Reputation Effects Of Disclosure: An Experimental Investigation[*, **]

Radhika Lunawat[†]

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[†]Department of Accounting, Opus College of Business, University of St Thomas, 1000 LaSalle Avenue, Mail# TMH 443, Minneapolis, MN 55403; e-mail: rlunawat@stthomas.edu.

Abstract

This paper examines experimentally the impact reputation building for trustworthiness has on investment in a setting where trust and reputation are important. I introduce information asymmetry in a finitely repeated investment game to allow for disclosure in the form of truthful communication of private information. I define two regimes, namely disclosure and no disclosure regimes and it is only in the disclosure regime that a manager actually has the option of disclosing her private information to the investor. In such a setting, a rational manager will mimic a trustworthy manager in an attempt to build a reputation for being trustworthy. Such mimicking could either occur with certainty (equilibrium in pure strategies) or occur with a probability strictly less than one (equilibrium in mixed strategies). By providing ex post verifiability of the state of nature, disclosure obviates such downward revision of an investor's prior beliefs about a manager's trustworthiness as occurs in the no disclosure regime. This results in greater time of mimicking with certainty in the disclosure regime and since such pure strategy play also implies investment with certainty, disclosure leads to higher investment in later periods of a repeated game. However, this theoretical prediction is based on prior beliefs about a manager's trustworthiness being equal across the two regimes. In testing this prediction experimentally, prior beliefs about a manager's trustworthiness turn out to be much lower in a disclosure regime compared to a no-disclosure regime, leading to lower investment in the disclosure regime. I introduce a two-stage experimental design to homogenize prior beliefs about managers' trustworthiness. This design, while confirming higher investment in later periods of the disclosure regime, also makes a contribution to experimental methodology.

Keywords: Disclosure, Reputation, Investment, Trust.

JEL codes: C73, C92, D82, M40.

Data Availability: Contact the author.

I. Introduction

> The drop in trust, we believe, is a major factor behind the deteriorating economic conditions. To demonstrate its importance, we launched the Chicago Booth/Kellogg School Financial Trust Index. Our first set of data—based on interviews conducted at the end of December 2008—shows that between September and December, 52 percent of Americans lost trust in the banks. Similarly, 65 percent lost trust in the stock market. A BBB/Gallup poll that surveyed a similar sample of Americans last April confirms this dramatic drop. At that time, 42 percent of Americans trusted financial institutions, versus 34 percent in our survey today, while 53 percent said they trusted U.S. companies, versus just 12 percent today.
>
> —Sapienza and Zingales (2009)

The preceding quotation appears to claim that the documented decrease in trust in financial markets and institutions is a driving force behind decreasing bank liquidity and investment. It leaves open a dire possibility that once trust is lost, economies will not be able to recover over the natural course of affairs without drastic intervention to restore trust. The obvious question for policy makers is if there are forces within the economy that allow trust to recover on its own. This experiment examines how the opportunity for voluntary disclosure provides a natural window to build trust and promote investment.

I introduce the opportunity to make verifiable voluntary disclosure into an investment / trust game to examine if disclosure has an impact on players' willingness to invest. In this game the owner is endowed with some wealth and chooses how much to invest in a manager. The manager then chooses whether to keep the investment and its earned profit or return some dividend to the investor. The magnitude of the profit depends on the state of nature. The manager always learns the state of nature but the owner may or may not depending upon the regime and upon the manager’s decision on whether to disclose voluntarily. There are two regimes, namely disclosure regime and no-disclosure regime. It is only in the disclosure regime that the manager has the option to truthfully disclose the state of nature to the owner. Controlling for

heterogeneous beliefs about player trustworthiness, I find that such disclosure opportunity raises the level of investment, improving the overall welfare of both parties.

In a setting with two types of managers – trustworthy and rational, choosing to disclose voluntarily and choosing to pay a fair dividend are natural acts of the trustworthy manager that the rational manager will mimic to receive additional future investments. Theoretically, in a finitely repeated game where disclosure of private information is a possibility, such mimicry will start with probability 1, and the investor will also invest with probability 1; that is, the game will start with pure strategic play. However, in later periods, mixed-strategy play will start in that the mimicry will switch to occurring with a probability strictly less than 1 to support managerial efforts at reputation building for trustworthiness. This switch will ensure that an investor's prior / ex ante belief about a manager's trustworthiness is updated upward to a point on the threshold at which the investor invests with a probability strictly less than 1.

In contrast, in a finitely repeated game where disclosure of private information is not a possibility, a rational manager will start with paying dividends consistent with the worst possible state of nature. Lack of ex post verifiability of the state of nature implies that she is able to get away with pretending that the worst possible state of nature has occurred; however, this leads to a downward revision of an investor's ex ante belief about a manager's trustworthiness. This downward revision ensures that the mixed-strategy play and the concomitant lower probability of investment will occur sooner in a game where disclosure is not a possibility. These differences in the way managerial reputation building for trust occurs in an economy with disclosure as compared to one without imply that while both economies start with comparable levels of investment, in later periods, investment will be higher in economies with disclosure. Higher

investment in later periods in economies with disclosure will translate into higher total investment in such economies.

However, in testing this result experimentally, I find, surprisingly, that prior beliefs about a manager's trustworthiness turns out to be lower in a disclosure regime compared to a no-disclosure regime. While the lower belief naturally results in lower investment in the disclosure regime, it also renders comparison of investment across the disclosure and the no-disclosure regimes meaningless. The homogenization of prior beliefs across conditions was achieved via introduction of a two-stage experimental design. The first stage, called the *screening round*, enabled categorization of subjects as trustworthy and untrustworthy. Then a predetermined proportion of trustworthy and untrustworthy types were selected to proceed to the second stage, called the *main round*. This proportion was announced to the subjects who proceeded to the main round and provided them with an anchor point for forming their prior beliefs. The main round comprised either the disclosure regime or the no-disclosure regime. The screening round, while enabling testing of the higher investment in disclosure hypothesis, is also a methodological contribution.

This paper is related to the existing literature on managerial reputation building and the role of information disclosure and ties these two strands together by focusing on the reputation-building role of information disclosure. Existing literature on managerial reputation building, for example, looks at the reputation for truthful reporting (e.g., King 1996) and the reputation for informative reporting (e.g., Healy and Palepu 1993). Hales and Williamson (2010) consider the role of reputation building in promoting firm productivity, whereas Seybert (2010) looks at the role of reputation concerns in capitalization of R&D. Existing literature on the role of information disclosure attributes to financial disclosure the role of reducing the information

asymmetry component of cost of capital (e.g., Verrecchia 2001; Dye 2001). Another strand of literature explicates the role financial disclosure plays in real investment and managerial decisions of a firm (e.g., Kanodia 2006). The role of information disclosure in markets has been examined experimentally in the context of market efficiency studies (e.g., Bloomfield 1996; Bloomfield and Libby 1996) and game-theoretic strategic disclosures (e.g., King and Wallin 1991, 1995). Leuz and Wysocki (2008) discuss the economic costs and benefits of disclosure.

This paper contributes to the emerging literature looking at the very foundational issues in accounting. As part of this emerging literature, Basu et al. (2009) tests the evolutionary hypothesis developed by Basu and Waymire (2006) to provide evidence of the role of financial recordkeeping in promoting trade and exchange. Dickhaut et al. (2008) examine the relation of disclosure and nonenforceable contract formation in single-venture settings and compare the results as an economy grows in size and complexity. Jamal et al. (2005) contrast the role of voluntary disclosure as a social norm with enforced standards and conventions. This work sheds light on foundational issues regarding the relation between reputation and financial disclosure.

