論 文

Voluntary Disclosure with or without an Antifraud Rule:

An Experimental Study

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Abstract

This paper presents the results of 16 experimental markets designed to test the theoretical model which states that, when disclosures are credible and costless, full disclosure of private information will be induced so as not to be interpreted as having the worst news. This experiment conducted two manipulations, and produced a 2x2 factorial cell design. The manipulations focused on (1) the number of realization values and (2) the presence/absence of an antifraud rule. The former manipulation was due to our questions about prior experimental studies. The latter was due to our interest in an antifraud rule posited as a critical condition in the models. The cells with an antifraud rule also were set up as the benchmark for those without an antifraud rule. Our results generally support the theoretical hypotheses and behavioral forecasts, and provide some interesting findings.

Key Words

Voluntary Disclosure; Accounting Regulation; Antifraud Rule; Experimental Economics

反不正ルールの存否と自発的開示：実験研究

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＜論文要旨＞
　本稿は、開示に信憑性がありかつコストがかからなければ、起こりうる最悪の情報を保有していると想起されないように私的情報の完全開示が生じる、との理論モデルの主張を検証するために設計された 16 の実験市場の結果を報告する。実験では 2 つの操作がなされ、2×2 因子のセル・デザインを創出した。操作における処理変数は （1） 起こりうる実現値の数および （2） 反不正ルールの存否である。前者は先行研究へのわれわれの疑問点によるもので、後者はモデルの決定的な条件として置かれている反不正ルールへのわれわれの関心によるものである。反不正ルールを伴うセルは、反不正ルールを伴わないセルのベンチマークとしても用いられる。結果は、理論仮説および行動予測を一般に支持し、かつ幾つかの興味深い知見を提供するものであった。

＜キーワード＞
自発的開示、会計規制、反不正ルール、実験経済学

1. Introduction

In this paper, we report some results of experimental markets designed to test the basic model of full disclosure, which is a special case of a class of "persuasion game" analyzed in Milgrom (1981) and extended by Milgrom and Roberts (1986) (hereafter, 'the basic model'). They show that the senders of information will fully disclose private information so as not to be classified as having the worst news when disclosures are both credible and costless.

The issue of voluntary disclosure is essential to accounting research because it closely relates to the fundamental question of whether accounting regulation is necessary to force managers to disclose or not (e.g., King and Wallin 1991a, 1991b, and Oishi 2000). According to the theoretical predictions for voluntary disclosure, there is no need to mandate information disclosure because of the existence of market forces[1]. However, the implications of the basic model are not consistent with the real financial reporting environment, where in past years a rapid increase in the financial reporting requirements has occurred. Are the implications of the basic model valid in principle? Would not the disclosure need to be mandated? These questions encourage us to test the predictions of the model. In addition, understanding managers' incentives to disclose might assist regulatory bodies in formulating their policies.

Broadly speaking, empirical accounting researchers have employed two different approaches to supplying useful evidence on accounting questions: archival and experimental (McDaniel and Hand 1996). Compared to studies using archival data[2], experimental methods may allow for more direct testing of theory because experiments can create conditions that do not actually exist and deal with "what if" questions (Swieringa and Weick 1982). In testing the predictions of the basic model, these methodological advantages in particular allow us to control and manipulate environmental characteristics and the information set of a manager assumed by the model.

The experimental literature has generally suggested that the theoretical predictions from the basic model are, in principle, the case (e.g., Forsythe et al. 1989, King and Wallin 1990, 1991a, 1991b), except for some studies (e.g., Chow et al. 1996). However, reviewing the existing experimental research that tested the basic model, we find that there could be some questions about the operation, design, and interpretation of the results. In the experimental studies reaching the conclusion that the results supported the theoretical predictions, for example, some had a very limited number of both designs and markets, and others had mixed results as to whether the predictions were actually supported or not. In addition, it may be argued that there is

little research on the role and effects of an antifraud rule, the mechanism that requires the sender of information to disclose truthfully (King and Wallin 1990, p. 870).

