randomly assigned from the set e = [L€0, L€50, L€100, L€150, L€200]. Individuals knew if they were in a complete information or incomplete information environment. Participants in the complete information sessions knew that the person with whom they were matched had an endowment of L€100. Participants in the incomplete information sessions knew the distribution from which endowments were selected, but did not know the endowment of the individual with whom they were matched.

At the beginning of each decision-period, subjects were endowed with laboratory euros and were told whether they would assume the role of a sender or a receiver for the period. 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. Receivers entered this 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. In the first phase, individuals were then re-matched and a second period of sending and responding took place. After the second period, individuals were reassigned to new partners and to new roles. For the next four periods the investment game was repeated as

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described for the first period. After the fourth period of the repeated game, partners were reassigned and roles were reversed. 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, where euros were converted into dollars at the rate L€100 = 1.00 dollar. The average earnings per subject for the session were $34. The average earnings for the five rounds reported in this paper were about $16.25.

3.2. Trust and Reciprocity

Senders' decisions in the investment game provide a measure of trust. The Nash equilibrium of the one-shot game played by income-maximizing risk-neutral individuals has nobody investing any endowment resources because senders anticipate that income-maximizing risk-neutral receivers will keep everything they receive, leaving the senders with less than their initial endowments. Sending anything implies some measure of trust by the sender that the receiver will not keep everything. Trust is measured as the proportion of the endowment that is invested.

Typically, reciprocity is measured as the proportion of the grossed-up (in this case, tripled) investment returned by the responder to the sender. This measure lies between unity and zero. However, in our environment the responder also has an endowment, and so the potential amount returned to the sender could be as much as the grossed-up investment plus the receiver's endowment. Thus, it is possible for the ratio of what is returned to the sender divided by the grossed-up investment to exceed unity. If this occurs, reciprocity is reported as unity. It also is possible for this measure to be

undefined if the sender invests nothing. In these cases, the observation is dropped from the sample of reciprocity measures.

4. Results

The results are presented in two stages. The first set of data analyzed is the set of data describing trust and reciprocity in the one-shot game and in the first round of the repeated game. The second set of data describes behavior over the four rounds of the repeated game.

Our laboratory design provides results about trust and reciprocity in four different environments. The environment may be a one-shot game or a repeated game and the participants may have complete information about the endowments or not. The outcomes for trust are summarized in Figure 1 and Table 1 and the outcomes for reciprocity are summarized in Figure 2 and Table 1. In addition to these features of the environment, there is a design feature that is not related to our research interests in repeated play or transparency. This third feature is the order in which our participants played the role of sender (or responder).

4.1. One-shot game and the first round of the repeated game

4.1.a. Trust in the one-shot game and the first round of the repeated game

To identify the statistical significance of the impact of playing one-shot versus repeated game on trust, we match the decisions of individuals in their role as sender in the one-shot game with their decisions in the first round of the repeated game. We calculate the difference between the latter and former. We then perform an analysis of variance on this new variable with the information condition, the order of playing the

game (i.e., sender first or receiver first) and their interaction as independent variables. The untabulated results from the analysis of variance indicate that neither the order in which individuals play the role of sender, the information condition that characterizes the environment in which they make investment decisions, nor their interaction have statistically significant effects ($p = 0.190$, $p = 0.126$ and $p = 0.530$, respectively). Controlling for information, order and their interactions, we find that the mean value of the differences between trust in the first round of the repeated game and trust in the one-shot game across the individuals in this experiment is 0.173 and this is significantly different from zero ($p = 0.000$). This result rejects hypothesis H2a, that the opportunity to build reputation will have no effect on trust in favor of the alternative that trust will be enhanced.

Analyses of variance of trust in the one-shot game and in the repeated game permit us to evaluate the impact of transparency on trust. The results are presented in Table 2. Controlling for the order in which participants played the role of sender in the investment game, the differences between trust displayed under the conditions of complete information (transparency) and incomplete information are statistically significant in the one-shot game and in the first round of the repeated game ($p = 0.000$ and $p = 0.013$). These results reject hypotheses H1a and H3a, that transparency has no effect on trust in favor of the alternative that trust will be enhanced by transparency in the one-shot game and that it will be affected by transparency in the repeated game.