The rest of the paper proceeds as follows. Section II discusses the theory and hypotheses. Section III discusses the experimental procedures and analyzes the data from disclosure and no-disclosure regimes. Section IV introduces the screening round, whereas section V summarizes and concludes.

II. Theory and Hypotheses

I will define two regimes, namely, a *disclosure regime* and a *no-disclosure regime*. Truthful disclosure of private information is a possibility only in the former regimes. Both regimes derive from the investment game of Berg et al. (1995).

Disclosure regime

There are two players: a sender/investor/owner and a receiver/manager (hereinafter referred to as owner and manager, respectively). Nature moves first and selects manager's type as either trustworthy or untrustworthy (to be defined momentarily). Manager knows her type, but owner does not. The game then proceeds through three periods, during each of which the owner and manager make a sequence of choices. In what follows, the subscript t (t = 1, 2, 3) will be used to denote a period. Manager chooses whether to disclose private information she will learn in the course of the game. Note that manager is not privy to the private information at the time she makes the choice of whether to disclose it—it is information she *will* learn in the course of the game. It is as if manager is making a choice of accounting system: manager could choose an accounting system that will generate information that both owner and manager will learn (by choosing to disclose), or alternatively, manager could choose an accounting system that will generate information only manager will learn (by choosing not to disclose).

Owner sees manager's disclosure decision, is endowed with ten units of wealth, and chooses how many of the ten units to send to manager (denoted by m_t^D). Manager sees m_t^D and receives $\lambda_t m_t^D$. The state of nature or multiplier (denoted by λ) is stochastic in that it is equally likely to be 1, 2, 3, 4, or 5. Manager decides how much of the multiplied amount ($\lambda_t m_t^D$) to return to owner (denoted by k_t) and how much to keep for herself ($\lambda_t m_t^D - k_t$). Owner receives k_t and learns λ_t only if manager had earlier chosen to disclose her private information; that is, if manager had chosen an accounting system that generates information both owner and manager learn, then owner learns λ_t. Otherwise, if manager had chosen an accounting system that generates information only manager learns, then owner does not learn λ_t. In this sense, λ_t is

manager's private information—she always learns the realized value of λ_t, but owner's knowledge of λ_t is dependent on manager's choice of accounting system. The timeline for this game is described in Figure 1.

<FIGURE 1 ABOUT HERE>

A *trustworthy manager* is defined as one that always chooses to disclose and always chooses to return half of what she receives. An *untrustworthy manager* is defined as a manager that is not trustworthy. The multiplied amount ($m_t^D \lambda_t$) may be thought of as the gross income of the firm comprising owner and manager, and the amount sent back by manager (k_t) may be thought of as the dividend manager pays to owner. Risk neutrality, additively separable utility, and zero discounting rate are assumed.

In equilibrium, owner plays a threshold strategy and chooses to invest all her endowment of ten units of wealth if her belief about manager's trustworthiness is above the threshold depicted in Figure 2. If her belief is below the threshold, she chooses to invest nothing. Denote by P_t^D the probability with which owner believes manager is trustworthy in period *t*. If P_t^D is above the threshold for period *t*, then owner chooses $m_t^D = 10$; otherwise, owner chooses $m_t^D = 0$.

<FIGURE 2 ABOUT HERE>

For $t < 3$, untrustworthy manager mimics the trustworthy type in period *t* if owner's period *t* belief is above the threshold at which she will invest in period $t + 1$. If her belief is below this threshold, then manager mimics the trustworthy type with some positive probability strictly less than 1. The choice of the probability is such that owner's updated period $t + 1$ belief about manager's trustworthiness is exactly on the threshold. Denote by S_t^D the probability with which manager mimics the trustworthy type in period *t*. Manager chooses S_t^D such that P_{t+1}^D is

exactly equal to the threshold for period $t + 1$. Note that owner updates her belief using Bayesian updating, and consequently, if manager mimics the trustworthy type with probability 1, then owner's updated period $t + 1$ belief is the same as her period t belief; that is, $S_t^D = 1$ implies $P_{t+1}^D = P_t^D$.

If owner's period t belief is exactly equal to the threshold for period t, then owner is indifferent about how much she chooses to invest. She chooses to invest a nonzero amount with some positive probability strictly less than 1. The choice of the probability is such that it makes manager indifferent between mimicking the trustworthy type in period $t - 1$ and not mimicking the trustworthy type in period $t - 1$. In period 3, untrustworthy manager chooses to disclose if she had chosen $k_2 = \lambda_2 m_2^D/2$ and chooses $k_3 = 0$.

Example: Full disclosure strategy

Define a full disclosure strategy as one in which untrustworthy manager always chooses to disclose and always chooses $k_t = \lambda_t m_t^D/2$; that is, she mimics being trustworthy with probability 1. Then, by Bayesian updating, $P_{t+1}^D = P_t^D$. Now, if P_{t+1}^D is less than the threshold for period $t + 1$, owner will not invest in period $t + 1$. On the contrary, in the equilibrium described earlier, manager will mimic being trustworthy with probability S_t^D, owner's period $t + 1$ belief will be exactly on the threshold, and owner will invest with some strictly positive probability less than 1. This implies that manager will not follow the full disclosure strategy. However, there is one exception: if owner's period 1 belief is higher than threshold for period 3, then manager will follow full disclosure—the equilibrium described earlier, too, predicts that in a world with very high initial prior belief, untrustworthy manager will follow full disclosure.

No-disclosure regime

Now consider the same game with the following modification: owner never learns λ_t; that is, manager does not have any means available to communicate her private information to owner, even if she wishes to share this information. A trustworthy manager is defined as one that always chooses $k_t = e\lambda_t/2$. This is a setting in which there is a firm comprising owner and manager and gross income of $m_t^{ND}\lambda_t$, but there is no accounting system available. A dividend of k_t can still be paid, but the income $m_t^{ND}\lambda_t$ cannot be reported. The modified timeline is described in Figure 3.

<FIGURE 3 ABOUT HERE>

In the no-disclosure regime, if owner's belief about manager's trustworthiness is sufficiently high, an untrustworthy manager can get away with paying a very low dividend. For example, if owner invests 8 units of wealth and a multiplier of 4 obtains, then manager receives 32 units of wealth. However, manager can pay a dividend of only 4 units of wealth and thereby convey to owner that a multiplier of 1 obtained. Because the multiplier that obtains in not verifiable by owner, manager can hide behind a low multiplier. This implies that when owner sees a dividend that conveys the occurrence of the lowest possible multiplier, she updates her beliefs about manager's trustworthiness in such a way that her posterior belief is lower than her prior belief. Such downward revision of owner's beliefs in the no-disclosure regime implies that if the game starts in both regimes with the same prior probability, then mixed-strategy play will begin at least as soon in the no-disclosure regime as in the disclosure regime. Under very mild conditions, it can be shown that mixed-strategy play will begin sooner in the no-disclosure regime than in the disclosure regime. In this sense, the disclosure regime provides for additional reputation-building opportunities. Because the probability of investment in a period of pure

strategy play is higher than the probability of investment in a period of mixed-strategy play, more pure strategy play in a disclosure regime will translate into higher total investment (m_1 + m_2 + m_3) in a disclosure regime. More specifically, investment in later periods will be higher in the disclosure regime[1].