We ran 16 experimental markets. Each market had a single seller (i.e., manager) and three buyers (i.e., investors). In each period, the seller was endowed with one commodity to offer for sale. The commodity was an asset that paid out a liquidating dividend which was exogenously determined. At the beginning of the experiment, the seller was informed of the realization of commodity's value and decided whether to disclose it truthfully to all buyers or not. Receiving the seller's message, the buyers submitted competing bids for the commodity. A 2×2 factorial design was created by manipulating (1) the number of realization values and (2) the presence/absence of an antifraud rule.

In our manipulation (1), previous experimental literature suggests that the number of possible realization values might be important for theoretical equilibrium to be attained, because an increased number of realization values might interfere with the buyers' abilities to infer the exact realization value. A large (small) number of realization levels could be, for example, interpreted as complex (simple) financial information in the financial reporting environment. Therefore, this manipulation might bear on the question of whether complex disclosure blocks investors' abilities to understand financial information or whether their abilities are affected by the degree of complexity of financial information.

In our manipulation (2), there exists no theoretical prediction in the cell without an antifraud rule, while an antifraud rule is imperfect and its enforcement is often costly in actual markets. How do managers disclose their private information in an environment without an antifraud rule? It must be significant to observe managers' disclosure behavior in the absence of an antifraud rule in order to develop such a rule more completely and to assess the functions of that rule toward full disclosure.

The results generally supported the theoretical predictions. That is, sellers usually disclosed completely although they were not indifferent between making a disclosure and making no disclosure when the realization was the worst possible value. The number of realization values did not affect the results. In the cells without an antifraud rule, overstatement (that is, disclosing a value more than the actual realization) was generally observed.

Section 2 presents a brief survey and some questions about prior research and is followed by the experimental methods in section 3, the hypotheses and results in section 4, and the summary in section 5.

2. A brief survey and some questions about prior research

2-1. A brief survey

As indicated earlier, the basic model predicts that a manager would fully disclose his/her private information when disclosures are credible and costless. The underlying issue in this result relates to the inferences of investors (i.e., receivers of information) in the case of no disclosure. Also, the manager is assumed to make a voluntary disclosure only when that disclosure results in a higher valuation from potential investors. In the case of no disclosure, the theory predicts that the investors should assume that the realization is the worst possible value from the known set. The manager anticipates such investors' skeptical attitudes and fully discloses his/her private information perhaps except for the case of the worst possible value[3].

The basic model has been developed by the discrepancy between the theoretical predictions and the real world and has been extended by taking into consideration costly disclosure, (Jovanovic 1982, Verrecchia 1983 and Wagenhofer 1990), uncertainty of the manager's information endowment (Dye 1985 and Jung and Kwon 1988), quality of information (Verrecchia 1990 and Penno 1997) and so on. All these models attempt to address a situation where a manager might have the incentive to withhold information and partial disclosure may result.

As the basic model is developed and extended, laboratory experiments have been used increasingly to investigate the implication of extended theories on the basic model about manager disclosure behavior as well as the predictions of the basic model. Also, the current issue of experimental research concerning voluntary disclosure could be described succinctly as follows: "Under what conditions does a manager have the incentive to withhold private information?" Due to space limitations, we briefly review some main experimental studies on disclosure behavior below.

To investigate the predictions of the basic model, Forsythe et al. (1989) designed experimental markets consisting of four sellers and four buyers, while a single seller was generally used in most previous experimental studies. In their markets, the seller could either disclose the true value of an asset to potential buyers or choose to make no disclosure. They reported that the results were consistent with sequential equilibrium where the seller was forced to disclose his/her asset's value. King and Wallin (1990) conducted a similar experiment, but their main purpose was to examine the effects of antifraud rules and *ex post* verifiability on the theoretical predictions of the basic model. Their results strongly supported the predictions

of the basic model, while the equilibrium of full disclosure was not reached in the cell without an antifraud rule. King and Wallin (1991b) investigated the effects of the number of disclosure options available to the seller on the predictions of the basic model. The double auction institution was adopted in their markets because this institution compared favorably with other institutions in terms of convergence to competitive equilibrium and permitted experimenters to have a multiasset environment (*Ibid.*, p. 176), whereas the asset was generally sold via the first-price, sealed-bid auction institution in other studies. They found that the seller moved toward full disclosure, although support for the basic model gradually weakened as the number of disclosure options increased. King and Wallin (1991a) reported the results of experimental markets designed to test the hypotheses based on Jung and Kwon's (1988) disclosure model, in which there was a positive *ex ante* probability that a seller had no information about the liquidating value of the asset. In this case, the buyer could not distinguish between the uninformed seller and the one who chose to withhold information. They concluded that the results were consistent with the general proposition stating that the amount of disclosure decreased as the probability increased. The unique work of Chow et al. (1996) argued that their findings failed to support the predictions of the basic model. They reported that the results were due to the subjects acting as buyers not having sufficiently price-protected themselves (i.e., assumed that the realization was the worst value) in the absence of disclosure.

