Can trust be sustained in an uncertain world when individuals have Machiavellian intelligence?

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First Draft as of March 29, 2010

Humans communicate for cooperative purposes but can also deceive others for personal gain. This Machiavellian intelligence poses a fundamental dilemma for whether human societies can secure gains from cooperation when uncertainty renders the relation between actions and outcomes opaque. Institutions can foster trust by providing clearer evidence on the results of exchange interactions, which enable us to form and communicate expectations of future behavior and hold others accountable for actions that violate norms of appropriate conduct. We use a multi-period trust game experiment with uncertainty where partners can engage in "cheap talk" to demonstrate several aspects of how direct communication and institutions for sharing hard information build trust. We first demonstrate that joint agreements reached via direct communication are nearly universal, but that deceptive communication and breaches of such agreements is widespread. An institution that permits hard information sharing reduces the incidence of deceptive communication and the extent to which joint agreements are breached. We also show that an institution for hard information sharing has a first-order effect on trust when opportunities to directly communicate are not available. Finally, we show that social losses associated with unexploited gains from trade are lowest in an economy where deception in communication is the greatest. This surprising result suggests that humans' Machiavellian intelligence is evident in cooperative interaction: humans engage in personally beneficial deceptive communication, but deception is subtle and does not destroy the trust of trading partners on whom longer-term benefits hinge.

Introduction

Homo sapiens is a social animal with evolved communication abilities that extend beyond that of other species (*1–5*). The inherent conflict in our ability to communicate through language is that these skills can enable cooperation while also allowing us to manipulate others for personal gain (*6–12*). This conflict can be lessened through mechanisms that provide evidence of exchange results, which affect reputation and future exchange opportunities and implicate punishment mechanisms that sanction cheating (*13–21*).

But, can humans secure gains from cooperation when uncertainty is present? A worker's productivity can be influenced by factors beyond her control and sometimes the family dog actually eats the child's homework. Uncertainty encourages deceptive communication precisely because it renders opaque the relation between an action and outcome. This opacity magnifies the tension inherent to cooperation because cheaters can exploit it while their partners' skepticism grows possibly causing cooperation to unravel. This raises two fundamental questions that we address in this paper. First, how successfully can humans obtain gains from cooperation when they can communicate directly within an uncertain environment? Second, how is the degree of cooperation influenced by the ability of a party to provide "hard" information about actions undertaken in executing such an agreement?

Ancient agrarian societies faced these problems when crop failures resulted from external factors such as weather and pestilence. Agreements between landowners and workers to divide the fruits from their venture would be difficult to settle and legal mechanisms would be used (*22–23*). In these, as well as other commercial transactions, formal legal codes required truthful witnesses to determine the factors responsible for non-completion of an agreement (*24–25*). This is broadly consistent with how reliable third-party information shared through "gossip" promotes indirect reciprocity (14, 17, 26).

We investigate the value of direct communication and hard evidence in sustaining cooperation using a multi-period trust game experiment with uncertainty. Our experimental design is distinguished in two ways. One is that subjects can directly communicate through "chat" (aka "cheap talk") in between rounds of the game. Another is that subjects can have the option of having their trading partner provided hard evidence that reveals the eventual outcome.

Our experiment reveals several fundamental aspects about how humans sustain trust in uncertain environments. First, we demonstrate that subjects craft cooperative agreements when they can directly communicate. Second, deceptive communication and breach of agreement are widespread when direct communication is possible but sharing of hard information is infeasible. Deception, however, has only modest redistributive consequences since cheating must be subtle and not result in a loss of trust by the partner being deceived. Third, we demonstrate that an institution for sharing hard information reduces the incidence of agreement breaches under a regime of personal exchange and has a first-order effect on trust in impersonal exchange where direct communication is not possible. Finally, we demonstrate that social losses are the lowest in an economy with direct communication but lacking an institution for hard information sharing. This counterintuitive finding is consistent with Machiavellian intelligence where deceivers takes short-run gains only to the extent that they do not destroy longer-term private gains from cooperation.

Experimental Setup

The building block for our laboratory economies is the single-dyad multi-period trust game where one investor is paired anonymously with one trustee for more than one period of play (*21, 27*). The investor receives ten units of experimental currency, which are referred to as *lira*,

and decides how many *lira* out of the ten (in whole numbers) to send to the trustee. The investment produces gains from exchange in a given period because a multiplier is applied that determines the amount actually received by the trustee. In our experiment, this multiplier is uncertain and ranges from one to five in whole numbers. The stochastic nature of the multiplier in our experiment introduces uncertainty to the standard trust game where both the investor and trustee know the multiplier in advance of play (*28*). Thus, if the investor sends all ten *lira* to the trustee in a given period, the trustee will receive either 10, 20, 30, 40, or 50 *lira*. The investor does not observe the amount received by the trustee. Also, the trustee does not know the amount sent by the investor although this can be inferred in many cases. For example, if the trustee receives 30 *lira*, this could occur both because the investor sent 10 lira and the multiplier realization was 3 or because the investor sent six *lira* and the multiplier equaled 5. However, if the trustee gets 50 *lira*, then it is obvious that the investor sent 10 *lira* and the multiplier realization was 5.