Hypotheses

Total investment (m_1 + m_2 + m_3) in the disclosure regime is higher than total investment in the no-disclosure regime. The higher total investment obtains because investment in later periods is higher in the disclosure regime:

$$m_1^D = m_1^{ND},$$

$$m_2^D \geq m_2^{ND},$$

$$m_3^D > m_3^{ND}.$$

Example

Consider a ten-period example in which the prior belief in both regimes is 0.4. Then, the way owner's belief about manager's type evolves in the disclosure and no-disclosure regimes is shown by the red dotted line and green dotted line in Figure 4, respectively. Note that when owner's belief is above the reputation threshold, owner plays a pure strategy of always investing. When owner's belief is on the threshold, owner switches to a mixed-strategy play, where the probability with which she invests is given by the equilibrium described earlier. Manager switches to mixed-strategy play to prevent owner's beliefs from falling below the threshold. In this example, even though the game in both regimes begins with an identical initial probability of

[1] For a formal derivation of the proof, refer to Lunawat (2011a) and (2011b).

0.4, the disclosure regime provides for more pure strategy play as compared to the no-disclosure regime. In this sense, the disclosure regime provides for additional reputation-building opportunities. Because the probability of investment in a period of pure strategy play is higher than the probability of investment in a period of mixed-strategy play, more pure strategy play in a disclosure regime should translate into higher investment in a disclosure regime.

<FIGURE 4 ABOUT HERE>

III. Experimental Procedures and Results

Experimental procedures

The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007). The experimental sessions were run at the Center for Interuniversity Research and Analysis on Organizations (CIRANO) in Montreal, Quebec, Canada.

Subjects were assigned the role of owner-player or manager-player. Roles remained unchanged throughout the session. One owner-player was grouped with one manager-player, and the players in the group played against each other for a set comprising three periods. At the end of a set, each player was grouped with some other player. No two subjects were grouped twice (perfect stranger matching). The roles and the game were explained to the players using neutral terminology (e.g. A-player for owner and B-player for manager).

In the disclosure regime, the computer prompted the manager-player to decide whether she would like to share with the owner-player the knowledge of the multiplied amount the manager-player would receive. Then, the owner-player saw the disclosure decision made by the manager-player. Note that the no-disclosure regime did not require this stage of the manager-player's disclosure decision.

The owner-player was endowed with ten units of experimental currency, called lira. She decided how much of her endowment to send to the manager-player. The amount sent by the owner-player was multiplied before the manager-player received it. The multiplier was equally likely to be 1, 2, 3, 4, or 5. The manager-player decided on how much to keep and how much to send back to the owner-player. At the end of every period, the subjects saw their payoffs and relevant information on their respective computer screens. At the end of the experimental session, each subject's total payoff was converted to Canadian dollars using a preannounced exchange rate.

An experimenter read the instructions (similar to the instructions in Appendix B) aloud to the subjects, while the subjects followed along on their own copies of the instructions. After the instructions were read, subjects were asked to answer questions about the experiment. The questions appeared on their computer screens, and they were paid 50 cents for every correct answer. The computerized game started after this quiz. The CIRANO Research Institute in Montreal recruited the subjects. The subject pool at CIRANO draws primarily from students (graduate and undergraduate), although it also includes some nonstudents in Montreal.

Results

I ran two sessions of the disclosure regime. Sixteen subjects participated in the first session, and 22 subjects participated in the second session. Of the 16 subjects in the first session, 8 were assigned to the role of owner-player and 8 to the role of manager-player. Perfect stranger matching of owner-players and manager-players implied that there were eight sets of three periods each. This session, therefore, yielded 64 (8 sets × 8 owner-manager dyads) observations. Of the 22 subjects in the second session, 11 were assigned to the role of owner-player and 11 to

the role of manager-player. Perfect stranger matching of owner-players and manager-players implied that there were 11 sets of three periods each. This session, therefore, yielded 121 (11 sets × 11 owner-manager dyads) observations. Sixty-four observations from the first session and 121 observations from the second session gave a total of 185 observations (Table 1).

<TABLE 1 ABOUT HERE>

I ran two sessions of the no-disclosure regime. Sixteen subjects participated in the first session, and 24 subjects participated in the second session. Of the 16 subjects in the first session, eight were assigned to the role of owner-player and eight to the role of manager-player. Perfect stranger matching of owner-players and manager-players implied that there were eight sets of three periods each. This session, therefore, yielded 64 (8 sets × 8 owner-manager dyads) observations. Of the 24 subjects in the second session, 12 were assigned to the role of owner-player and 12 to the role of manager-player. Perfect stranger matching of owner-players and manager-players implied that there were 12 sets of three periods each. This session, therefore, yielded 144 (12 sets × 12 owner-manager dyads) observations. Sixty-four observations from the first session and 144 observations from the second session gave a total number of 208 observations (Table 1).

Figure 5 shows the average amount invested in each of the three periods in the two regimes. The average for each period in the disclosure regime is across 185 observations, and the average for each period in the no-disclosure regime is across 208 observations. It is startling that the investment in the disclosure regime is lower than the investment in the no-disclosure regime. Tables 2A–2C report the repeated-measures analysis of variance (ANOVA) for the effect the option to disclose (which was available only in the disclosure regime) has on investment in

periods 1, 2, and 3, respectively. This reiterates the significant difference between investment in the disclosure regime and investment in the no-disclosure regime[2].

<FIGURE 5 ABOUT HERE>

<TABLES 2A–2C ABOUT HERE>

A closer look at the data reveals that in the disclosure regime, 17 managers in period 3 were trustworthy (Table 3), whereas in the no-disclosure regime, 74 managers in period 3 were trustworthy (Table 4). This implies that in the disclosure regime, at least 9.19 percent (17/185) of the initial sample of 185 observations was composed of trustworthy managers (Table 3), whereas in the no-disclosure regime, at least 35.58 percent (74/208) of the initial sample of 208 observations was composed of trustworthy managers (Table 4). Furthermore, the inferred prior probability in the disclosure regime is 0.2951, whereas the inferred prior probability in the no-disclosure regime is 0.3855 (Appendix A).

<TABLES 3 AND 4 ABOUT HERE>

We can conclude that owner's belief about manager's trustworthiness is much higher in the no-disclosure sample than in the disclosure sample, and this explains why average investment in the no-disclosure sample turns out to be higher than average investment in the disclosure sample. The subject samples for both the disclosure and the no-disclosure regimes are drawn from the same population, and it is very intriguing that the prior beliefs across the samples are different. It may also be that the disclosure regime induces a lower prior belief than the no-disclosure regime. Though the question of why the disclosure regime induces a lower prior belief is in and of itself interesting, the next section introduces an experimental design to homogenize

[2] The data on disclosure regime can be bifurcated into instances where subjects actually chose to disclose and those where they did not choose to disclose. The average investment in the instances where subjects actually chose to disclose is significantly higher than the average investment in the instances where subjects chose not to disclose but is still significantly lower than the average investment in the no-disclosure regime.

prior beliefs across the disclosure and no-disclosure regime samples. Because the prediction of higher investment in the disclosure regime is for a case of equal prior beliefs, such homogenization will enable a test of the prediction.

IV. Screening Round

A two-stage design was introduced to ensure that prior beliefs across the disclosure and no-disclosure samples were equal. The first stage was called the screening round and enabled the classification of managers into trustworthy and untrustworthy types. Then, a predetermined proportion of trustworthy and untrustworthy managers proceeded to the second stage, called the main round. This proportion was announced to the subjects who proceeded to the main round to give them an anchor point for forming their beliefs. The main round comprised either the disclosure regime or the no-disclosure regime. Common anchor points for subjects participating in the postscreening disclosure regime and the postscreening no-disclosure regime ensured that prior beliefs in the two postscreening regimes were equal. The screening round comprised a simplified version of the one-shot investment game. This simplified version is derived from McCabe and Smith (2000) and is graphed in Figure 6.