An anonymous referee raised a concern as to whether trust displayed an endowment effect in the incomplete information treatment, and whether individuals exhibit more trusting behavior when they had larger endowments? We addressed this concern by

including the endowment as an additional variable into an analysis of variance for the incomplete information condition. Because the endowments changed for participants from the one-shot game to the repeated game we could not use the difference between an individual's trust in the two game treatments as the dependent variable. Instead, the levels of trust in each game treatment for each participant were included separately in the ANOVA and the participants' identification numbers were used to account for fixed effects. The resulting ANOVAs showed that only the game treatment variable was significant ($p = 0.000$). Endowment was not significant ($p = 0.748$) and none of the interaction terms in the ANOVAs were significant ($p > 0.546$ for each interaction term). There was no systematic relationship between an individual's endowment and the individual's measure of trust when endowments across individuals and over time were assigned randomly from the values 0, 50, 100, 150 and 200.

4.1.b. Reciprocity in the one-shot game and the first round of the repeated game

To identify the statistical significance of the impact of playing one-shot versus repeated game on reciprocity, we match the decisions of individuals in their role as responder in the one-shot game and in the first round of the repeated game. We calculate the difference between the latter and former. We then perform an analysis of variance on this new variable with the information condition, the order of play and their interaction as independent variables. The untabulated results from the analysis of variance indicate that neither the order in which individuals play the role of responder nor the interaction between order and the information condition have statistically significant effects ($p = 0.536$ and $p = 0.108$). However, the information condition that characterizes the environment in which they make investment decisions does have a statistically significant

effect (p = 0.072). This effect is reflected in Figure 2 by the positive difference between reciprocity in the repeated game and the one-shot game with transparency and the very small negative difference between these two measures in the repeated game.

Controlling for information, order and their interactions, we find that the mean value of the differences between reciprocity in the first round of the repeated game and reciprocity in the one-shot game across the individuals in this experiment is 0.174 and this is significantly different from zero (p = 0.000). This result rejects hypothesis H2b, that the opportunity to build reputation will have no effect on reciprocity in favor of the alternative that reciprocity will be enhanced.

Analyses of variance of reciprocity in the one-shot game and in the repeated game permit us to evaluate the impact of transparency on reciprocity. The results are presented in Table 3. Controlling for the order in which participants played the role of responder in the investment game, the differences between reciprocity displayed under the conditions of complete information (transparency) and incomplete information are statistically significant in the one-shot game but not in the first round of the repeated game (p = 0.061 and p = 0.658). These results reject hypothesis H1b, that transparency has no effect on reciprocity in the one-shot game in favor of the alternative that transparency has an effect (in this case it is positive), but permit us to retain hypothesis H3a, that transparency has no effect on reciprocity in the repeated game context.

Because we are using a within-subject design to identify the treatment effect, it is possible that some of the increase in trust or reciprocity that we may find will be associated with learning as well as the change in the game. To ascertain the impact of learning effects on our main results, we ran additional experiments where we required the

subjects to interact in a one-shot setting for ten periods (with a new anonymous partner for each period), using the same design as we used to generate the data we are analyzing here. The results indicate that there is no statistically significant increase in trust or in reciprocity in each of rounds 2 to 5 compared to round 1. Furthermore, trust and reciprocity are lower with incomplete information than with complete information. This additional evidence supports our claim that the increase in trust reported in the paper is due to the treatment effects of the anticipation of repeated play and not due to learning in the first round of a one-shot game.

4.2. Play over time in the repeated game

4.2.a Trust and the repeated game

Figures 1 and 2 display the trust and reciprocity indices for the one-shot investment games and the four rounds of the repeated investment games. The analysis presented above support statistically significant effects of game-type by information condition for both trust and reciprocity. While the effect of transparency on trust displayed in the one-shot game persists with the repeated game over time, this effect is not displayed in the reciprocity data. Another characteristic of the trust data that is not reflected by the reciprocity data from the repeated games is the stability over time of the indices.

The data summarized in Figure 1 suggest that trust is stable over the four repeated rounds played by these participants. Because participants were not told when the repeated game phase of the session would end, there is not a noticeable end-game effect. The reciprocity data in Figure 2 display a marked decline after the second round of the repeated game (R2), and while the reciprocity index for the repeated game without

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transparency does not return to its level from the one-shot game, the reciprocity index in the fourth round of the repeated game does not appear to be much different from that in the one-shot game.

The round-to-round changes are reported in Table 1 for those individuals who sent something in sequential rounds, or who returned something in sequential rounds. Table 1 includes data from matched pairs between the one-shot game and the first round of the repeated game as well as data from matched pairs between the one-shot game and the fourth round of the repeated game. These data provide corroboration for the game effect obtained from the fixed effects analysis reported above and shows that repetition resulted in a higher and stable trust relationship than the one-shot game. In the case of reciprocity, the data suggest that transparency may lead to a reciprocity index of about 0.50 and that the effects of repetition may lead to this overtime in an environment in which there is incomplete information.