We implement a multi-period game by repeating the one period trust game with uncertainty between an investor and a trustee ten times with new endowments of ten *lira* each time. Subjects are not told how many times the game will be repeated. As in Basu *et al*. (2009), we use a multi-dyad trust game. In the present experiment, two subjects play the role of investor and two play the role of trustee. In each period, both investors have two separate endowments of 10 *lira*, one for each trustee. For each 10 *lira* endowment, the investor decides how much of that amount to send to the respective trustee. In turn, each trustee receives two separate amounts, one from each of the two investors. A different random draw on the multiplier is applied for each of the four dyads in the economy. Thus, the realized multipliers, in the vast majority of cases, are not equal for all dyads. Each trustee then decides, for each investor, how much of the amount received to send back. This process is repeated ten times with each investor reendowed each time separately for each trustee. The multi-dyad setting allows individual subjects to formulate a strategy for interacting with a specific partner using what they learn from their interactions with the other partner.

We ran the multi-dyad repeated trust game for four types of economies. Our focal economy is one where investors and trustees engage in personal exchange enabled by direct communication via a "chat" mechanism. Subjects in this economy can converse with one another by sending text messages via computer interface for three-minute periods between rounds of the game. The first chat period occurs after the first round of investment and return decisions. Trustees in this condition can share information with investors about realized multipliers, but this information is "soft" because it is not verifiable by the investor. We refer to economies of this type as *Conversation-No Hard Information Sharing (C-NoHIS)*.

We ran three other types of economies for comparative purposes. One allows for personal exchange in that investors and trustees can also converse between rounds of the game. Trustees in this economy can also pre-commit before the investor makes his decision to have the investor learn (with perfect verifiability) the amount the trustee subsequently receives. Thus, the trustee can have the investor receive "hard" information akin to the gross income from investment that improves accountability by making it impossible to disagree about the ultimate results of the investor's decision (*29*). We refer to this as the *Conversation-Hard Information Sharing (C-HIS)* economy. A second contrasting economy allows the trustee to pre-commit to having the investor receive hard information, but the subjects cannot directly communicate. We refer to this as the *No Conversation-Hard Information Sharing (NoC-HIS)* economy. The final type of economy is one where both soft information sharing via chat and hard information sharing are not possible. We refer to this as the *No Conversation-No Hard Information Sharing (NoC-NoHIS)* economy.

All economies are conducted using the computer software *z-Tree*, whose windows are displayed on the left hand side of each subject's computer screen (*30*). We position a running program, *TextBox*, on the right side of the computer screen in the *C-NoHIS* and *C-HIS* economies. Subjects are told they can type anything they want, but could not include any personal information. The ten-period length of the experiment implies that subjects had an opportunity to converse in nine periods before a round of experimental play (periods after rounds 1 through 9 inclusive).

We replicated all four economies eight times. The eight replications for each economy generate data for 32 subjects; 16 played the role of investor and 16 played the role of trustee. Within each replication, interactions occur in four distinct dyads, or 32 total dyads across all eight replications of a given economy.

Deception in the *C-NoHIS* Economy

In the *C-NoHIS* economy, trustees can use personal communication to deceive the investor and take a greater share of the payoffs without the partner knowing it. This can be made possible through communication that keeps the investor poorly informed when the realized multiplier is high. Deceptive communication can take one of two forms (*31*). The trustee can provide false information (e.g., state the multiplier was 1 when it equals 5) or conceal information altogether (e.g., say nothing when the multiplier equals 5). Deceptive communication will accompany a trustee's decision to send back low amounts that may be inconsistent with either a prior explicit agreement between the investor and trustee or implicit social norms of fairness.

Investigating deception requires that we identify joint agreements in the chat data as well as statements by the trustee about the multiplier realized just prior to a given conversation period. We identified proposals for joint agreements by the presence of a proposal (by either the investor or trustee) regarding investment decisions by the investor, trustee return decisions, or both. As one example, a proposal and acceptance of the proposal are noted in bold in the following conversation, which took place in the conversation session following the first round of decisions:

<u>After Period 1</u>
Investor: I sent you the maximum(10). How much did you get it from me
Trustee: 20
Trustee: so I sent back 10
***Trustee*: if you continue to send me the maximum, I'll continue to send you exactly half of the total earnings (CODED AS PROPOSAL)**
***Investor*: good i think its better to send the maximum its good for both of us because of the multipler between a and b (CODED AS ACCEPTANCE)**
Trustee: agreed
Investor: good

Table 1 shows that at least one such proposal was put forth in each of the 32 dyads in *C-NoHIS* economy and an agreement was reached by 31 dyads. The subject making the first proposal was evenly divided between investors and trustees. Twenty of the 31 agreements were reached in the first conversation period. The final agreement in place for 29 dyads was that the investor would invest all ten *lira* and the trustee would divide the amount received equally (termed "invest 10 & split 50-50"). As a benchmark, table 1 also shows comparable descriptive statistics for the *C-HIS* economy.[1] For these economies, proposals and agreements were not

[1] These data show fewer observations for the Conversation-Hard Information Sharing economy because the conversation data for one replication was unable to be stored while play progressed.

universal, but still over 80% (24 of 28) of the dyads show at least one proposal being extended and 18 of the 24 final agreements were “invest 10 & split 50-50.”

