How do the differences in accounting institutions affect on the development of trust and reciprocity?: An experimental study of a modified trust game

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Abstract

This study examines how the differences among perspectives to the formation of disclosure and auditing institutions affect the development of trust and reciprocity between managers and investors, and how these influence the performance of society.

We use the trust game with disclosure option and compare the US-oriented disclosure system with the UK-oriented disclosure system via experiments. Our results demonstrate that the US-oriented disclosure system poses certain risks because managers can use the disclosure option to initially win investor trust and later betray it.

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1 Introduction

This study examines how the differences among perspectives to the formation of disclosure and auditing institutions affect the development of trust and reciprocity between managers and investors, and how these issues influence the performance of society. We use the trust game with disclosure option and compare the US-oriented disclosure system (US condition) with the UK-oriented disclosure system (UK condition) via experiments. Our results demonstrate that the US condition poses certain risks because managers can use the disclosure option to initially win investor trust and later betray it.

Faith in accounting and auditing institutions has been shaken after the exposure of large accounting frauds, such as the Enron scandal.¹ This study examines the most fundamental and important questions: For whose benefit do accounting and auditing systems exist? Stated simply, would differences in institutions’ approaches cause a gap in human relationships and the overall performance of society?

This study approaches this issue by a new framework of experimental comparative institutional analysis,² which combines comparative institutional analysis (Aoki 2001, 2010; Grief 2006) and behavioral game theory (Camerer 2003). On the basis of this methodology, we examine this issue using game theory and economic experiments.

Throughout history, although there have been many arguments on countries’ approaches to the formation of accounting institutions, two types of approaches have predominated. The first approach is the UK condition, in which disclosure and auditing systems have been established for the benefit of shareholders. The Corporate Act of 1879 of the UK, for example, reflects shareholders’ demand for trustworthy accounting systems and hiring of auditors to verify managers’ honesty (Edwards 1978). The second approach is the US condition, in which disclosure and auditing systems have been established for the benefit of managers. In 1901, for example, a US Steel Co. manager established a trustworthy accounting system and hired an auditor to prove

¹ Refer to Benston et al. (2003) and Brewster (2003) regarding the Enron scandal.
² Refer to Kawagoe (2010) and Taguchi (2011) for more details on this framework.
her honesty and to finance huge money (Edwards 1978, Watts and Zimmerman 1983). However, it is unclear how the difference between the approaches to the formation of accounting and auditing systems affect the performance of institutions and society. To resolve this ambiguity, we use the modified trust game and compare two institutions through experiments.

The remainder of the paper is organized as follows. Section 2 discusses related literature. Sections 3 and 4, respectively, develop the model and explain the experimental design. Section 5 presents the experimental results. Section 6 concludes.

## 2 Related literature

### 2.1 The trust game

This study adopts the trust game (Berg et al. 1995) because it has one of the essential factors of the relationship between managers and shareholders.

The trust game is a two-step game played by a sender (shareholder or investor) and a receiver (manager). The first step is the determination of the investment amount. Here, a sender freely determines the amount of money ($M$) to be given to the receiver within the initial endowment limit ($E$) ($0 \leq M \leq E$). The receiver conducts business activities using $M$ as the initial capital to earn $e$ times the amount received. $e$ is defined as a multiplier and $e > 1$. Therefore, the amount of money actually received by the receiver is $eM$.

The second step is the determination of the repayment amount. Here, the receiver determines the amount of money to be repaid to the sender ($K$) within the limit $eM$ ($0 \leq K \leq eM$).

In sum, the sender’s gain ($\text{gain}_{\text{sender}}$) and the receiver’s gain ($\text{gain}_{\text{receiver}}$) are as follows.
\[
\text{gain}_{\text{sender}} = E - M + K. \quad (1)
\]

\[
\text{gain}_{\text{receiver}} = eM - K. \quad (2)
\]

Compared to the modified trust game (described in Section 2.3), it is important that the players in this game are aware of the multiplier \( e \) (public information). On the contrast, in our model the multiplier \( e \) is not public but private information because, in reality, the multiplier \( e \) is considered as a managerial prerogative and private information of managers (the receiver in the trust game).