For each of the changes in trust and reciprocity displayed in Table 1, the change in trust from the one-shot game to the first round of the repeated game was statistically significant ($p < 0.050$ for a two-tailed t-test in all cases). From rounds 1 to 2, 2 to 3 and 3 to 4, none of the changes in trust were statistically significant ($p > 0.100$ for a two-tailed test in all cases). Changes in reciprocity, however, were significant from round 2 to round 3 ($p < 0.050$ for a two-tailed t-test in both cases).

Comparing the one-shot game values of trust and reciprocity with those in the fourth round of the repeated game, using a matched-pairs t-test, we find that the trust indices with transparency fell from their round 1 levels, but were still significantly greater than in the one-shot environment ($p \approx 0.050$). With incomplete information, trust indices

were higher in round 4 than in round 1 and significantly greater than in the one-shot game (p > 0.001). The reciprocity indices in the transparent environment were not significantly different in the fourth round of the repeated game than in the one-shot game, but while reciprocity in the repeated game with incomplete information had declined from round 1 to round 4, it was still significantly greater than in the one-shot game (p ≈ 0.050)

5. Conclusion

The contribution of this paper lies in its demonstration, in a controlled environment, of how opacity in a simple investment setting can affect trust and trustworthiness and reduce the returns to the participants in the investment activity. The results support the notion that transparency is important in eliciting trust and that the implications of regulatory actions, such as Sarbanes-Oxley Act of 2002, which stipulate enhanced disclosure in corporate financial reporting, will have a positive impact on the social surplus. This is important as the literature is sparse on the examination of the impact of transparency on trust and reciprocity in a controlled laboratory environment.

One finding of our study is that in one-shot interactions transparency (complete information) significantly increases trusting behavior over that realized in incomplete information environments. This result persists in repeated interactions as well. Further, transparency appears important for reciprocity in one-shot interactions. People engage in many business transactions that can be characterized as one-shot events. They purchase many different sorts of capital goods, such as homes and automobiles, and more often than not do not enter into these transactions repeatedly with the same partners. While we have a sense that anything that enhances trust and reciprocity in these one-shot bilateral transactions will lead to increased joint returns, the outcomes of these simple investment

games, while not precisely equivalent to the purchase of a home, offer an assurance that our intuition is correct. As well, our environment may be viewed as a simple two-partner alliance with a dominant partner -- an abstraction of the organizational forms of alliances and joint ventures with various contractual parties possessing different information sets. These ventures may be one-shot interactions or long-term relationships.

In the case of repeated transactions, our results are slightly different for trust than for reciprocity. Our results demonstrate that just as transparency is important in increasing trust in the one-shot environment, it is important in maintaining trust when engagements are repeated. However, we find that the repeated nature of the game alone is sufficient for maintaining the level of reciprocity from the receiver of trust. In fact, with or without transparency, we find decay in reciprocity over the rounds in the sessions we conduct. However, the repeated nature of the encounter appears to be sufficient to maintain reciprocity above the level attained in the one-shot encounter. The result regarding the role of repetition in maintaining reciprocity is not new, but the identification of the lack of effect of transparency in these repeated interactions is noteworthy.

While transparency and repeated interactions can increase trust in an investment setting and lead to increased surpluses to agents on both sides of a transaction, the environment we have studied leaves the ultimate power of providing the investors surplus to the receiver. Laws have been put into affect which provide agents comparable to the investors in the investment game with more power to nullify a transaction if they lose faith in the ultimate trustworthiness of the receiver. The environment we have used in this paper could be used to extend the analysis of trust and reciprocity to study how the

empowerment of senders to retaliate against untrustworthy agents can affect the levels of

trust, reciprocity and the consequent surplus generated in an economic exchange.