<FIGURE 6 ABOUT HERE>

An experimenter read aloud the instructions for the screening round (attached in Appendix C) to the subjects, while the subjects followed along on their own copies of the instructions. The subjects were recruited for three hours. Therefore, after reading the instructions for the screening round, they had the potential to be able to guess that there was something more to follow. Such guessing could alter their behavior in the screening round. To preempt this, the instructions said, “After everyone finishes this game on the computer, all of you will proceed to

another session." Now, creating a required mix of managers meant that not all subjects who participated in the screening round could go to the main round. Therefore the subjects who did not go to the computerized main round filled out a questionnaire for $10.

I ran 2 sessions – the main round comprised the disclosure regime in the first session and it comprised the no disclosure regime in the second session. Twenty-six subjects participated in the screening round of the first session. Of these, 13 were assigned to the role of an owner-player and 13 were assigned to the role of a manager-player. The roles and the game were explained to the players using neutral terminology (e.g. A-player for owner and B-player for manager). Of the 13 owner-players, 2 did not invest and consequently, the 2 manager-players they were respectively paired with could not be categorized into trustworthy or untrustworthy. Of the remaining 11 manager-players, 8 returned and were classified as trustworthy while 3 did not return and were classified as untrustworthy. Thirty subjects participated in the screening round of the second session – 15 were assigned to the role of an owner-player and 15 were assigned to the role of a manager-player. Of the 15 owner-players, 5 did not invest leaving only 10 manager-players in the game. Of these 10 manager-players, 7 returned and were classified as trustworthy while 3 did not return and were classified as untrustworthy.

In each of the two sessions, 3 untrustworthy managers and 1 trustworthy manager were selected to go to the main round. This proportion was announced to the participants of the main round in the instructions for the main round (Appendix B). Further, in each session, any 4 of the subjects who played the role of owner-player in the screening round were randomly selected to go the main round. Of these 8 subjects (4 owner-players and 4 manager-players) that proceeded to the main round in each session, those who were assigned the role of owner-player in the screening round continued to play as owner-players in the main round, and those who were

assigned the role of manager-player in the screening round continued to play as manager-players in the main round. One owner-player was grouped with one manager-player, and the players in the group played against each other for three periods. At the end of three periods, each player was grouped with some other player. No two subjects were grouped twice (perfect stranger matching). Eight subjects in the main round and implementation of perfect stranger matching implies that there were 16 observations for each experimental session (Table 5).

<TABLE 5 ABOUT HERE>

Figure 7 shows the average amount invested in each of the three periods in the two regimes. The average is across 16 observations for each of the two regimes. Tables 6A–6C report the repeated-measures ANOVA for the effect the option to disclose (which is available only in the disclosure regime) has on investment in periods 1, 2, and 3, respectively. Investment in periods 1 and 2 does not differ significantly across the two regimes, whereas as predicted, investment in period 3 is significantly higher (at a 5 percent level of significance) in the disclosure regime.

<FIGURE 7 ABOUT HERE>

<TABLES 6A–6C ABOUT HERE>

V. Conclusion

This paper illustrates the potential for the construct of voluntary disclosure to promote welfare-increasing investment in an exchange with private information. Reputation building occurs differently in a regime where disclosure of private information is a possibility as compared to one where such disclosure is not a possibility. Without disclosure, a dividend is the only tool available for reputation building. There is no way to identify untrustworthy behavior

with certainty, so the value of benevolent behavior is diminished. In contrast, disclosure allows honest versus dishonest behavior to be distinguished, thereby making benevolent behavior more valuable. This difference in the way reputation building occurs implies that the probability of investment in a disclosure regime in the later periods of a finitely repeated game is higher.

A test of the disclosure and no-disclosure regimes revealed that an investor's ex ante/prior beliefs about a manager's trustworthiness are lower in a disclosure regime as compared to a no-disclosure regime. This necessitated the introduction of a two-stage design involving a screening round, but why the disclosure regime induces lower prior beliefs is an unanswered question and calls for further study. The introduction of a screening round enabled composition of subject samples with uniform prior beliefs but different disclosure institutions. Once the priors were made uniform, the experimental data showed significantly higher investment in later periods of the disclosure regime. The two-stage experimental design, while enabling a test of the prediction of higher investment in the disclosure regime (as compared to the no-disclosure regime), is also a contribution to experimental methodology.

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Figure 1. Timeline of disclosure regime.

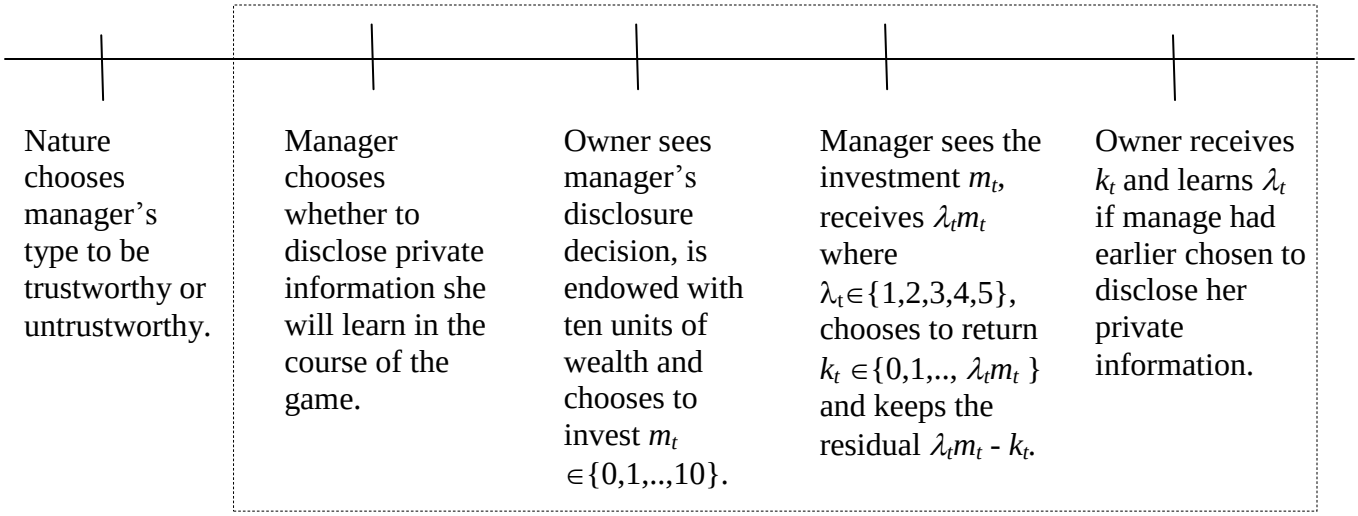
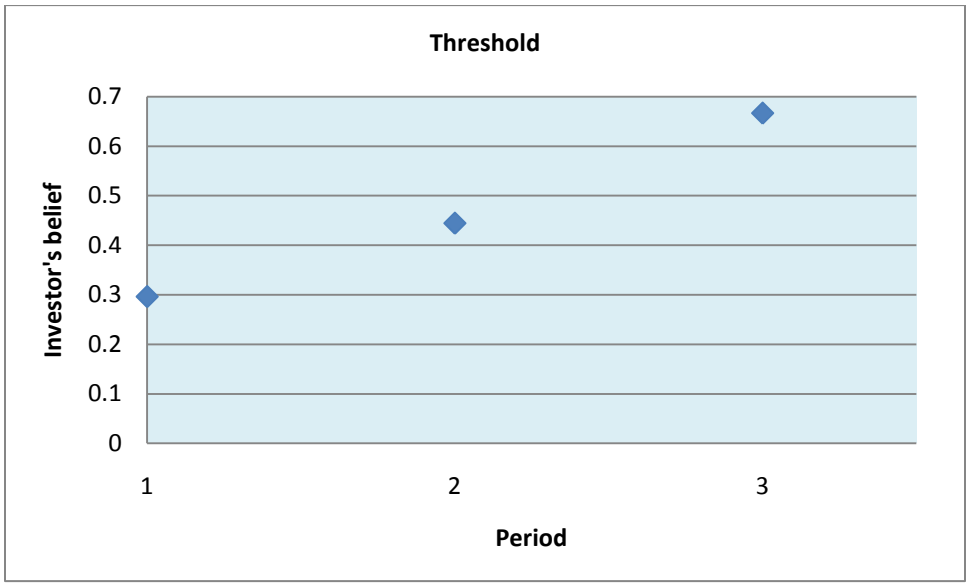


Figure 2. Threshold.