In summary, most studies have showed that the experimental results supported the predictions of both the basic model and the general thrusts of its extended models[4].

2-2. Some questions about prior experimental research

The main purpose of this paper is to investigate predictions from the basic model by using experimental methods because of some questions about the operation, design, and interpretation of results in previous experimental research that centered on the basic model, although it is also significant for testing new disclosure models.

One problem in the previous studies is that it would be difficult for us to interpret the results of several studies as consistent with predictions of the basic model. For instance, in King and Wallin (1991b), no disclosure occurred in the proportion of 40 percent (in the cell A that provided a test of the basic model). Also, King and Wallin (1991a) reported that no disclosure was observed in the proportion of 8 to 34 in the setting where the theory predicted the occurrence of full disclosure. Forsythe et al. (1989) documented that disclosure was not made in the ratio of about one to five.

In the end, King and Wallin (1990) might be viewed as the sole experiment clearly showing the occurrence of full disclosure without reservation. In King and Wallin (1990), for example, disclosure was made in the proportion of 95.5 percent (=128/134, in cell A that provided a test of the basic model). The economic commodity traded in King and Wallin (1990) was, however, a lottery ticket, having one of three realization levels (10%, 50% or 90%). Under a small number of realization levels (3 in King and Wallin 1990), the equilibrium of full disclosure could be clearly brought about. But the experimental results became somewhat ambiguous as the number of realization levels increased (8 in King and Wallin 1991a, 1991b), and furthermore, the results could not be interpreted as the approach to the theoretical equilibrium in the case of a large number of realization levels (125 in Forsythe et al. 1989 or 201 in Chow et al. 1996). If increasing the number of realization values interferes with the buyers' abilities to draw inferences about the sellers' incentives, generalizing the experimental results to a naturally occurring setting would be *seriously* restricted.

Relatively low monetary incentives to subjects might also be problematic. In Chow et al. (1996), for example, the average cash rewards for three hours' participation in the experiment were $13.84 to subjects as managers and $7.76 as investors[5].

In order to obtain results supporting the theoretical predictions, various devices or ideas in experimental design such as double auction (DA) institution (King and Wallin 1991b) and competition among multiple sellers (Forsythe et al. 1989) were introduced to test the basic model. Though the theory does not assume one particular trading mechanism, the adoption of the *DA institution* may not be appropriate for testing the basic model because it would allow some additional information flow from a manager (seller) to investors (buyers) by way of offers made and bids accepted. The introduction of competition among plural managers (sellers) brings a new factor into the basic model, although Forsythe et al. (1989, p. 221) documented that the factor did not significantly affect the theoretical predictions.

Finally, it should also be stressed that the number of both designs and markets is limited in the previous studies intended to conduct direct testing of the basic model. In addition, although an antifraud rule has been indicated as a *critical* condition in the basic model both theoretically and experimentally (e.g., King and Wallin 1990 and King 1996), the effects of an antifraud rule have not been sufficiently tested experimentally in the simple setting.

3. Experimental methods

3-1. Market environment

Since terms such as 'manager', 'investors', 'liquidating value', and 'disclosures' might give subjects some psychological biases (Hayes and Kachelmeier 1998, pp. 99-107), more neutral terms, such as 'seller', 'buyers', 'commodity's value' and 'sending messages' were substituted. In each market, four subjects acted as a single seller with three buyers. This group of four subjects was held constant throughout the experiment. The subjects' task was the trading of fictious commodities. In each period, the seller had one commodity to offer for sale to the buyers. At the beginning of each period, each seller was informed of the realization of the commodity's value, which was drawn from one of two uniform discrete distributions. All subjects were informed of either of these distributions. The trading mechanism was a first-price, sealed-bid auction institution[6].

