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資訊可靠性與回饋對預測股票報酬及人類資訊處理之影響

The Effects of Information Reliability and Feedback on the Performance of Predicting Stock Prices and Human Information Processing

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ABSTRACT

The main purposes of this research are to examine two issues: (a) how information reliability may affect decision makers' financial judgment task, and (b) whether feedback can serve as a useful mechanism to mitigate the adverse effects of unreliable information. The experimental task involves asking subjects to predict stock prices for 25 Taiwan textile companies on May 1, 1996, based on stock prices on May 1, 1995 and seven 1995 accounting and market information cues selected by a stepwise regression of 17 accounting and market information cues of all textile companies over the period 1990-94. Two independent variables are employed in the experiments - *information reliability* (manipulated at two levels: perfectly reliable and less reliable, which is measured by variance) and *feedback types* (manipulated at three levels: cognitive feedback, task properties feedback, and lend model feedback). The dependent variable is each subject's prediction performance (measured by *achievement* index and its components). Sixty second-year MBA students participate in the experiments. The experimental results indicate two important findings. First, information reliability has no significant effect on subjects' performance in predicting stock prices. Second, task properties feedback is as effective as the lens model feedback. This result is consistent with Kessler and Ashton (1981).

Key Words: Feedback, Financial reporting, Information reliability, Probabilistic judgment.

1. INTRODUCTION

The main purpose of financial accounting is to provide useful information about business enterprises for the decision makers to make probabilistic judgments or predictions. One of the most important functions of financial accounting information is to help investors and creditors predict future cash flows which form a firm's stock price. In fact, the usefulness of accounting information in predicting stock prices (or returns) has been the center of current financial accounting research (e.g., Abarbanell 1991; Atiase 1985; Easton et al. 1992; Han and Wild 1992; Lev and Ohlson 1982; Ohlson and Penman 1992).

According to the Financial Accounting Standards Board's (FASB) *Statement of Financial Accounting Concepts No. 2,* one of the two major qualitative characteristics of information usefulness is reliability. This characteristic requires that accounting information be free of error or bias. As a society becomes more complex, however, there is an increased likelihood that unreliable (or imperfect) information will be provided to decision makers.[1] One most common way for decision makers to increase the reliability of accounting information is to have an independent audit performed. However, due to the inherent limitations of current auditing procedures[2] and cost-benefit consideration, auditing can only provide reasonable assurance that a company's financial statements contain no material misstatements. Therefore, most of the decision makers' real judgment and prediction tasks inevitably involve the use of unreliable information. In light of this, an examination of how people react and use imperfect accounting information cues to make financial judgments can provide valuable insight into the decision maker's information selection, decision process, and the resulting judgment and decision. The importance of examining how information reliability may affect decision makers' judgment in context of interest to accounting has been emphasized by Eihhorn (1976).

Since the 1970s, accounting researchers have used theories and methods from the cognitive psychology literature, particularly the judgment and decision-making literature, to examine various decision-making issues in financial reporting.[3] However, no prior study has ever explored the issue of how the reliability of information may affect decision makers' financial judgments and, even more important, what mechanism can be used to mitigate the adverse effects of unreliability. The main purpose of this research is to address

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[1]Arens and Loebbecke (1998) points out several factors which may explain the increased possibility of unreliable information. First, the growing of an organization leads to an increase in the volume of its transactions, resulting in a high likelihood that improperly recorded information will be included in the records (perhaps buried in a large amount of other information). If large number of small misstatements remain undiscovered, the combined total could be significant. Second, in the past several decades, transactions among organizations have become increasingly complex and hence more difficult to record properly. For example, the accounting treatments of derivatives financial instruments poses relatively difficult and critical accounting problem. Finally, due to the globalization of modern business enterprises, it is virtually impossible for a decision maker to have complete information about the overall organization. Therefore, if information is provided by someone whose goals are not consistent with those of the decision maker, the information may be intentionally manipulated or biased in favor of the provider.

[2]For example, the famous ZZZZ Best fraud occurred in 1987 shows how the functions of certain commonly-used audit procedures (e.g., third party confirmation, review of documents, analytical procedures, and physical site visits) can be limited due to the management's intentional deception to the auditor.

[3]See Maines (1995) for a comprehensive overview of behavioral studies in this area.

this issue. In particular, this study examines whether feedback can serve as a useful "mitigating" mechanism to users of imperfect accounting information on a financial judgment task. This is an important issue to accounting information users because they should recognize the fact that they usually rely on imperfectly reliable information in making their decisions and should know what ways to overcome the problem. This issue is also critical to the policy maker because, if feedback is truly useful in mitigating the adverse effects of information unreliability, certain feedback-oriented information (e.g., financial statement analysis, forecasted and actual sales revenue numbers, etc.) should be disclosed in companies' periodic financial statements or Websites.