Period	Threshold	
1	(2/3)^3	0.2963
2	(2/3)^2	0.44444
3	(2/3)	0.66667

Figure 3. Timeline of no-disclosure regime.

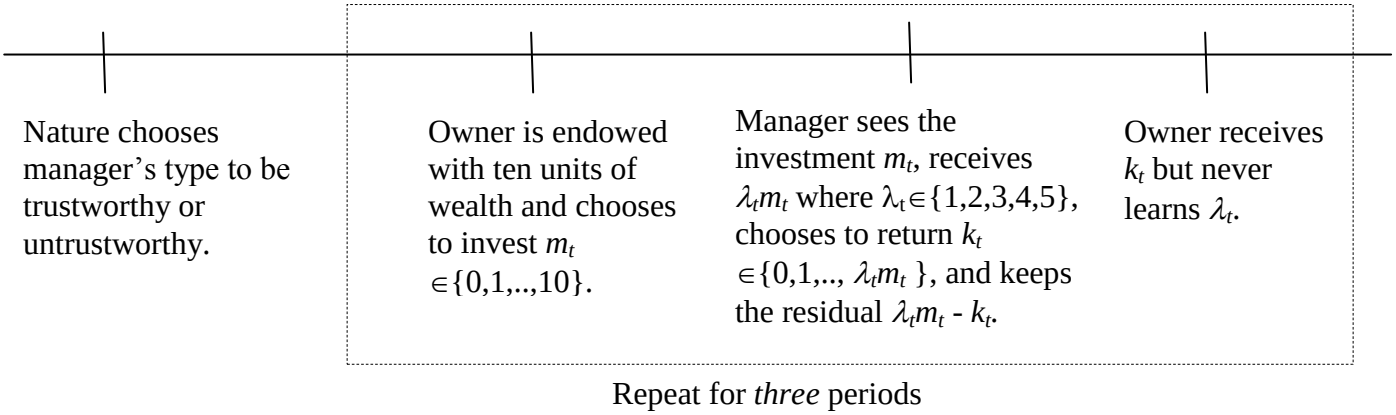


Figure 4. Reputation threshold at which owner invests with some probability and owner's beliefs about manager's type in a ten-period game with prior belief about manager's trustworthiness at 0.4.

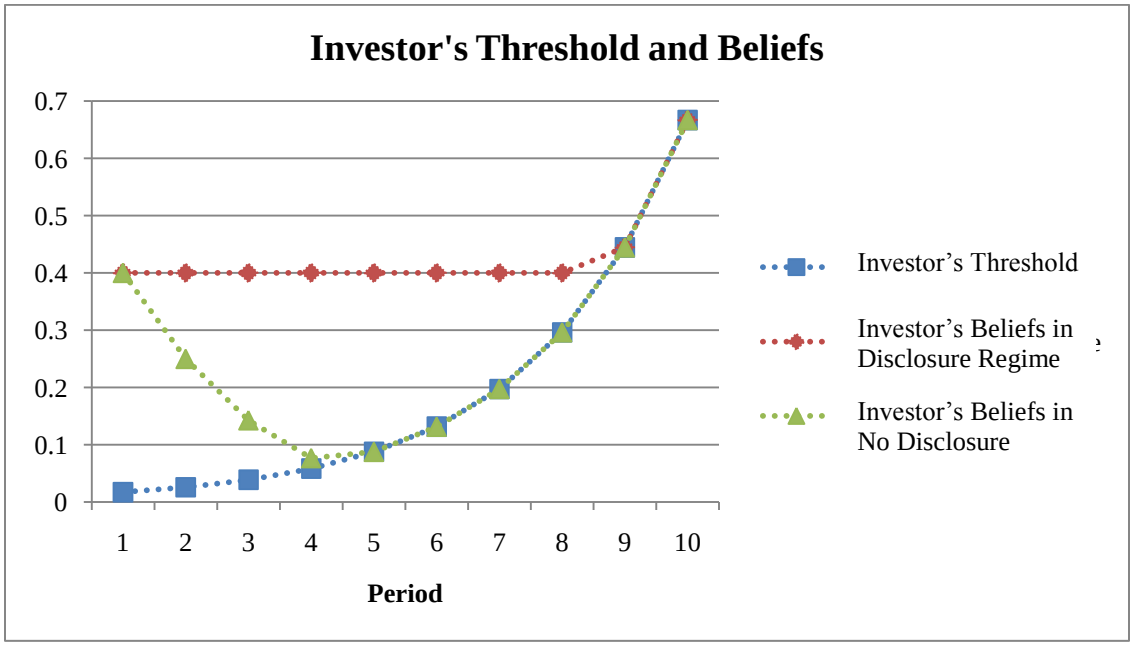


Figure 5. Average investment.

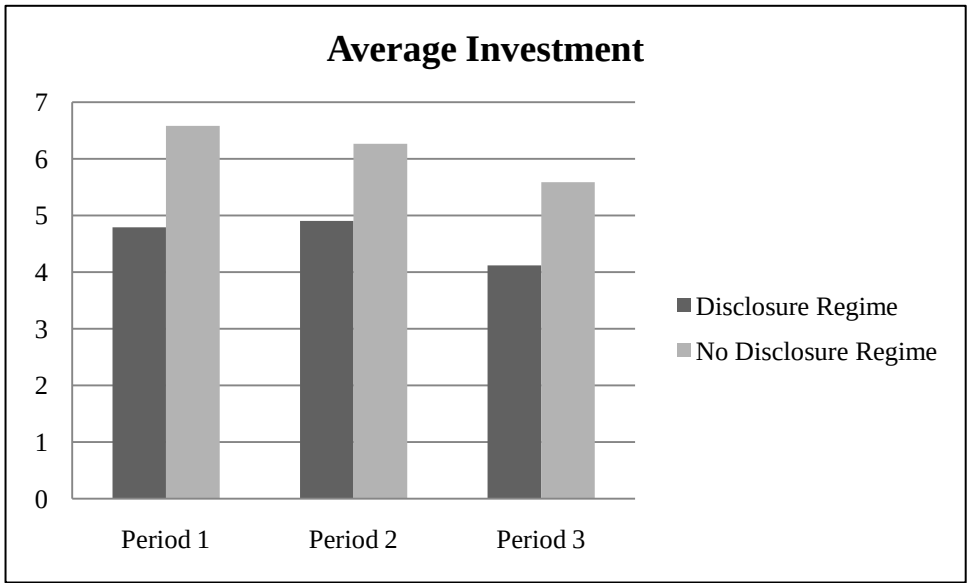


Figure 6. Screening round.