Analyzing deceptive communication requires that we identify *C-NoHIS* trustees’ decisions to share soft information about realized multipliers or amounts received after the investor’s investment decision. A disclosure of soft information is present in the second conversation period for the same subjects shown in the earlier excerpt. The soft multiplier disclosure is noted in bold and the entire conversation between these two subjects in this period is as follows:

After Period 2
Investor: how much did you receive from me
Trustee: **I received 30 this time**; I sent 15
Trustee: 30 - **The multiplier was 3 (CODED AS SOFT MULTIPLIER DISCLOSURE)**
Investor: good its fair
Investor: I have no way to know if its true but I trust you ill always send you the whole 10
Trustee: yeah; I realized the system allows for the B person to be a real jerk, but that's really not fair
Investor: yep b player can pretend what he wants
Trustee: I wouldn't want to be the A player being screwed over
Trustee: yeah
Investor: Yep thanks

Table 2 indicates that trustees in the *C-NoHIS* economies shared soft information in 131 of the 288 conversation periods (45%), which implies that trustees did not share soft information in 157 of 288 periods (55%). This rate of non-disclosure is over four times greater than the rate at which trustees did not share hard information in the *C-HIS* economies (13%, or 41 of 320 cases). The rate of non-disclosure in the *C-NoHIS* economies is also generally increasing in the actual multiplier realization. The rate of non-disclosure is 35% when the multiplier equals 1 compared to 65% when the multiplier equals 4 or 5.

Table 2 also shows that 24 of the 131(18%) specific soft disclosures made by *C-NoHIS* trustees falsely state that multiplier was lower than the actual realization. The average actual multiplier exceeds the reported multiplier for reported multiplier levels of 1, 2, 3, and 4. The average actual multiplier in periods when the trustee shared soft information was 2.73 compared to 3.38 for non-disclosure periods and 3.92 in periods where the trustee falsely reported that the multiplier was lower than its actual level.

Table 3 shows that trustees in the *C-NoHIS* economy breach their agreement in 25% of the periods where an agreement is in place (65 of 254). This rate is at least five times greater than that observed for investors in the *C-NoHIS* economy as well as investors and trustees in the *C-HIS* economy. This suggests that one benefit from hard information sharing is that breach of agreement is much less pervasive.

Table 3 also indicates that 47 of the 65 (72%) breaches by *C-NoHIS* trustees occur in periods where the multiplier equals either 4 or 5 compared to five cases (8%) where the multiplier equals either 1 or 2. The third panel in table 3 describes the relation between agreement breaches and trustee soft disclosures for the 37 cases where a *C-NoHIS* trustee breached an agreement in the current period and had not breached the agreement in the prior period. These data suggest a higher incidence of soft information non-disclosure immediately after a breach, but that the disclosures actually made after a breach are far more likely to understate the true multiplier realization.

The evidence in tables 2 and 3 is consistent with deceptive communication by *C-NoHIS* trustees that could possibly benefit themselves at the expense of investors. If so, do investors in *C-NoHIS* economies lose trust and curtail investment compared to investors in the *C-HIS* economies? Figure 1 demonstrates that trustees in the *C-NoHIS* condition do not lose the trust of their trading partners. The extent to which investors are willing to make maximum investments does not decline for later periods, and the incidence of maximum investments of ten *lira* is higher in the *C-NoHIS* (74.7 %) economies than in the *C-HIS* economies (68.8 %). This suggests that the character of cheating by *C-NoHIS* trustees may be subtle rather than large enough to induce skepticism by investors (*6*). Figure 2 provides evidence consistent with this interpretation. This figure demonstrates that the mean percentage return to investors in the *C-NoIS* economies is indistinguishable from that of the *C-IS* economies for multipliers of 1 or 2, but is larger only for multipliers of 3, 4, or 5.

Hard Information Sharing Increases Trust in Impersonal Exchange

The data from the *C-NoHIS* and *C-HIS* economies suggests that sharing hard information reduces the extent to which trustees breach joint agreements, but has little impact on investor trust. This suggests that either hard information sharing has no overall impact on trust, or it has an impact only under impersonal exchange where direct communication is infeasible. A comparison of investor behavior with and without hard information sharing in settings of impersonal exchange can discriminate between these two interpretations.

Table 4 shows that trustees share hard information in 7.3 of the 10 periods for the *NoC-HIS* economies compared to 8.7 of the 10 periods for the *C-HIS* economies. This difference is significant at $p < 0.002$. They begin information in the first possible period with similar frequency, but more dyads continue to share information on an ongoing basis in the *C-HIS* economies.

The evidence in Figure 3 indicates that hard information sharing has a first-order positive impact on investor trust in economies when direct communication via chat is impossible. The percentage of maximum investments is greater in the *NoC-HIS* economies than the *NoC-NoHIS* economies in each of the ten periods. Overall, *NoC-HIS* investors invest the maximum amount in 37.5% of all periods whereas *NoC-NoHIS* investors make maximum investments in only 10.9% of all cases. This difference is significant at $p<0.006$. This evidence indicates the institution of hard information sharing increases trust in impersonal exchange settings. One result of this lower trust by *NoC-NoHIS* investors is that trustees in such economies must compensate investors by returning a greater percentage of amounts received (see Figure 4).

Economy-Wide Performance Effects of Direct Communication and Hard Information Sharing

To clarify economy-wide differences in performance, we computed measures of the social loss associated with lack of trust along with measures of private losses for investors and trustees. The economy-wide social loss is computed as the difference between the total payoffs to the investor and trustee subjects over all rounds less what the payoffs would have been had the investor invested the entire endowment for all periods. Investor and trustee private losses represent the difference between the individual's payoffs for all rounds and what the subject would have received if the dyad had implemented an "invest 10 & split 50-50" rule in every period. To aid comparability, all measures are stated in percentages relative to maximum payoff possible.