In the trust game, the amount of \( M \) can be regarded as an indicator of the degree of the sender’s trust in the receiver because this amount changes according to the sender’s expectation of the amount the receiver will repay. Therefore, the more the sender trusts the receiver, the larger the amount of \( M \) the sender would invest with the receiver. On the other hand, the amount of \( K \) (return on investment (ROI\(^3\))) can be regarded as an indicator of the degree of reward for the partner’s trust (reciprocity).

### 2.2 The subgame perfect equilibrium of the trust game and experimental results

Next, we will predict the consequences of the trust game using the game theory. We solve this game by the backword induction.

First, considering the receiver’s behavior in the second step, and regardless of the sender’s behavior in the first, the receiver is not required to repay a positive amount of \( K \) if he only wishes to maximize his own gain. Therefore, the optimal strategy for the receiver would be to set \( K = 0 \) regardless of the sender’s behavior in the first stage. Considering this fact, it would be logical for the sender to set \( M = 0 \) (give nothing to the receiver) in the first step. We can predict these consequences on the basis of the

\(^3\)ROI is defined as the rate of \( K \) per \( M \).
subgame perfect equilibrium, which is a standard equilibrium concept in game theory.

However, despite this game theory prediction, several psychological and economic experiments have observed a phenomenon in which the sender provides a positive amount of $M$ to the receiver and the receiver repays a positive amount of $K$ (Berg et al. 1995, 130).

A rewarding relationship between sender and receiver, in which the amount of $K$, which the receiver repays, increases as the amount of $M$, which the sender invests, increases, has also been observed. Thus, there are cases where the experimental results contradict the prediction of the subgame perfect equilibrium by game theory. Therefore, this study needs to not only develop a model but also conduct experiments to test the theory’s hypothesis.

2.3 trust game and accounting literature

This section examines existing accounting literature which has used the trust game, primarily featuring two studies. Here we focus on the multiplier $e$ in the trust game.

Basu et al. (2009) verified the importance of recordkeeping by repeated trust game experiments. In their study, the multiplier $e$ was fixed and common knowledge. In our model (described in Section 3), in contrast, the multiplier $e$ is flexible and private information of the receiver.

Lunawat (2009) examined the sequential equilibrium theory of disclosure and reputation through a modified trust game in which only the sender decides whether to disclose the multiplier $e$. In our model, in contrast, not only the sender but also the receiver decides. This is the novelty our model provides.
3 The model

3.1 History of the formation of disclosure and auditing system

To solve the question "For whom accounting and auditing institutions exist?", we review the history of the formation of disclosure and auditing systems.

There are two major approaches to the historical development of accounting institutions among countries. The first approach is the UK condition. In this approach, disclosure and auditing systems are established for shareholders. In the UK Corporate Act of 1879, for example, shareholders had requested the adoption of trustworthy accounting systems and hired an auditor to verify manager honesty (Edwards 1978). In audit theory, this approach is known as information hypothesis, which indicates that audits exist to protect shareholders and investors on the assumption that managers may be dishonest (Wallace 1986). For example, the need to conduct audits by accountants to protect shareholders spread in the United Kingdom in the nineteenth century (Tomooka 1995). This study refers to this approach as the UK condition.

The second approach is the US condition, in which disclosure and auditing systems have been established for managers. In 1901, for example, a US Steel Co. manager established a trustworthy accounting system and hired an auditor to prove her innocence and finance huge money (Edwards 1978, Watts and Zimmerman 1983). In audit theory, this approach is referred to as stewardship hypothesis: managers use audits to prove their innocence (bonding), to secure a large amount of capital (Wallace 1986). Historically, the need for audits performed by accountants increased because of this approach, which originated primarily in the United States (Edwards 1978). This study refers to this approach as the US condition.
3.2 The model: trust game with the disclosure option

This subsection considers how the difference in the approaches to disclosure and auditing institutions among countries affect the development of trust and reciprocity between managers and investors, and how these influence the performance of society.