3-2 Experimental design

Two manipulations were conducted. One was related to the number of realization values of commodity. The commodity's value was randomly drawn from one discrete uniform distribution either of $[25,50,75,100,125,150,175]$ or of $[25,26,...,175]$. These two were equal in a range of 25 to 175 and a mean of 100, but differed widely in the number of realization values (7 and 151). This manipulation reflected the argument in section 2-2 that the differences in the number of realization values might have great influence on the experimental results.

The other manipulation was related to the presence/absence of an antifraud rule. Since disclosure models generally assume that an antifraud rule is one of the critical conditions, models result in losing their explanatory power if no antifraud rule exists. While it might be possible to develop some predictions not based on a theoretical model, the experiments of the cell without an antifraud rule were conducted not to test the solid theoretical prediction but to obtain some findings when no antifraud rule is posited.

By these two manipulations, the experimental design is presented as follows.

EXPERIMENTAL DESIGN		The number of possible states	
		7	151
An antifraud	Exist	Cell ①	Cell ②
rule	Not exist	Cell ③	Cell ④

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3-3. Conduct of experiments

Experimental markets were run in November 1998. All four cells had four markets respectively and each market had 20 periods. Each period contained the same sequence of events (a sequence of events was referred to as a transaction). Subjects were students at Osaka University. As four subjects (a seller and three buyers) participated in each market, subjects were 64 in total (4 cells×4 markets×4 participants). Upon arrival in the classroom, subjects drew lots at the entrance and were ushered to their numbers' seats. After all subjects took their seats, experimental sessions started. At first, we took considerable time for instruction to inform the subjects about their tasks, rules governing trade and how their cash rewards would be determined. A transaction (a sequence of events) in each period was as follows.

(1) One realization value of the commodity was randomly selected and was informed only to the subject acting as a seller in the experimental market.

(2) The seller decided his/her message subject to the constraints of the cell under investigation. In cells ① and ②, the seller had the disclosure option either of 'disclosing the value truthfully' or 'making no disclosure'. In cells ③ and ④, the latter option was replaced by 'disclosing a value which may happen'.

(3) After receiving the message, each buyer valued the commodity and submitted a written bid.

(4) The winning buyer, who submitted the highest bid, paid the amount equal to his/her bid and received the commodity. If plural buyers tied for the highest bid, a dice randomly selected the winner.

The winning buyer's payoff was equal to the commodity's value minus the amount paid to the seller, and the losing buyer's payoffs were zero. The payoff of the seller was equal to the bid amount received from the winning buyer. The more total payoffs the seller and the buyers gained, the more cash rewards they received[7]. All relevant information was announced to participants at the end of each period. As indicated earlier, the transaction was repeated 20 times, and told to all subjects in advance[8].

After the experimental session ended, the subjects completed evaluation forms and post-experiment questionnaires and then were paid and left. Each experimental market lasted about 2.5 hours and the average cash pay was ¥2,721.86.

4. Hypotheses and experimental results

4-1. Hypotheses and behavioral forecasts

<u>Hypotheses for the cells with an antifraud rule (cells ① and ②)</u>

For the cells with an antifraud rule, the basic model predicts the disclosure pattern as follows.

Hypothesis 1-1. In the cells with an antifraud rule, the seller fully reveals his/her commodity's value.

In addition, the basic model suggests that the seller is indifferent between disclosing the exact value and making no disclosure in case of the lowest value. Therefore, the next hypothesis 1-2 is also posited.

Hypothesis 1-2. When the realization is the worst possible value, the seller is indifferent between disclosing it truthfully and making no disclosure.

As discussed in section 2-2, our experiment centers on the extent to which the differences in the number of realization values have an influence on the results. Previous experimental market studies suggest that the subjects adjust their behavioral strategies with repeated trials and converge to certain equilibrium. If full disclosure is obtained through an unraveling process, which is one of convergence processes whereby the buyers continuously adjust their behavior over time[9], an increased number of realization values might reduce the buyers' abilities to see through the seller's incentive to disclose, although the basic model does not explicitly address the question of the number of realization values. This suggests:

Hypothesis 2. *Ceteris paribus*, the results are unaffected by the differences in the number of realization values of the commodity.