Table 5 shows that the mean social loss in the two economies where direct communication is possible are modest in both cases: -6.9% in the *C-NoHIS* economies and -7.5%

in the *C-HIS* economies. These amounts are statistically indistinguishable at conventional levels (p=0.05). The social loss in the No*C-HIS* economy is -19.2% compared to -29.6% for the *NoC-NoHIS* economies. This difference is significant at p<0.0008.

Investors do better in the *C-HIS* economies (loss of -3.5%) than in the *C-NoHIS* economies (loss of -8.2%), and vice versa for the trustees (losses of -11.5% and -5.7%, respectively). This suggests that trustee deception has redistributive consequences, but such effects are modest. The difference in investor private losses is marginally significant at p<0.086, and the differences in trustee private losses are not significant at even marginal levels. The redistributive effect of trustee decisions in the *C-NoHIS* economy is apparent in comparing Panels A and B of figure 5. Panel A indicates that the percentage of cases where the trustee sends back less than 50% of the amount received is only about ten percent of the cases when the realized multiplier equals 1, but increases monotonically as the realized multiplier increases reaching nearly sixty percent when the realized multiplier equals 5. While there is an upward tick at multiplier = 5 for the *C-HIS* economies, even here the incidence of returns less than 50% still comprises less than forty percent of the cases.

The private losses of investors are statistically indistinguishable between the *NoC-HIS* economies (investor loss of -11.0%) and the *NoC-NoHIS* economies (investor loss of -13.0%). The difference in trustee private losses in the *NoC-NoHIS* economies (-48.2%) and the *NoC-HIS* economies (-25.5%) is large and highly significant (p<0.0004). One interpretation of this pattern is that the deadweight losses associated with lack of hard information sharing are not borne by investors since they can protect themselves by withholding investment in the *NoC-NoHIS* economies where trustees can be expected to take a greater share of the payoff from investment. This is consistent with the graph in panel B of Figure 6, which shows that the number of cases where the trustee returns less than 50% greatly exceeds returns of greater than or equal to 50% for realized multipliers of 3 or more.

The evidence in table 5 and figures 5 and 6 support the notion that social losses from under-exploited exchange opportunities are modest, and are not qualitatively different from each other, in the *C-NoHIS* and *C-HIS* economies. There is a modest tendency for trustees to exploit an information advantage in the *C-NoHIS* economies, but this effect is not large enough to lead investors to curtail investment due to lack of trust. The impact of hard information sharing on trust in the *NoC-HIS* economies is substantial, and leads to a material decline in social losses that are borne mainly by trustees in the *NoC-NoHIS* economies.

Concluding Remarks

Our experiment offers insight into the effects of direct communication and an institution that provides hard evidence of exchange results on trust among trading partners. When subjects can directly communicate, the overwhelming tendency is for them to propose and reach agreements about behaviors that determine gains from cooperation. Consistent with Machiavellian intelligence, individuals often breach such agreements and provide deceptive communication when their trading partners cannot observe their actions. An institution that reports hard evidence on the results of exchange decreases agreement breaches, but surprisingly has no overall impact on the trust of others by the person being cheated. In a setting of impersonal exchange where direct communication is not possible, an institution that provides hard information on exchange results has a major positive impact on overall trust. The social losses associated with lacking trust are greatest in a setting where neither direct communication nor sharing of hard information is possible. Social losses are lowest in an economy that provides for direct communication but not hard information sharing. The likely reason for this surprising result

is that deceptive communication sustains subtle forms of cheating that have only modest redistributive consequences.

Notes

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Table 1
Frequency of Proposals and Agreements Between Investors & Trustees

	C-NoHIS ***(32 Dyads)***	***C-HIS*** ***(28 Dyads)***
Proposals		
# Dyads Where at Least One Proposal Made	32 of 32	24 of 28
# Dyads Where Agreement Reached	31 of 32	24 of 24
Subject Making First Proposal	16 by Investor 16 by Trustee	14 by Investor 10 by Trustee
Agreements		
# Agreements Reached in First Conversation Period	20	12
# Where Final Agreement is “Invest 10 & Split 50-50”	29	18

Table 2
Nature and Extent of Soft Information Sharing by Trustees in *C-NoHIS* Economy

Rates Not Sharing Soft Information for Alternative Multiplier Realizations

# (%) Periods Where Soft Information Shared	131 of 288 (45%)
# (%) Periods Where Soft Information Not Shared (Non-Disclosure)	157 of 288 (55%)
# (%) Non-Disclosures Occurring After:	
Multiplier = 1	20 of 57 (35%)
Multiplier = 2	22 of 49 (45%)
Multiplier = 3	35 of 59 (59%)
Multiplier = 4	39 of 60 (65%)
Multiplier = 5	41 of 63 (65%)
# (%)Trustee Did Not Share Hard Information in the *C-HIS* Economies	41 of 320 (13%)

Frequency of Actual Multipliers Conditional on Reported Multiplier for C-NoHIS Economy