This study modifies the traditional trust game by focusing on the multiplier $e$. There are two major differences between the traditional trust game and ours.

First, in our model the multiplier $e$ is not public but private information because, in reality, the multiplier $e$ is considered as a managerial prerogative and private information of managers (the receiver in the trust game). The disclosure and audit system is meant to inform society of the credible multiplier $e$. Thus, it can be said that this setting better represents the reality.

Second, our model contains two types of options to disclose the multiplier $e$. These options depend on the two approaches to the formation of institutions. The multiplier $e$, which, in reality, is considered a managerial prerogative, is private information. Thus, we will introduce a disclosure option in this game to allow knowledge sharing of the value of the multiplier $e$ through disclosure and auditing systems. This option is available to both the manager (receiver) and the investor (sender). Once either party exercises the option, an objective and credible value of the multiplier $e$ is shared among the players. The first type is in the UK condition, in which the investor (sender) has the option requiring the manager (receiver) to disclose a credible value of the multiplier $e$. The second type is in the US condition, in which the manager (receiver) has the option to disclose a credible value of the multiplier $e$. Therefore, we compare the case in which the investor has the option (UK condition) versus the case in which the manager has the option (US condition).

1. The UK condition: The investor (sender) determines whether to exercise the option to require the manager (receiver) to disclose credible value of the multiplier
$e$ prior to playing the trust game. The subsequent flow is the same as in the US condition.

2. The US condition: The manager (receiver) determines whether to exercise the option to share the value of the multiplier $e$ before playing the trust game. When the option is chosen, the value of the multiplier $e$ is disclosed to the investor (sender), and the trust game is played in the manner as previously described. When the option is not chosen, the game is played without disclosing the value of the multiplier $e$ to the investor (although the investor knows in what probability distribution the value of the multiplier $e$ can be found).

To simplify the analysis, we assume (1) zero costs to exercise the option and (2) the value of disclosed multiplier $e$ is credible and 100% reliable. Figure 1 depicts the overall setting of our modified trust game, and Figure 2 depicts our model timeline.

*Insert Figure 1 about here.*

*Insert Figure 2 about here.*

### 3.3 Subgame perfect equilibrium of the trust game with the disclosure option and hypothesis

What differences does comparing the UK and US conditions reveal in the behavior of investors and managers? Moreover, regarding institutional design, which condition promotes corporate investment and which causes corporations to respond to investor trust?

The predictions of game theory state that there should be no difference between these two conditions because the disclosure of the value of the multiplier $e$ does not
affect gains of both players.\textsuperscript{4} Figure 3 depicts the game tree and the theoretical predictions of the game theory.

*Insert Figure 3 about here.*

We propose the following hypothesis for this model:

**Hypothesis 1** There is no statistical difference in senders’ and receivers’ actions (the amount of M and K) between the The US condition (where the receiver holds the disclosure option) and the UK condition (where the sender holds the disclosure option).

## 4 Experimental design

we conducted experiments of the trust game with the disclosure option under the UK and US conditions described in the section 3.

We report data from the 58 subjects, collected in February 2013. 28 subjects participated in the US condition and 30 subjects participated in the UK one.

These sessions were conducted at Doshisha University in Japan. Subjects were primarily undergraduate students from Doshisha University, and were sought by advertisements and e-mail. Because of the abstract and relatively simple nature of the decision task, an accounting background was not a prerequisite for participation. Each subject participated in one session, comprising 20 rounds of decision making. Each session lasted for 90 minutes (including instructions) and participants earned an average of JPY 2,872.

The experiment was conducted using networked computers using the z—Tree experiment software package (Fischbacher 2007) (Figure 4). Our subjects were asked to refrain from direct communication with each other, to enable interactions exclusively

\textsuperscript{4}This is also true because there is no cost to exercise the option in our model.
via the computer program. Also, all treatments randomly re-matched pairs of subjects in each round to minimize the potential impact of reciprocal concerns.