This study differs from prior behavioral research in financial accounting in two ways. First, while almost all the prior studies assume that the information given to the subjects was perfectly reliable, this study explicitly examines the effects of information reliability on human's information processing with an opportunity of receiving different types of feedback. The potential benefits of feedback to help decision makers process unreliable information is important but has never been explored before. Second, the judgmental task used in this study is the prediction of stock prices. Only few studies (e.g., Wright 1977) have investigated how and how well people use accounting information to predict stock prices in an experimental setting. The relative lack of interest in this research area may result from the inability of individual-level decision researchers in financial accounting to link their results with the role of market forces in investment decision-making (Ashton and Ashton 1995). In fact, a decision maker's knowledge of how people processes unreliable information cues to make financial judgment may lead to improved judgmental accuracy and efficiency.[4] Furthermore, identifying potential limitations of individual's information processing ability is a crucial step toward improving the quality of individual decision-making. However, prior studies only provide evidence on human's information processing ability in settings of predicting default on debts (Abdel-Khalik and El-Sheshai 1980), corporate failure (Simnett and Trotman 1989) or municipal bond rating (Lewis et al. 1988). Since financial accounting information is most widely used by investors and creditors to predict future stock prices, it is necessary to examine how and how well decision makers process information in a setting of predicting stock prices.

The remainder of this proposal is organized as follows. The second section develops the testable hypotheses. Section 3 describes the experimental design and preliminary procedures.

2. HYPOTHESIS DEVELOPMENT

According to Kessler and Ashton (1981), psychologists have examined the effectiveness of three types of feedback – outcome, cognitive, and task properties. *Outcome feedback* indicates the correct response to the subject immediately after each prediction. *Cognitive feedback* reveals periodic information about the subject's prediction strategy (e.g., the association between each information cue and

[4]Wright (1977) finds that an awareness of the statistical relationship between the financial judgment and accounting or market information cues may contribute to improved prediction models and decisions.

subject's prediction). *Task properties feedback* involves periodic information about the statistical properties of the judgmental task criterion (e.g., the association between each information cue and the actual task outcome). Various combinations of these feedback types have also been examined, among which the combination of cognitive and task properties feedback (called *lens model feedback*) has been investigated most extensively.

Prior work in psychology and accounting shows that outcome feedback is extremely ineffective (Hammond et al. 1973; Hirst and Luckett 1992; Luckett and Eggleton 1991; Schmitt et al. 1977), and sometimes even detrimental, because it provides no direct information on the nature or extent of association between each information cue and the task criterion and because a long series of trials is required for subjects to distinguish between systematic and random associations (Hammond 1971). Even though in practical situations a series of trials may occur over a long time period, the subjects may forget the outcomes of earlier trials. Therefore, studies in accounting tend to de-emphasize the role of outcome feedback in improving judgments (Arunachalam and Daly 1995; Ashton 1981; Kessler and Ashton 1981).

Experimental evidence shows that providing outcome feedback together with task properties feedback (Hammond et al. 1973) or lens model feedback (Hammond and Summers 1972) may result in poorer performance than simply providing task properties or lens model feedback alone). The possible reason is that the random component of outcome feedback decreases the consistency with which the subjects use the information cues (Hammond et al. 1973). Cognitive feedback has also been shown to be relatively ineffective because a long series of trials is required for the subjects to discover the underlying properties of the judgmental task (Kessler and Ashton 1981; Schmitt et al. 1976).

Task properties feedback and lens model feedback have been found to be the most effective types (Steinmann 1976). Some experiments even show that these two types are equally effective (Kessler and Ashton 1981; Nystedt and Magnusson 1973; Steinmann 1976). Kessler and Ashton (1981) suggests that task properties feedback and lens model feedback improve subjects' predictions by allowing them to match their information cue weights more closely to those of the environmental model.

Accounting research in human information processing has examined the effectiveness of several feedback types in multiple-cue probabilistic tasks such as performance evaluation (Hirst and Luckett 1992; Luckett and Eggleton 1991; Luckett and Hirst 1989), corporate bond rating (Kessler and Ashton 1981), and financial distress prediction (Tuttle and Stocks 1998). Little is known about whether results generated in such tasks will hold in predicting stock prices. In fact, it is possible that certain types or combinations of feedback are more effectiveness for some kinds of tasks than for others (Kessler and Ashton 1981). Therefore, this study examines how different feedback types may affect subjects' performance in predicting stock prices, especially in an environment with unreliable information. This leads to the following testable hypotheses:

(1) The effects of information reliability on subjects' performance:

H1: If we ignore the effects of feedback, then subjects who are provided perfectly reliable information cues will perform better over time than subjects who are provided less reliable information cues.