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Table 1.   Statistics for matched-pairs t-tests for changes in trust and reciprocity indices over time

		1-Shot to Round 1	Round 1 to 2	Round 2 to 3	Round 3 to 4	1-Shot to Round 4
Trust						
Complete Information	Mean Diff	0.136	-0.009	-0.000	-0.029	0.098
	StDev	0.240	0.285	0.263	0.345	0.381
	Observations	60	60	60	60	60
	t-statistic	4.359	-0.251	-0.010	-0.650	1.975
Incomplete Information	Mean Diff	0.220	0.021	0.021	-0.058	0.248
	StDev	0.327	0.326	0.262	0.307	0.376
	Observations	48	56	57	53	53
	t-statistic	4.612	0.478	0.592	-1.349	4.772
Reciprocity						
Complete Information	Mean Diff	0.120	0.019	-0.098	-0.040	0.025
	StDev	0.355	0.308	0.287	0.203	0.306
	Observations	60	60	57	52	55
	t-statistic	2.588	0.480	-2.567	-1.403	0.590
Incomplete Information	Mean Diff	0.248	0.002	-0.121	-0.068	0.107
	StDev	0.350	0.279	.270	0.286	0.345
	Observations	44	50	49	43	40
	t-statistic	4.643	0.058	-3.114	-1.553	1.944

Note: The critical value of the t-statistic is at least 1.960 for significance at the 5 percent level using a two-tail test.

Table 2.   Trust Analysis of Variance (by Game)

Source	One-Shot Game			Repeated Game (Round 1)		
	Partial SS	F-stat (df)	p-value	Partial SS	F-stat (df)	p-value
Model	1.537	6.91 (3)	0.000	1.056	4.02 (3)	0.009
Info	1.422	19.17 (1)	0.000	0.554	6.33 (1)	0.013
Order	0.122	1.65 (1)	0.201	0.482	5.50 (1)	0.021
Info x Order	0.001	0.02(1)	0.889	0.029	0.33 (1)	0.568
Residual	8.381			10.251		
Total	9.918			11.307		
Observations	117			121		
Root MSE	0.272			0.296		
Adj R-sq	0.133			0.070		

Notes: Trust is the proportion of an individual's endowment that is invested. Info is a variable that indicates whether participants know with certainty or not the endowment of the person with whom they are paired in the investment game. Order is a variable that indicates whether an individual played the role of a sender before playing the role of receiver. There were 132 people in this experiment. 60 participated in the complete information treatments and 72 completed in the incomplete information treatments. Of the 72 in the incomplete information treatments, 15 received an endowment of zero as a sender in the one-shot game and 11 received an endowment of zero in the repeated game. The data for these individuals were dropped from the analysis for the rounds in which they had endowments of zero. A variance ratio test of the data permits us to retain the null hypothesis that the data under the information conditions are drawn from the same underlying distribution for the one-shot game and for the repeated game.

Table 3. Reciprocity Analysis of Variance (by Game)

Source	One-Shot Game			Repeated Game (Round 1)		
	Partial SS	F-stat (df)	p-value	Partial SS	F-stat (df)	p-value
Model	0.444	1.31 (3)	0.275	0.213	1.18 (3)	0.322
Info	0.404	3.57 (1)	0.061	0.012	0.20 (1)	0.658
Order	0.001	0.01 (1)	0.911	0.139	2.30 (1)	0.132
Info x Order	0.034	0.30 (1)	0.585	0.063	1.04 (1)	0.311
Residual	12.196			7.020		
Total	12.641			7.233		
Observations	112			120		
Root MSE	0.336			0.246		
Adj R-sq	0.008			0.004		