<u>Behavioral forecasts for the cells without an antifraud rule (cells ③ and ④)</u>

The absence of an antifraud rule (in cells ③ and ④) makes it possible for a seller to lie. As stated in section 3-2, the creation of the cells without an antifraud rule was not based on any theoretical predictions, because it has not been sufficiently analyzed until now. That is why we used the term 'behavioral forecasts' instead of the term 'hypotheses'.

Among previous experimental studies that have considered the effects of the absence of an antifraud rule on a policy of disclosure, for example, King and Wallin (1990) investigated the cells that the number of realization values was three and the traded asset was a lottery ticket, and King (1996) produced the experimental design that experimenter paid subjects for 'precision' in their predictions. It is clear that both settings are different from that of our experiment.

As to an outline of behavioral forecasts for the cells without an antifraud rule, it might be helpful to note

the analyses made by King and Wallin (1990) and King (1996). They suggested that in the single period game the buyers anticipated that the seller sent a false message because the buyers were not able to impose a penalty on the lying seller. Accordingly, the buyers were expected to value the asset given ignoring the seller's message. This means that the seller would not be able to specify the best disclosure strategy in response to the buyers' reactions. However, if there is a probability that the buyers were viewing a seller's message as truthful, the seller might have the incentives to report a value more than its actual realization[10].

4-2. Results

This section is devoted to analyzing experimental data and addressing the hypotheses. First, the hypotheses for the cells with an antifraud rule are dealt with. Second, the behavioral forecasts concerning the cells without an antifraud rule are addressed. Finally, the differences between results of the cells with an antifraud rule and those of the cells without an antifraud rule are summarized and discussed. We should be very careful in interpreting results from the statistical tests because of the possibility of serial correlation and the limited number of data. We will frequently pay attention to the results of the latter half of the periods because subjects were expected to establish their consistent behavioral strategies in the course of repeated trials. Subjects' responses to the post-experiment questionnaire suggested that almost all subjects had established their behavioral strategies by the end of period 10.

Results of the cells with an antifraud rule (cells ① and ②)

Table 1: Relative frequency of disclosures

	All periods**	Latter half of the period (Periods 11 through 20)**
Cell ① (7)*	68.8%(=55/80)	77.5%(=31/40)
Cell ② (151)*	67.5%(=54/80)	75.0%(=30/40)

* Numbers in parentheses represent the number of realization values./ ** Numbers in parentheses are row data.

Table 1 presents the proportions of disclosure to disclosure occasions. On average, sellers made a disclosure (irrespective of the actual realization) in 68.8 percent and 67.5 percent of all periods throughout the entire market in cells ① and ② and the relative frequencies increased to 77.5 percent and 75.0 percent of the latter half of all periods. These percentages are significantly below 1.0 ($z = 3.41$ ($p < 0.01$) for cell ① and ($z = 3.65$ ($p < 0.01$) for cell ②) even if the observations for the latter half of all periods are used. It is impossible to conclude that full disclosure occurred.

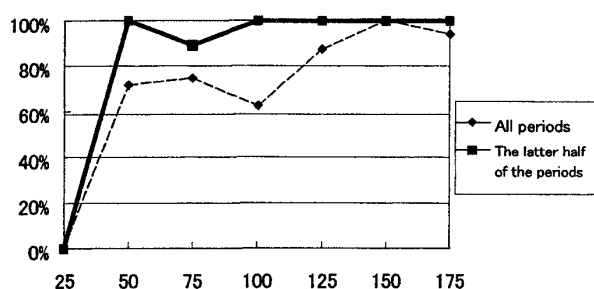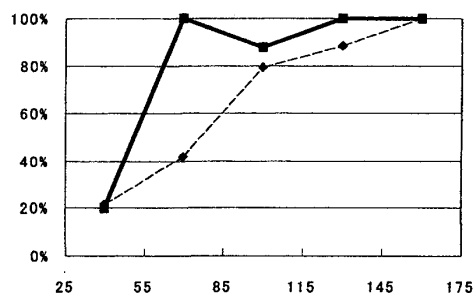Figure 1-1. Proportion of disclosures for Cell ①

Figure 1-2. Proportion of disclosures for Cell ②

However, it is necessary to remind ourselves that the seller is assumed to be indifferent as to whether to reveal the commodity's value or not when the actual realization is the lowest, as suggested by the basic model (see endnote 1).