Reported Multiplier	*Actual = 1 (n=57)*	*Actual = 2 (n=49)*	*Actual = 3 (n=59)*	*Actual = 4 (n=60)*	*Actual = 5 (n=63)*	*Average*
= 1 (n=43)	37	3	1	1	1	1.28
= 2 (n=31)	0	23	3	2	3	2.52
= 3 (n=28)	0	1	19	6	2	3.32
= 4 (n=15)	0	0	1	12	2	4.07
= 5 (n=14)	0	0	0	0	14	5.00
ALL DISCLOSURES (n=131)	37	27	24	21	22	2.73
ALL NON-DISCLOSURES (n=157)	20	22	35	39	41	3.38
DISCLOSED > ACTUAL (n=2)	0	1	1	0	NA	2.50
DISCLOSED < ACTUAL (n=24)	NA	3	4	9	8	3.92

Table 3
Breaches of Agreements in the *C-NoHIS* and *C-HIS* Economies

Frequency of Breaches

	C-NoHIS	***C-HIS***
# Conversation Periods Where Agreement:		
In Place	254 of 288 (89%)	181of 252 (72%)
Breached by Investor	10 of 254 (4%)	12 of 181 (7%)
Breached by Trustee	65 of 254 (25%)	8 of 181 (4%)

Trustee Breaches - By Multiplier Realization

	C-NoHIS	***C-HIS***
Multiplier = 1	0 of 65 (0%)	4 of 8 (50%)
Multiplier = 2	5 of 65 (8%)	0 (0%)
Multiplier = 3	13 of 65 (20%)	0 (0%)
Multiplier = 4	17 of 65 (26%)	2 of 8 (25%)
Multiplier = 5	30 of 65 (46%)	2 of 8 (25%)

Change in Soft Multiplier Disclosure for 37 Trustee Breaches Not Immediately Preceded by a Trustee Breach in C-NoHIS Economies

	Period *Before* Trustee Breach	**Period *After* Trustee Breach**	**Pre- to Post Change**
# (%) Multiplier Mentioned in Conversation	27 (73%)	21 (57%)	-6 (-16%)
# (%) Non-Disclosures	19 (51%)	25 (68%)	+6 (+17%)
Total # Multiplier Disclosures	18	12	-6
# Disclosed Multiplier = Actual Multiplier	17	2	-15
# Disclosed Multiplier < Actual Multiplier	1	9	+8
# Disclosed Multiplier > Actual Multiplier	0	1	+1

Table 4
Information Sharing Frequency in the *NoC-HIS* and *C-HIS* Economies

	NoC-HIS	***C-HIS***	***p-value***
Mean # Periods Where Trustee Chooses to Share Information in a Given Economy (Max = 40 per economy)	29.4 (7.3 per dyad)	34.9 (8.7 per dyad)	0.002
# Where Information Shared in First (Every) Period	19 (12)	18 (26)	

p-values computed based on Mann-Whitney applied to four-person economy means

Table 5
Mean (Median) Social Losses, Private Losses, and Subject Profits Per Round Under Four Different Economy Types

Mean (Median) Economy-Wide Social & Private Losses

	C-NoHIS	***C-HIS***	***p-value***
Social Loss	-6.9%	-7.5%	0.264
	(-5.2%)	(-6.9%)	
Investor Private Loss	-8.2%	-3.5%	0.086
	(-8.1%)	(-1.9%)	
Trustee Private Loss	-5.7%	-11.5%	0.337
	(-7.0%)	(-10.6%)	

	C-NoHIS	***C-HIS***	***p-value***
Social Loss	-19.2%	-29.6%	0.0008
	(-17.9%)	(-30.4%)	
Investor Private Loss	-13.0%	-11.0%	0.264
	(-12.8%)	(-8.5%)	
Trustee Private Loss	-25.5%	-48.2%	0.0004
	(-25.1%)	(-46.6%)	

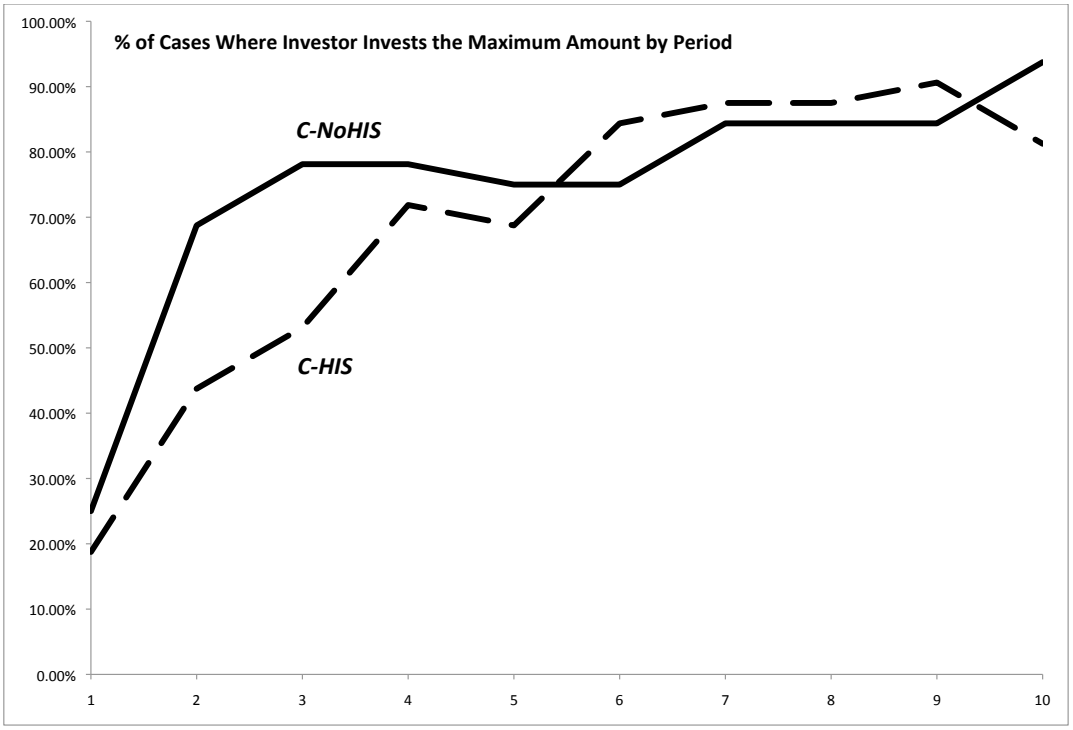
p-values computed based on Mann-Whitney applied to four-person economy means