*Insert Figure 4 about here.*

At the beginning of each session, subjects were seated in a single room and were given written instructions. Instructions were read aloud to the subjects to make them aware of the rules of the game. A quiz was conducted to ensure that subjects understood the rules. We strived for neutral terminology in the instructions.

After entering action choices, each subject was shown the following information: his/her own action, other’s actions, and his/her own payoff (Figure 5). In all treatments, subjects were not given information, either individually or in aggregate, about the results of other pairs of subjects. At the end of the round, subjects were asked to observe their results and enter information specific to that round into a record sheet.

*Insert Figure 5 about here.*

The experimental session comprised 20 rounds. Each subject was paid at the rate of JPY 50 per point. In addition, all subjects received JPY 2,000 for their participation.

Although a subject’s partner in the game was randomly selected in each round, the subject’s role (sender or receiver) was predetermined and remained the same throughout the 20 rounds. Specifically, participants for both conditions, 28 in the US condition or 30 in the UK condition, were divided into two groups (senders or receivers) of 14 or 15 individuals. Each individual from one group played the trust game with a randomly selected subject from the other group.

Parameters for the experiment were standardized for both conditions as follows. The value of the initial endowment $E$ is 10. The value of the multiplier $e$ was set at 3.
or 5, each with a 1 in 2 chance. Since Basu et al. (2009) adopted $e$ at 3 and Lunawat (2009) adopted $e$ at 3 or 5, we adopt the same condition of related literatures. Because of the difficulty of comparing both conditions in case of a bias in the resulting values of the multiplier $e$, the experimenter selected cases in which the frequency of occurrence on the basis of the above distribution is 10 times the actual value of the multiplier $e$ and applied them to all pairs of senders and receivers in each of the two conditions.

5 Experimental results

Here, we report the results of the experiment.

We examine the changes that occurred in audit option usage under each condition as the game was repeated. The bar graph in Figure 6 reports the rate at which the audit option was considered to disclose the value of the multiplier $e$ under each condition in the first half (rounds 1-10) and in the second half (rounds 11-20).

Insert Figure 6 about here.

Accordingly, we observe that during the first half, the usage rate under the UK condition was very high, at approximately 86%, whereas it remained at approximately 64% under the US condition. In the second half, the usage rate was approximately 82-86% under both conditions.

This outcome indicates that although investors frequently requested the disclosure of the multiplier $e$ by exercising the option in the UK condition, the managers were not eager to exercise the disclosure option voluntarily during the first half of the experiment in the US condition. However, this preference drastically changed in the second half of the experiment, and the difference in the usage rate almost disappeared. The disappearance of the gap between the conditions can be attributed to a significant increase in the usage rate under the US condition.
How can we explain the significant increase in the rate of the option usage under the US condition? Figure 7 reports the average investment by condition and option usage.

*Insert Figure 7 about here.*

Figure 7 indicates the following trends for the US conditions: The amount of investment is clearly higher when the disclosure option is exercised compared to when it is not. From this, we observe that the disclosure system stimulates corporate investment behavior under the US condition.⁵

Thus, the option usage rate significantly increased under the US condition because it was assumed that managers learned that the amount of investment increases when they exercised the option. That is, under the US condition, managers who exercised the disclosure option to share the value of the multiplier e earned the trust of investors and subsequently received larger investments, whereas managers who did not exercise the option lost the trust of investors and received lower investments.

Why did the shareholders trust the manager under the US condition? Perhaps, the shareholders imagined that the manager who exercised the option to share the value of the multiplier e was trustworthy and would repay more money. However, making such an assumption is incorrect. The manager’s decision about exercising the option is not associated with repaying more money in this game. This trend can be referred to as “the shareholder’s illusion about managers.”

Finally, to see how managers rewarded investors for their investments, we observe the investor’s ROI.⁶ ROI can indicate the receiver’s (manager) reciprocity toward the sender (investor) in this game. The line graph in Figure 8 depicts the ROI by condition.

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⁵This difference is statistically significant (*p* < .05). Our hypothesis is not supported in the amount of *M*.