To investigate whether the seller's policy of disclosure would vary across the actual realizations of commodity's value, we observe the proportions of disclosure to disclosure occasions with each realization of commodity's value. (The realization values in cell ② are integrated into 5 intervals as the number of them is 151). The results are exhibited in Figure 1-1 (cell ①) and Figure 1-2 (cell ②).

Except for both the lowest value of 25 in cell ① and the lowest interval of $(25,...,55)$ in cell ②, disclosure was made in the proportions of $31/32$ (cell ①) and $30/34$ (cell ②) of the latter half of all periods. Consistent with Hypothesis 1-1, it could be concluded that the sellers generally revealed the commodity's value when the realization is more than the worst possible value or values in the lowest interval. In case of the lowest value and values in the lowest interval, however, in only 3 disclosures out of 28 cases did the sellers choose to disclose, refuting Hypothesis 1-2. The seller might find it advantageous to disclose nothing if there is a probability that some buyers will not assume the worst and will overbid on the commodity. Or, as suggested by the finding of behavioral science research, there might be a cost that the basic model did not assume (e.g. the cost of filling out the message forms or other mental costs).

Hypothesis 2 addresses the question of whether the number of realization values affects the seller's disclosure. Table 1 shows that relative frequencies of disclosures were not significantly different between cells ① and ② ($\chi^2 = 0.029$ for all periods and $\chi^2 = 0.069$ for the latter half of the periods). Consequently, Hypothesis 2 cannot be rejected. The results are inconsistent with those of the previous research (e.g., Chow et al. 1996). The number of realization values did not significantly affect the buyers' abilities to infer the

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commodity's value in the case of non-disclosure, while the convergence to the equilibrium was also achieved through an unraveling process in our markets. Our subjects acting as buyers might be sophisticated enough for the equilibrium to be obtained.

<u>Results of the cells without an antifraud rule (cells ③ and ④)</u>

As stated in section 4-1, there is no solid theoretical prediction concerning the cells without an antifraud rule. For this reason, first, the results for cells ③ and ④ are presented and then are compared with those for the cells with an antifraud rule (i.e., cells ① and. ②).

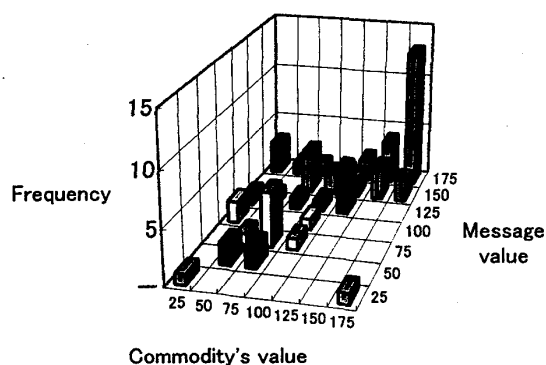Figure 2-1. Commodity's value vs. Message value (Cell ③)

Frequency

Commodity's value

Message value

Figure 2-2. Commodity's value vs. Message value (Cell ④)
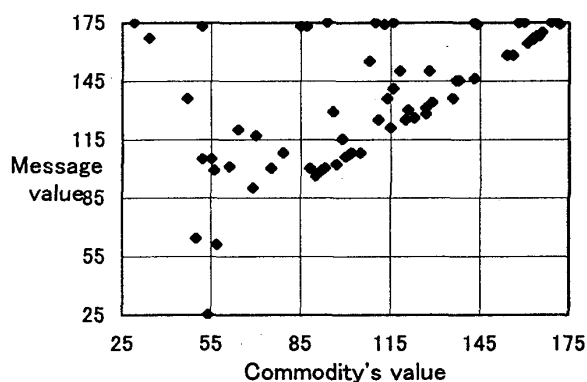