Economy-Wide Social Loss = $\sum_{it}$ [(Investor Profit$_{it}$ + Trustee Profit$_{it}$) – (10•Realized Multiplier$_{it}$)]/(10•Realized Multiplier$_{it}$)

Economy-Wide Investor Private Loss = $\sum_{it}$ [Investor Profit$_{it}$ – (5•Realized Multiplier$_{it}$)]/(5•Realized Multiplier$_{it}$)

Economy-Wide Trustee Private Loss = $\sum_{it}$ [Trustee Profit$_{it}$ – (5•Realized Multiplier$_{it}$)]/(5•Realized Multiplier$_{it}$)

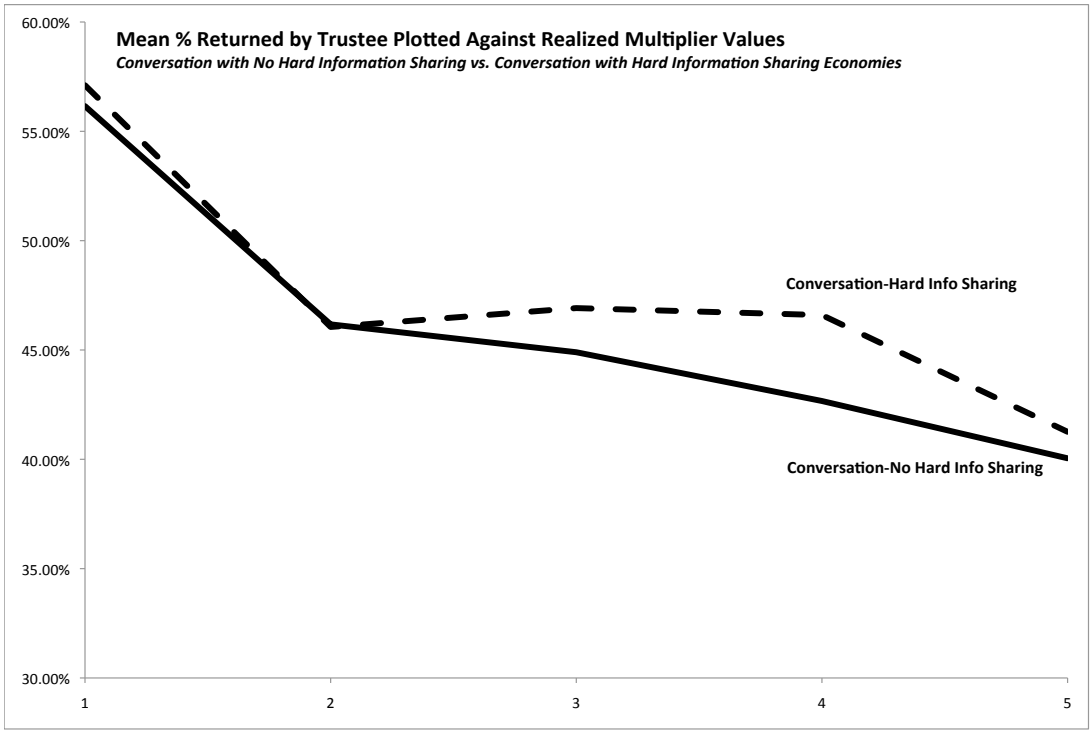
Figure 1
Percentage of Maximum Investments by Period in the *C-NoHIS* & *C-HIS* Economies