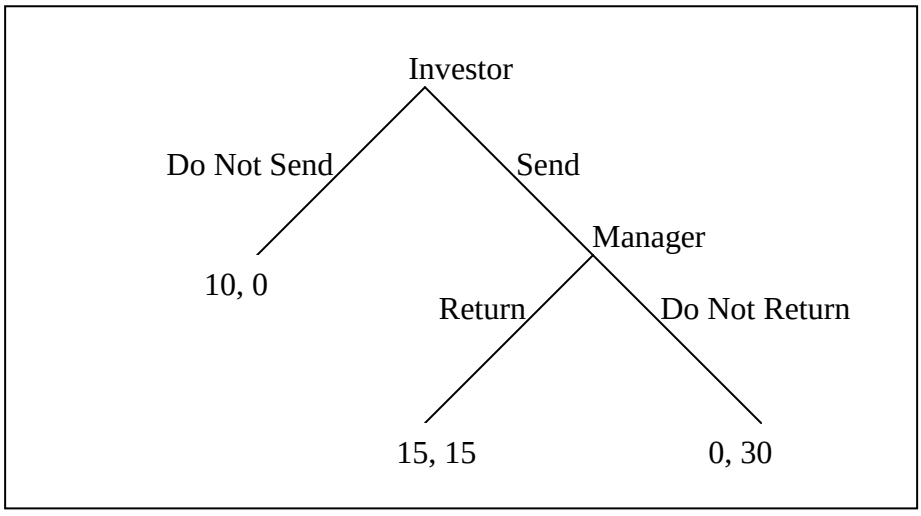


Figure 7. Average investment in postscreening sessions.

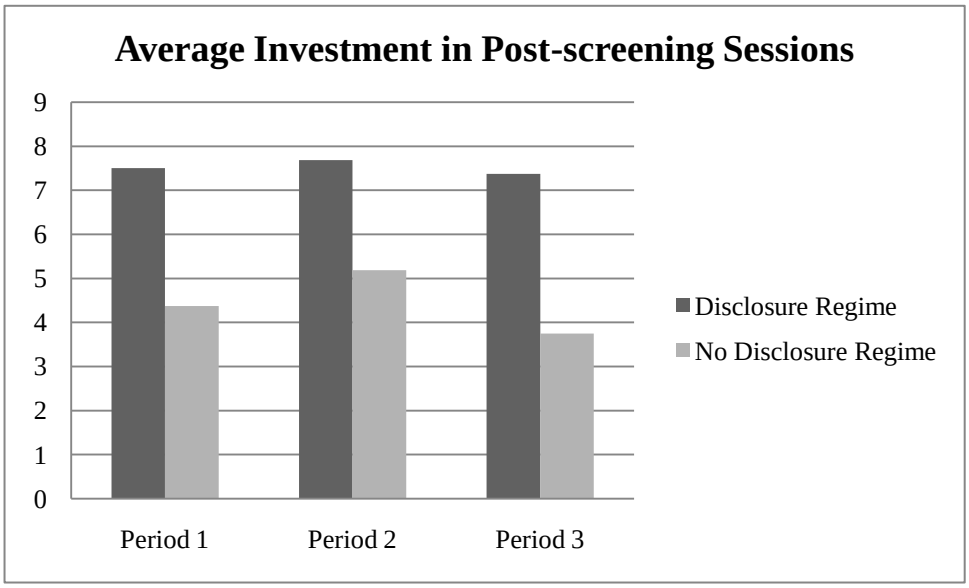


Table 1. Average investment

Session	Set	Average Investment		
		Period 1	Period 2	Period 3
		Disclosure Regime		
1	1	4.63[a]	4.13	3.13
1	2	4.13	4.5	3.63
1	3	4.25	3.5	4.25
1	4	4.88	2.88	2.63
1	5	2.25	3.75	3.5
1	6	3.5	3.5	1.75
1	7	3.38	5.13	2.63
1	8	3.63	2.5	4
2	1	5.45[b]	5	5.36
2	2	5.36	5.55	3.91
2	3	5.82	6.27	6.36
2	4	5.73	6.27	5.27
2	5	6.18	6.45	6.09
2	6	5.45	6.09	4.45
2	7	5.64	5.45	5
2	8	4.27	4.82	4.55
2	9	5.36	5.36	4.27
2	10	4.45	4.91	2.45
2	11	4.55	4.55	3
		No-Disclosure Regime		
1	1	5.5[a]	6	6
1	2	5.75	5.5	5.75
1	3	6.5	5.75	6.88
1	4	5.5	6.5	6.88
1	5	6.38	6.25	5.38
1	6	6.13	6.13	6.88
1	7	6.5	6	7.25
1	8	6.75	6.38	5.25
2	1	6.25[c]	4.83	6.08
2	2	6.92	5.83	4.83
2	3	6.92	6.83	6.58
2	4	7.17	6.42	5.92
2	5	5.92	7.42	5.42
2	6	6.5	6.33	3.42
2	7	6.75	6.58	4.75
2	8	6.83	6.5	5.25
2	9	6.58	6.67	5
2	10	6.83	5.83	5.58
2	11	7.42	6.92	5
2	12	7.33	6.08	5.5

[a]Each observation in this session is obtained by averaging across eight observations.
[b]Each observation in this session is obtained by averaging across eleven observations.
[d]Each observation in this session is obtained by averaging across twelve observations.

Table 2A. ANOVA[3] for the effect of option to disclose on investment in period 1[4]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	3374.12	73	46.22	14.04	0
Option to disclose	147.41	1	147.41	58.2	0
Subject | option to disclose	88.65	35	2.53		
Group	2861.84	37	77.35	23.5	0
Residual	1049.89	319	3.29		
Total	**4424.01**	**392**	**11.29**		

Table 2B. ANOVA for the effect of option to disclose on investment in period 2[5]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	3385.49	73	46.38	10.16	0
Option to disclose	132.3	1	132.3	27.09	0
Subject | option to disclose	170.93	35	4.88		
Group	2903.88	37	78.48	17.19	
Residual	1456.77	319	4.57		
Total	**4842.26**	**392**	**12.35**		

Table 2C. ANOVA for the effect of option to disclose on investment in period 3[6]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	3190.92	73	43.71	5.92	0
Option to disclose	97.2	1	97.2	7.68	0.01
Subject | option to disclose	442.84	35	12.65		
Group	2437.82	37	65.89	8.93	0
Residual	2353.8	319	7.38		
Total	**5544.72**	**392**	**14.14**		

[3]In Tables 2A – 2c and Tables 6A – 6C, I have treated Group as the repeated variable and Subject as being nested in Option to disclose. Alternatively it is possible to treat Subject as the repeated variable and Group as being nested in Option to disclose – it will lead to qualitatively similar results.

[4] Box's conservative ε is 0.0270 and its associated *p*-value is 0.0010.

[5] Box's conservative ε is 0.0270 and its associated *p*-value is 0.0027.

[6] Box's conservative ε is 0.0270 and its associated *p*-value is 0.0160.