Notes: Reciprocity is the proportion of the grossed-up investment that is returned to the sender by the receiver. Info is a variable that indicates whether participants know with certainty or not the endowment of the person with whom they are paired in the investment game. Order is a variable that indicates whether an individual played the role of a sender before playing the role of receiver. There were 132 people in this experiment. 60 participated in the complete information treatments and 72 completed in the incomplete information treatments. Of the 72 in the incomplete information treatments, 15 received an endowment of zero as a sender in the one-shot game and 11 received an endowment of zero in the repeated game. In addition 5 senders in the one-shot game with positive endowments invested nothing and 1 similar sender in the repeated game invested nothing. The data for the 20 receivers in the one-shot game and the 12 receivers in the repeated game who were paired with senders who sent nothing were dropped from the analysis of reciprocity for the rounds in which they received nothing from the sender. A variance ratio test of the data permits us to retain the null hypothesis that the data under the information conditions are drawn from the same underlying distribution for the one-shot game and for the repeated game.
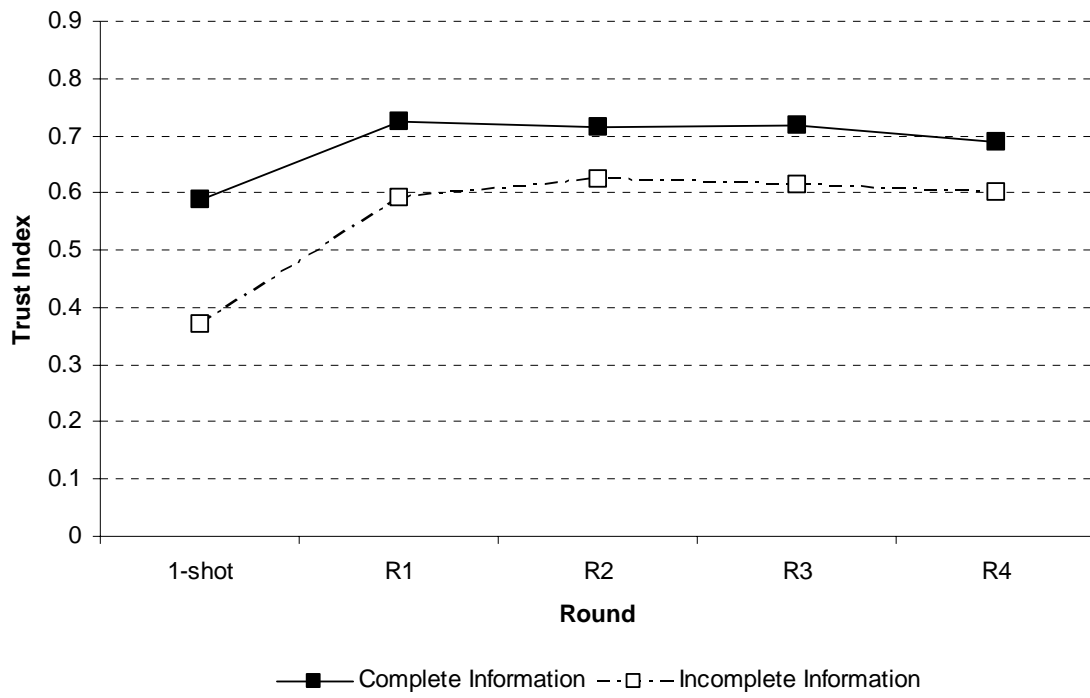
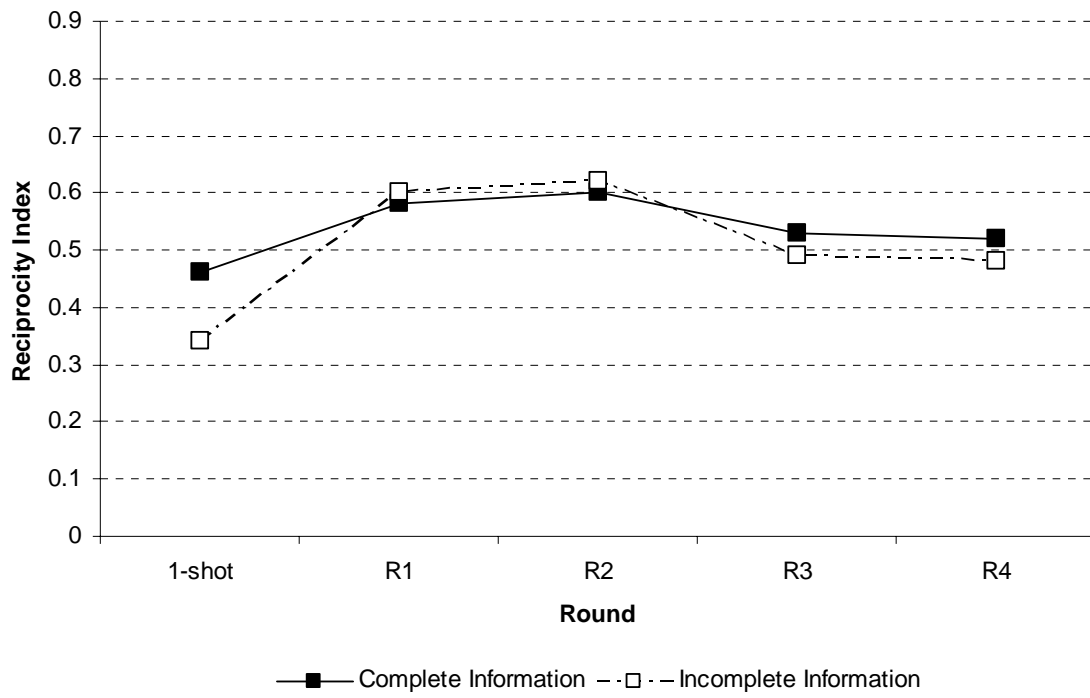Figure 1.   Mean trust indices by game, round and information condition

Figure 2. Mean reciprocity indices by game, round and information condition