	C-NoHIS	*C-HIS*	*p-value*
% Maximum Investments	74.7%	68.8%	0.104

p-values computed based on Mann-Whitney applied to four-person economy means

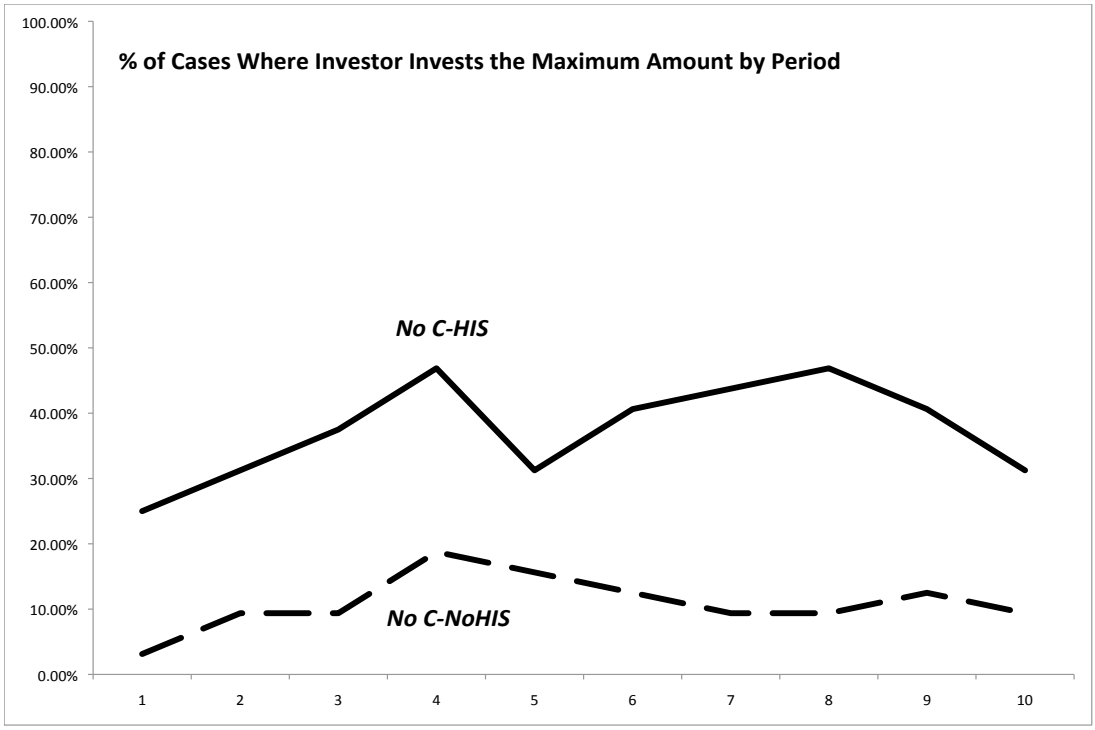
Figure 2
Mean % of Amount Received by Trustee that is Sent Back to the Investor *C-NoHIS* and *C-HIS* Economies



Mean % of Amount Received that Trustees Return

	Mult=1	Mult=2	Mult=3	Mult=4	Mult=5	All Cases
C-HIS	**57.1**	**46.1**	**46.9**	**46.6**	**41.3**	**47.6**
C-NoHIS	**56.2**	**46.2**	**44.9**	**42.7**	**40.0**	**46.0**

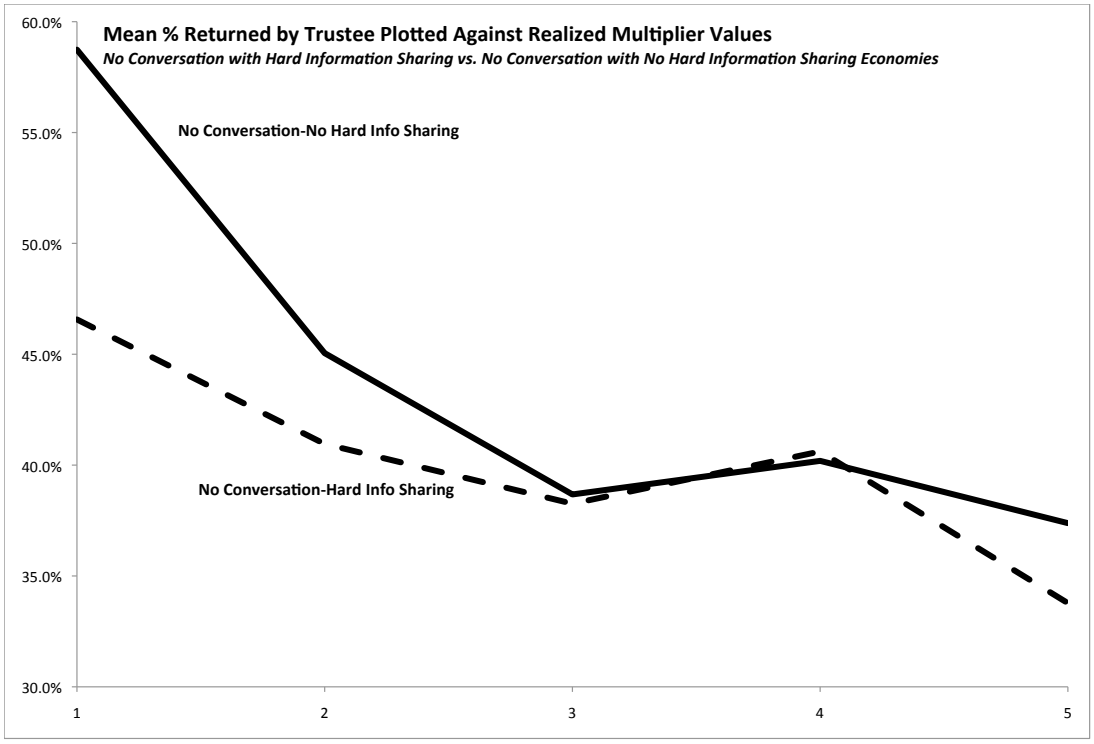
Figure 3
Percentage of Maximum Investments by Period in the *NoC-NoHIS* & *NoC-HIS* Economies