Message value

Commodity's value

Figure 2-1 (cell ③) and Figure 2-2 (cell ④) present the actual realization of the commodity's value versus the seller's message value in the cells without an antifraud rule. The third dimension 'frequency' is established since each coordinate has two or more observations in Figure 2-1. The diagonal line in Figure 2-2 plays an important role in understanding the results of cell ④, implying that a dot above the diagonal line represents the case where the seller's message value was more than the actual realization (i.e., overstatement), a dot on the diagonal line represents the case where both values are equal (i.e., truthful disclosure), and a dot below the diagonal line represents the case where the seller's message value is less than the actual realization (i.e., understatement).
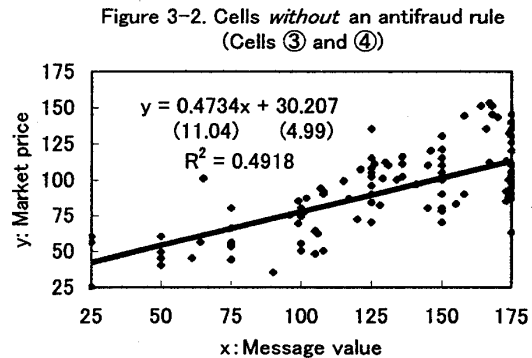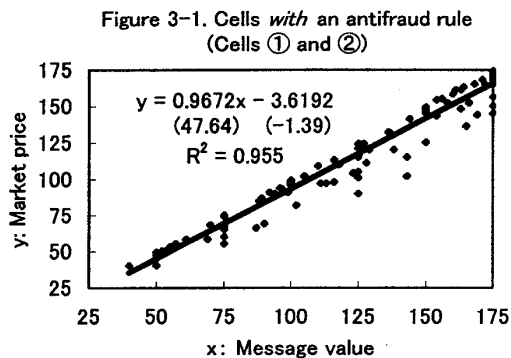
The figures, in general, show that the seller's message value is either equal to or more than the actual realization. The results are consistent with the informal behavioral forecasts that overstatement might tend to take place. Unlike the results in King's (1996) NC sessions (similar to our cell ④), in which the sellers under-reported 11.2 percent of the possible 152 disclosures, the sellers under-reported 1.5% of the possible 66 disclosures in cell ④. Furthermore, this tendency seems to strengthen as the number of realization values

increased. In comparison with cell ③ in which 27 overstatements out of a possible 62 disclosures (18 non-disclosures (ND)) occurred, 64 overstatements out of a possible 66 disclosures (14 ND) occurred in cell ④.

The final consideration is the reaction of the buyers to the seller's disclosure behavior.

Figures 3-1 and 3-2 show the market price (i.e., the highest bid) versus the seller's message value and display graphically the results of regressions of the price on message as an independent variable. Figures 3-1 and 3-2 present the results of the cells with and without an antifraud rule respectively. In the cells with an antifraud rule (Figure 3-1), the slope of regression was 0.9672, the intercept was -3.6192, and all variance was virtually explained by the model ($R^2 = 0.955$).

Figure 3-1. Cells *with* an antifraud rule
(Cells ① and ②)

$$y = 0.9672x - 3.6192$$
$$(47.64) \quad (-1.39)$$
$$R^2 = 0.955$$

Figure 3-2. Cells *without* an antifraud rule
(Cells ③ and ④)

$$y = 0.4734x + 30.207$$
$$(11.04) \quad (4.99)$$
$$R^2 = 0.4918$$

In the cells without an antifraud rule (Figure 3-2), the case was different. The explanatory power of the model without an antifraud rule was considerably less ($R^2 = 0.4918$). One possible explanation was that the buyers completely ignored the seller's message value. However, this was not the case. The slope was 0.4734, which indicates that the buyers took to some extent the message value into consideration, and the tendency that the higher message had generated a higher price was at least admitted. Moreover, the results of regressions in the first and the latter half of all periods are $y = 0.5354x + 18.377$ ($R^2 = 0.5548$) and $y = 0.3566x + 49.354$ ($R^2 = 0.389$) respectively, indicating that the buyers clearly lowered their reliance upon the sellers' disclosure over time.

5. Summary

Sellers (i.e., managers) generally chose to disclose in cases with an antifraud rule, although they were not indifferent between making a disclosure and making no disclosure when the realization value was lowest.

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The number of realization values (i.e., liquidating dividends) did not affect results in the setting of our experiment. The reasons for this discrepancy between the prior work (e.g., Chow et al. 1996) and our results remain unclear. Without an antifraud rule, overstatement was generally observed and there was a growing tendency for overstatement to be made as the number of realization values increased. The buyers (i.e., investors) did not ignore disclosure in such cases completely but discounted it in part. Of course, our results must be interpreted realizing the limitations of any experimental study and the limited amount of data. However, we may say that our results provide a foundation for additional research in this area.