⁶This indicator was also used by Basu et al. (2009).
We observe the common tendencies of ROI under both conditions and option usage. ROI is clearly higher when the option is used compared with when it is not. These results indicate that ROI increases in an environment of trust.

Now, we examine the differences between these two conditions. As Figure 8 indicates, the ROIs under the UK condition are higher than those under the US condition, regardless of the disclosure option. Figure 9 indicates the total ROI period and time series change of ROI by condition.

In the total ROI period, Figure 9 reveals the ROI difference between the two conditions. This difference is statistically significant ($p < .05$). Thus, our hypothesis is not supported for the amount of ROI.

In the time series, Figure 9 indicates that the ROI markedly decreased under the US condition because certain managers intentionally betrayed investor trust after choosing the disclosure option.

The important point is that ROI is higher under the UK condition, even though the average investment amount is higher under the US condition. Consequently, we see that the managers who earned investors’ trust by exercising the disclosure option under the US condition were less likely to reward investors for their investment than the managers who were asked to disclose the value of the multiplier $e$ in the UK condition.
6 Conclusion

This study examined how differences in the approaches to the formation of disclosure and auditing systems affect trust and reciprocity between managers and investors, and ultimately how these differences influence the overall performance of society.

In a laboratory setting, we hypothetically created two societies: one where managers had the disclosure option (the US condition) and another where the option was available to investors (UK condition). We examined how subjects with financial incentives behaved, how they developed trust and reciprocity, and how the performance of the societies changed as a whole.

This study had three important implications. First, disclosure systems stimulate investment behavior among investors under the US condition, where managers can voluntarily exercise the disclosure option. This result suggests the possibility for corporate investment to become more active under a US condition. Second, the active investment is supported by “the shareholder’s illusion of managers.” Third, the experiment reveals that the US condition poses certain risks because managers can use the disclosure option to skillfully win investor trust and later betray it.

Finally, the study makes a significant contribution to the real world. Major accounting frauds such as the Enron scandal are increasing, and similar incidents have occurred in the United States. This may be so because this system comprises a mechanism that leads investors to trust managers who later betray that trust. If this is true, perhaps we need to seriously consider the mechanism of the US condition.

This study has the following limitations. First, the model only scrapes the surface of the real issue; therefore, it does not necessarily reflect all factors in the real world. Undoubtedly, other factors must be analyzed simultaneously. Second, there is a need to conduct comparative reviews of conditions other than those in the US and the UK (e.g., comparison between a society where the value of the multiplier \( e \) is disclosed and a society where the multiplier \( e \) remains undisclosed (i.e., there is no option)). Future
research should explore these concepts and overcome these limitations.
References


Figure 1: Trust game setting with disclosure option compared with the normal trust game
Figure 2: Trust game timeline with disclosure option and theoretical prediction

1. The sender or receiver decides whether to exercise the disclosure option.

\[ \Rightarrow \text{If she exercise the option, \[ e \] will become common knowledge.} \]

(\text{It doesn't cost to exercise the option (costless option)}).

2. The sender is given 10 units as a show-up fee, and she decides how much of her 10 to send to a receiver (M).

\[ 10-M+K \]

3. The receiver is given eM units (e is the multiplier). e is private information for the receiver except for the case of exercise the option. The receiver decides how much of the amount to send back to the sender (K).

\[ eM-K \]

Figure 3: Game tree of trust game with disclosure option

1. The sender or receiver decides whether to exercise the option.

0. The nature decide \[ e \].

3. R decides K.

1. S decides M.

The game theory anticipates that there is no difference depending on who has the option.
Figure 4: z-tree

The screen of the sender

The screen of the receiver

Figure 5: Information after action choices were entered

The screen of the sender

The screen of the receiver
Figure 6: Changes in the Usage Rate of the disclosure Option (Rate of Disclosure of $e$) by Condition

Figure 7: Changes in Average Investment by Condition and Option Usage
Figure 8: Changes in ROI by Condition and Option Usage

Figure 9: ROI in total period and time series by condition