Table 3. Summarizing the data collected for the disclosure regime

	All sets	Excluding Set 1
Number of observations	185	166
Number of observations where disclosure occurred in period 1 (1)	149	135
Number of observations from (1) where nonzero investments occurred in period 1 (2)	141	128
Number of observations from (2) where manager returned half or more of what she received in period 1 (3)	91	85
Number of observations from (3) with disclosure in period 2 (4)	78	72
Number of observations from (4) where nonzero investments occurred in period 2 (5)	77	72
Number of observations from (5) where manager returned half or more of what she received in period 2 (6)	55	50
Number of observations from (6) with disclosure in period 3 (7)	53	49
Number of observations from (7) where nonzero investments occurred in period 3 (8)	50	46
Number of observations from (8) where manager returned half of what she received in period 3 (9)	17	16
Proportion of trustworthy types in the original sample is at least	9.19% (17/185)	9.64% (16/166)

Table 4. Summarizing the data collected for the no-disclosure regime

	All sets	Excluding Set 1
Number of observations (1)	208	188
Number of observations from (1) where nonzero investments occurred in period 1 (2)	201	181
Number of observations from (2) where manager returned an amount consistent with her being the trustworthy type in period 1 (3)	173	157
Number of observations from (3) where nonzero investments occurred in period 2 (4)	170	154
Number of observations from (4) where manager returned an amount consistent with her being the trustworthy type in period 2 (5)	159	145
Number of observations from (5) where nonzero investments occurred in period 3 (6)	148	134
Number of observations from (6) where manager returned half of what she received in period 3 (7)	74	67
Proportion of trustworthy types in the original sample is at least	35.58% (74/208)	35.64% (67/188)

Table 5. Average investment in postscreening session

		Average Investment		
Session	Set	Period 1	Period 2	Period 3
		Disclosure Regime		
1	1	7.75[a]	8.75	9.25
1	2	8	8	5
1	3	7.75	7.25	7.75
1	4	6.5	6.75	7.5
		No-Disclosure Regime		
1	1	5.5[a]	4.5	5.25
1	2	5.5	4.25	1
1	3	3.75	5.5	4.75
1	4	2.75	6.5	4

[a]Each observation in this box is obtained by averaging across four observations.

Table 6A. ANOVA for the effect of option to disclose on investment in period 1 in the postscreening session[7]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	166.13	13	12.78	1.52	0.2
Option to disclose	15.13	1	15.13	1.92	0.22
Subject | option to disclose	47.25	6	7.88		
Group	40.75	6	6.79	0.81	0.58
Residual	151.75	18	8.43		
Total	**317.88**	**31**	**10.25**		

Table 6B. ANOVA for the effect of option to disclose on investment in period 2 in the postscreening session[8]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	100.75	13	7.75	0.68	0.76
Option to disclose	4.5	1	4.5	1.26	0.3
Subject | option to disclose	21.38	6	3.56		
Group	29.38	6	4.9	0.43	0.85
Residual	205.13	18	11.4		
Total	**305.88**	**31**	**9.87**		

Table 6C. ANOVA for the effect of option to disclose on investment in period 3 in the postscreening session[9]

Source	Partial SS	df	MS	*F*	Prob > *F*
Model	252.63	13	19.43	2.22	0.06
Option to disclose	78.13	1	78.13	10.03	0.02
Subject | option to disclose	46.75	6	7.79		
Group	100.75	6	16.79	1.92	0.13
Residual	157.25	18	8.74		
Total	**409.88**	**31**	**13.22**		

[7] Box's conservative ε is 0.1667 and its associated *p*-value is 0.4356.
[8] Box's conservative ε is 0.1667 and its associated *p*-value is 0.5590.
[9] Box's conservative ε is 0.1667 and its associated *p*-value is 0.2597.

Table A1. Return probabilities in disclosure regime

Period	Observed Return Frequency, from Data	Observed Return Frequency, Excluding Set 1
1	0.6454 (91/141)	0.6641* (85/128)
2	0.7143 (55/77)	0.6944 (50/72)
3	0.34 (17/50)	0.3478 (16/46)

Note. Prior probability inferred from threshold for period 2 and (*) = 0.2951.

Table A2. Return probabilities in no-disclosure regime

Period	Observed Return Frequency, from Data (2)	Observed Return Frequency, Excluding Set 1 (3)
1	0.8607 (173/201)	0.8674* (157/181)
2	0.9353 (159/170)	0.9416 (145/154)
3	0.5 (74/148)	0.5 (67/134)

Note. Prior probability inferred from threshold for period 2 and (*) = 0.3855.

Appendix A: Inferring Prior Probability

Disclosure regime

In period 1, the average disclosure is 81.33% (135/166). After seeing manager's disclosure decision, owner updates her belief about manager's trustworthiness. Manager's overall return probability (including trustworthy and untrustworthy managers) in period 1 is 0.6641. This overall return probability is estimated from data (Table 3). In estimating the overall return probabilities, instances where a manager returned more than half have been included with those where she returned half, and instances where manager returned less than half have been included with those where she returned nothing.[10] Because the overall return probability is less than 1, it must be that mixed-strategy play by the untrustworthy manager begins in period 1. Now, owner sees manager's return for period 1 and her disclosure decision for period 2. After seeing these, she updates her belief about manager's trustworthiness. Since mixed-strategy play by manager has begun in period 1, it must be that owner's updated or posterior belief about manager's type is exactly equal to the threshold for period 2. The threshold for period 2 is 0.4444 (Figure 2). Using the overall return probability for period 1, the threshold for period 2, and the Bayesian updating formula, one can infer the prior probability at the beginning of period 1. This inferred prior probability is 0.2951 (Table A1).

<TABLE A1 ABOUT HERE>

No-disclosure regime

[10] In the experiment, manager was allowed to return only in whole liras. This led to instances where manager could not return to owner exactly half of what she received. Consequently, in moving from the model to the data, the cutoff of half or more was replaced by a cutoff of 0.4 or more.

Table A2[11] shows manager's overall return probability (including trustworthy and untrustworthy managers). This overall return probability is estimated from data. In estimating the overall return probabilities, instances where a manager returned more than half of what owner invested were included with instances where she returned exactly half of what owner invested, and instances where a manager returned less than half of what owner invested were included with instances where she returned nothing.[12] Note that while in the disclosure regime, the cutoff used is half or more of what manager received; in the no-disclosure regime, the cutoff used is half or more of what owner invested. This is because in the no-disclosure regime, an untrustworthy manager can return the minimum amount consistent with her being the trustworthy type, while in the disclosure regime, such return behavior is disciplined by the presence of an accounting disclosure system. Manager's overall return probability (including trustworthy and untrustworthy managers) in period 1 is 0.8674 (Table 4). Because there are some instances of zero return, it must be that mixed-strategy play by the untrustworthy manager begins in period 1. Now, owner sees manager's return for period 1 and updates her belief about manager's trustworthiness. Since mixed-strategy play by manager has begun in period 1, it must be that owner's updated or posterior belief about manager's type is exactly equal to the threshold for period 2. The threshold for period 2 is 0.4444 (Figure 2). Using the overall return probability for period 1, the threshold for period 2, and the Bayesian updating formula, one can infer the prior probability at the beginning of period 1. This inferred prior probability is 0.3855.

<TABLE A2 ABOUT HERE>

[11] There are no instances in the data where investment did not occur in period t but occurred in period $(t + 1)$ or period(s) subsequent to $(t + 1)$.

[12] In the experiment, manager was allowed to return only in whole liras. This led to instances where manager could not return to owner exactly half of what owner invested. Consequently, in moving from the model to the data, the cutoff of half or more of what owner invested was replaced by a cutoff of 0.4 or more of what owner invested.

Appendix B: Instructions for Main Round

Instructions

Introduction

You have been invited to participate in a decision making experiment. This experiment will last approximately two hours. During today's session, you will earn income in an experimental currency called Lira. At the end of the session, this currency will be converted to dollars at a rate of $0.08 (8 cents) per Lira, and you will be paid in cash. In addition to this income, you will also receive a show-up fee of $10.

Please read these instructions very carefully. You will be required to complete a quiz, in order to demonstrate that you have a complete and accurate understanding of these instructions. After you have completed the quiz, the administrator will check your answers and discuss with you any questions that have been answered incorrectly.

You are free to withdraw from the experiment at any time, for any reason. If you choose to do so, please raise your hand. In this case, you will be paid your $10 show-up fee as you leave.