A number of experimental modifications are possible. One might be to introduce an uncertain (or randomized) stopping point to our markets in order to mitigate end-of-game behavior (see endnote 8). Other modification would include the rotated assignment of the subjects to the seller or the buyer, which enables us to investigate the repetition of a 'real' single-period game. An establishment of more performance-contingent reward system would be also necessary to force subjects to take the experimental setting more seriously, although the responses to the post-experiment questionnaire indicate that participants found our experiments to be interesting and the monetary incentives to be motivating.

One of our extensions would be to focus on some conditions that might affect various costs of voluntary disclosure. For example, since disclosure is not costless in practice and subjects tend to prefer being informed of the commodity's value regardless of their avoidance of losses by not observing it (e.g., King and Wallin 1995), it might be significant to impose a direct cost to the seller to observe. Second, we may control the quality of information. Penno (1997) shows that the *ex post* quality of information, which is defined as 'the precision of the information's noise term conditional on it being acquired by the manager (*Ibid.*, p. 276)', is significant in predicting managers' disclosure behavior. Finally, extensions would include incorporating legal liability regimes for false disclosure, while an antifraud rule was already imposed in our markets. There is a considerable body of experimental market research on various liability regimes in auditing (e.g., DeJong et al. 1985 and Dopuch and King 1992). Integrating voluntary disclosure research with the auditing literature would also be worthwhile to obtain a better understanding of managers' incentives in more complex accounting environment.

Acknowledgements

Notes

Experimental data, main materials and instructions are available upon request.

[1] Of course, voluntary disclosure generally refers to disclosure outside financial statements which is not mandated (FASB 2001). However, the essential issue in our paper is to investigate whether market forces are sufficient to bring about full disclosure or not, regardless of whether they are voluntary or mandatory disclosures.

[2] As to empirical studies testing the basic model with archival data, some studies presented evidence that a manager's full disclosure was not always observed (e.g., Lev and Penman 1990).

[3] When the realization is the lowest value, a sequential equilibrium predicts that the manager should be indifferent between making a disclosure and making no disclosure because the buyer makes the same inference regardless of the seller's policy of disclosure. For more about the basic model, see Milgrom (1980) and Milgrom and Roberts (1986). Of course, the mathematical appendix is available upon request from the authors.

[4] It is well-known that experimental results typically deviate from the specific point predictions (e.g., disclosure always occurs when the realization is more than a certain threshold value). In previous studies (e.g., King and Wallin 1991a, 1995 and Chow et al. 1996), therefore, such predictions are viewed as benchmarks that provide the criteria to test whether the results are in the predicted directions.

[5] Generally speaking, as long as the experimenter has given subjects the incentive according to Smith's (1976) induced-value theory, it is supposed that there is no big influence on the result. However, when using students as subjects, it may be necessary to make the experimental design taking the equivalent rate of their part-time job into consideration.

[6] Using this trading mechanism does not generate any inconsistency with the theory (Forsythe et al. 1989, pp. 216-217).

[7] The seller's total cash pay was sum of the winning amount for the commodity across all 20 periods. Each buyer was paid the initial endowment (i.e., budget=¥1,000) adjusted for cumulated trading profits/losses. In consonance with Forsythe et al. (1989), the seller and the buyers were also paid commission values of ¥40 and ¥80 for each period that was conducted.

[8] To inform subjects of the terminal trading period might induce end-of-game behavior. Fortunately, such a behavior was not found in our experiment. For this reason, we do not touch this issue hereafter.

[9] An unraveling process is briefly explained by King and Wallin (1991b): "The unraveling process works in an iterative fashion. Sellers with assets that have high dividend values would not remain silent (and receive offers consistent with "average" assets) but would identify their assets being of high quality and buyers price them as

such. In like fashion, sellers with medium assets would not remain silent because by identifying their type they would receive more than being pooled with low asset quality types. Therefore, all types are communicated except the lowest, which is revealed by the silence of the seller (*Ibid.*, p. 174, footnote 9)."

[10] For more detailed discussion by positing some additional assumptions, see King and Wallin (1990) and King (1996).

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