	NoC-HIS	*NoC-NoHIS*	*p-value*
% Maximum Investments	37.5%	10.9%	0.006

p-values computed based on Mann-Whitney applied to four-person economy means

Figure 4
Mean % of Amount Received by Trustee that is Sent Back to the Investor *NoC-NoHIS* vs. *NoC-HIS* Economies

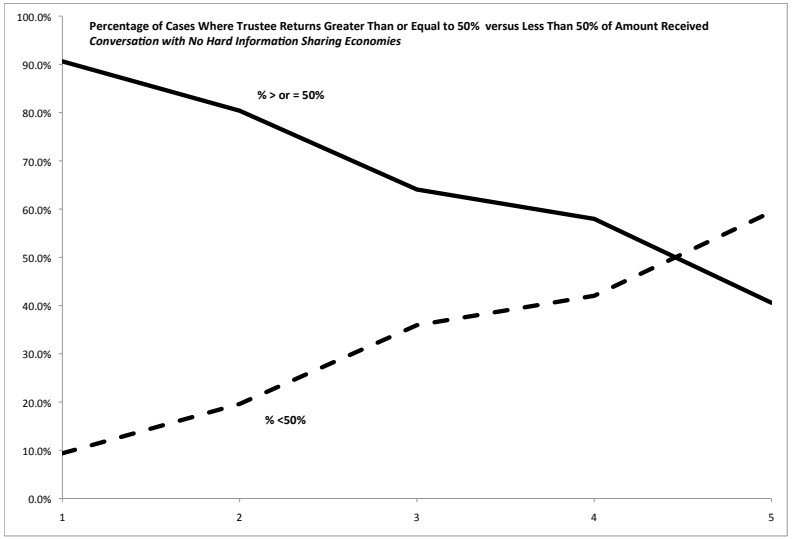


Mean % of Amount Received that Trustees Return

	Mult=1	Mult=2	Mult=3	Mult=4	Mult=5	All Cases
NoC-HIS	**46.6**	**41.0**	**38.3**	**40.6**	**33.8**	**40.0**
NoC-NoHIS	**58.7**	**45.0**	**38.7**	**40.2**	**37.4**	**44.0**

Figure 5
Frequency of Trustee Returns of < 50% & ≥ 50% Plotted as a Function of Realized Multiplier for Conversation Economies

A: C-No HIS Economies



B: C-HIS Economies

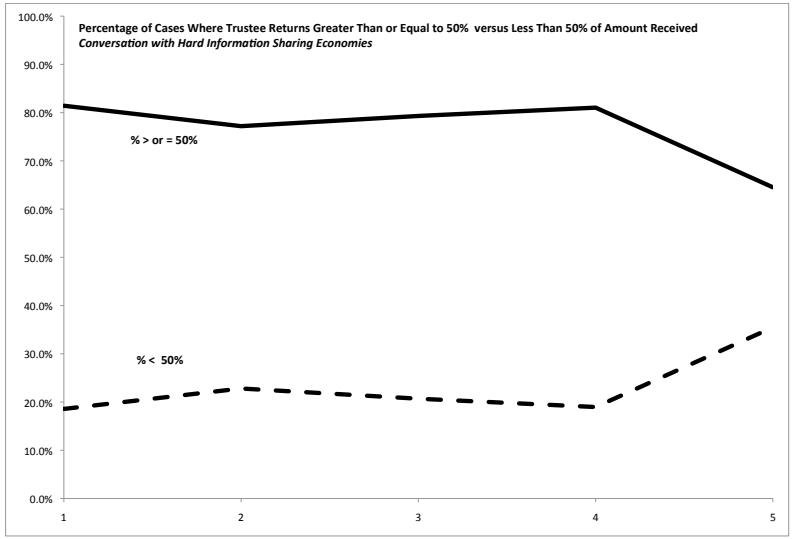
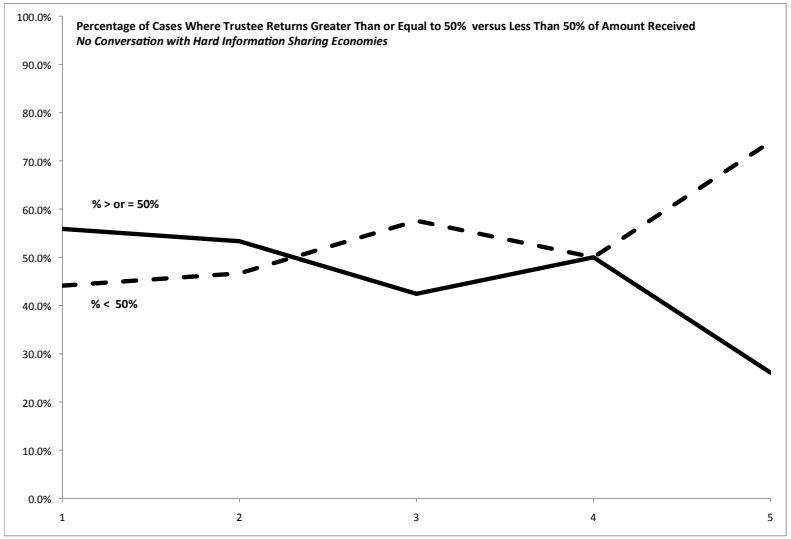


Figure 6
Frequency of Trustee Returns of < 50% & ≥ 50% Plotted as a Function of Realized Multiplier for No Conversation Economies

A: NoC-HIS Economies



B: NoC-No HIS Economies