Session Overview

This session will be run entirely over the computer. Please do not talk with any of the other participants. If you have a question, you may raise your hand, and the administrator will answer the question privately.

Roles and Procedures

Every participant will be assigned to the role of either an A-player or a B-player. Once assigned, your role will remain unchanged during this session. Note that if you were assigned the role of an A-player in the previous game, you will be an A-player in this session, too and similarly, if you were assigned the role of a B-player in the previous game, you will be a B-player in this session, too. Also, of every 4 B-players playing this session, 1 B-player returned to the A-player while 3 B-players did not return to the A-player in the previous game. Now, you will know your own role, but you will not know the role of any other participant. You will play several sequences of 3 periods each. In the beginning of every 3-period sequence an A-player and a B-player will be grouped for that sequence. No 2 participants will be grouped twice.

Each period proceeds through four stages. The 4 stages are briefly described in Figure 1.

Outline of the Stages in Each Period

Stage 1 - B-player decides whether or not private information (multiplied amount) s/he will get in stage 3 will get revealed to A-player in Stage 4.

Stage 2 - A-player sees the decision made by B-player and receives an endowment of 10 liras (experimental currency unit). A-player then decides how many of the 10 liras to send to B-player.

Stage 3 - The amount sent by the A-player is multiplied. This multiplied amount is received by the B-player. B-player then decides how much of the multiplied amount to return to A-player and how much to keep for himself / herself.

Stage 4 - A and B-players are told their payoffs and relevant information.

Figure1

Stage 1 – **B-Players' Disclosure Decisions**

In Stage 1, B-player will have the choice of deciding whether s/he wants to let the A-player know the multiplied amount s/he will receive from A. B-player will see the following screen:

Screen 1

B-player may click either ‘Yes’ or ‘No’.

Stage 2 – **A-Players’ Decisions**

A-player sees the decision made in Stage 1 by the B-player s/he is paired with. A-player also receives an endowment of 10 Liras. In the second stage, A-player will be prompted by the computer to decide how much of the initial endowment to keep and how much to send to a paired B-player. The amount sent will always be in whole Lira. The A-player will keep any money s/he has not sent to B-player.

A-player will see the following screen:

Screen 2

Stage 3 – **B-Players’ Decisions**

The amount sent by the A-player is multiplied by 1 or 2 or 3 or 4 or 5 (referred to as ‘the multiplier’) before the B-player receives it. B-player will see the following screen (namely, Screen 3). Please note that every multiplier is equally likely to occur.

Screen 3

B-player decides how much of the total amount to return to A-player. The amount returned will always be in whole Lira. B-player will keep the amount s/he does not send back to A-player.

The B-player's Stage 3 decisions will be entered on Screen 3, pictured above.

Stage 4 - **Disclosure and Payoffs**

In each period, A-player's payoff will be the sum of the amount that s/he did not send to B-player and the amount returned by B-player. In each period, B-player's payoff will be the amount that s/he received minus the amount s/he returned to A-player.

Following each period, A-player will receive the information presented on Screen 4, pictured below. Note that A-player will learn the amount B-player received only if B-player has elected to let the A-player know this amount.

Screen 4

Following each period, B-player will receive the information presented on Screen 5, pictured below.

Screen 5

Completion of Periods

After completing each period, the computer will proceed to the next period, which will be conducted identically to the previous period. After every 3 periods, every A-player will be grouped with a different B-player and every B-player will be grouped with a different A-player. You will not be grouped with the same participant twice.

Once all periods have been completed, you will be paid your cumulative income.

Please answer the questions that appear on your screen. You will be paid 50 cents for every correct answer. The experiment will begin after all the participants have answered all the questions.

The following questions appeared on subjects' screen. Answers are provided next to the questions.

1. How many B-players will each A-player be grouped with in each sequence of 3 periods? **1 B-player**

2. How many liras will an A-player be endowed with in Stage 2 of each period? **10 liras**

3. No two participants will be grouped more than once (True / False). **True**

4. Will the amount sent by an A-player to a B-player be multiplied en route before it reaches the B-player (Yes / No)? **Yes**

5. Suppose A-player sent 1 lira. What are the possible amounts B-player may receive? **1, 2, 3, 4, 5**

6. Is each multiplier equally likely in each round? **Yes**

7. Suppose in a period A-player sent to B-player 6 liras and then received from B 10 liras. What will be player A-player's profit from the pairing with B?
   Amount retained by A + Amount returned by B = 4 + 10 = 14 liras

8. Suppose in a period A-player sent 3 liras to B-player. B-player received 9 liras and sent back 2 liras to A-player. What will be B-player's profit from pairing with A?
   Amount received by B – Amount returned by B = 9 – 2 = 7 liras

Appendix C: Instructions for Screening Round

Instructions

Introduction

You have been invited to participate in a decision making experiment. I will read these instructions out loud. Please do not talk among yourselves. If you have any questions, please raise your hand. I will then answer your questions individually.

During today's session, you will earn income in an experimental currency called Lira. At the end of the session, this currency will be converted to dollars at a rate of $1 per Lira, and you will be paid in cash. In addition to this income, you will also receive a show-up fee of $10. You are free to withdraw from the experiment at any time, for any reason. If you choose to do so, please raise your hand. In this case, you will be paid your $10 show-up fee as you leave.

Session Overview

Every participant will be assigned to the role of either an A-player or a B-player. Every A-player will be endowed with 10 liras. A-player can choose to send his / her endowment to a paired B-player. If the A-player chooses not to send the endowment, then the game ends here – B-player receives nothing from A and A-player keeps her / his endowment of 10 liras. If A-player chooses to send her / his endowment to the B-player, then the endowment is tripled before it reaches the B-player. That is, the B-player receives 30 liras.

If the B-player receives 30 liras from A-player, s/he can choose to return to the A-player. If B-player chooses to return, then A-player receives 15 liras and B-player keeps 15 liras. If B-player chooses not to return, then A-player receives nothing and B-player keeps 30 liras.

Figure 1 summarizes the game.

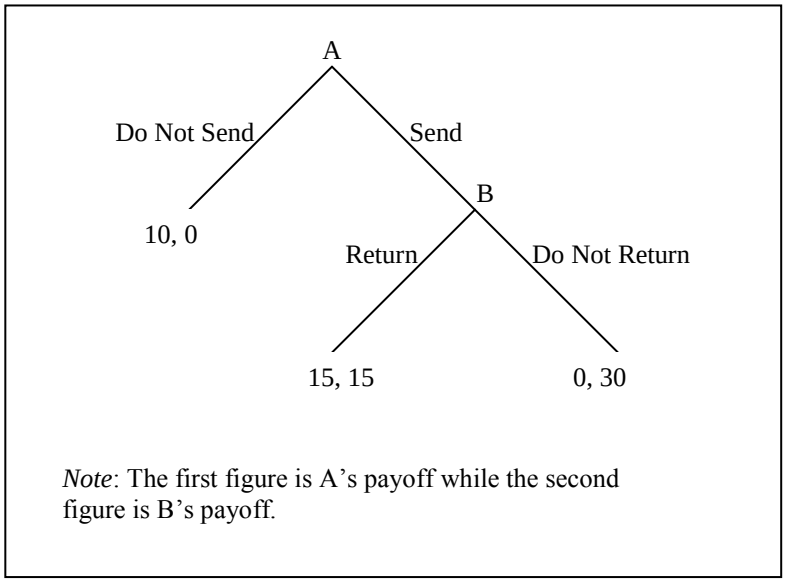


Figure 1

After everyone finishes this game on the computer, all will proceed to another session.