(2) The effects of different feedback types on subjects' performance:

H2: Ignore the effects of information reliability. If we define F ≡ {cognitive feedback, task properties feedback, lens model feedback} and define P_f as subjects' performance under different feedback types to be, where f Č F, then we have:

$$P_{cognitive} < P_{task\ properties} = P_{lens\ model}$$

(3) The interactions between different feedback types and information reliability: Define $X^j_{f'}$ as subjects' performance when they are provided *j* type of information and *f* type of feedback, where $j \in$ {perfectly reliable, less reliable} and $f \in$ F. Also define $Q^j_{f'}$ as subjects' performance improvement generated by feedback type *f*, given information type *j*, where $f \in$ F - {no feedback}, in other words, $Q^j_{f'} = X^j_{f'} - X^j_{no}$, then we have:

H3a: $Q^{less\ reliable}_{cognitive} < Q^{less\ reliable}_{task\ properties} = Q^{less\ reliable}_{lens\ model}$

H3b: $Q^{perfectly\ reliable}_{cognitive} < Q^{perfectly\ reliable}_{task\ properties} = Q^{perfectly\ reliable}_{lens\ model}$

H3c: $Q^{perfectly\ reliable}_{f'} < Q^{less\ reliable}_{f'}$, *for all* f'

3. EXPERIMENTAL DESIGN

3.1 The Experimental Task and Information Cue Selection:

The prediction of stock prices was selected as the experimental task because it encompasses all the features of the abstract multiple-cue probability judgment tasks studied by psychologists. Moreover, it serves as an analogue to financial analysis tasks in general, that is, basic characteristics of firms or securities must be abstracted from a large amount of accounting information.

According to Kessler and Ashton (1981), prior human information processing studies suggested that between 30 or 40 cases, each containing three to five cues, could be evaluated in the time available for each experimental session. After considering these constraints and costs, we randomly chose 25 firms whose stock prices will be predicted. These firms: (a) are all public textile companies listed on the Taiwan Stock Exchange,[5] (b) their stock prices are available on May 1, 1995 and May 1, 1996,[6] (c) they all received a clean audit report in 1995 and 1996, and (d) they were not highly diversified during 1995 and 1996.

To select the information cue set, a sterwkse regression was performed using 17 accounting and market information cues of all textile companies from the 1990-94 Taiwan Economic Journal (TEJ) database.[7] The final

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[5]To control for the industry effect on stock price, we concentrate on a single industry. The textile industry was chosen because it is a relatively mature industry in Taiwan and is not subjected to special tax regulations.

[6]This time period was selected because there was no significant macroeconomic events (e.g., the Asia financial crisis) occurred within this period.

[7]For a company to be a candidate for the stepwise regression sample, it must have all 17 accounting and market information cues available during 1990-1994. A total of 41 (out of 46) textile companies were included in the final sample. Lev and Thiagarajan (1993) identifies twelve fundamental signals which can contribute significantly to the explanation of excess return variance beyond earnings alone. Due to data availability and tax

model (R^2 = 0.34, probability of *F-to-enter* is 0.12) includes current ratio, liability ratio, accounts receivable average collection period, CAPM beta, cash dividend, stock turnover rate, and times interest earned ratio. We then calculated these seven ratios for the 25 sample companies using their 1995 financial statements. Therefore, the experimental task involves asking subjects to predict stock prices for 25 textile companies on May 1, 1996, based on stock prices on May 1, 1995 and seven 1995 accounting and market information cues.

3.2 Basic Experimental Setting:

Two independent variables are employed in the experiments - *information reliability,* which is manipulated at two levels: perfectly reliable (PR) and less reliable (LR), and *feedback types,* which is manipulated at three levels: cognitive feedback (CF), task properties feedback (TPF), and lend model feedback (LMF). This leads to a 2 × 3 between-subject design. It should be noted that the reliability of each information cue is measured by its variance and each information cue is presented to the subjects by its mean and variance. For example, if the true value of a selected company's current ratio is 2.5, then subjects under the PR treatment will be told that the current ratio has a mean of 2.5 and a zero variance; while subjects under the LR treatment will be told that the current ratio has a mean of 2.5 and a variance of 4. Table 1 summaries the experimental design.

[Insert Table 1 here]

The dependent variable is each subject's prediction performance, which is measured by prediction achievement (r_a). According to Tucker (1964) and Kessler and Ashton (1981), two components of this measure, matching G and response consistency R_s, are also analyzed:

$$r_a = GR_sR_e + C\sqrt{1-R_e^2}\sqrt{1-R_s^2}\ .$$

Subjects' prediction performance is also measured in terms of mean absolute error (MAE), where

$$MAE=\frac{\sum_i^n \left|\text{Firm } i\text{'s actual stock price - Subject's prediction on firm } i\right|}{n}$$

3.3 Subjects:

The subjects include 60 second-year MBA students in National Chengchi University. Each subject is randomly assigned to one of the six experimental sessions. At the end of each experiment session, all subjects are paid in cash based upon their relative performance of prediction.[8]

4. EXPERIMENTAL RESULTS

The experimental results generally support our hypotheses.

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regulation problems, this study selects five of them: inventory turnover, account receivable average collection period, capital expenditure change rate, R&D expense, and gross margin rate. The accounting cues also include current ratio, earnings per share (EPS), firm's pretax interest coverage ratio, net worth per share, operating income growth rate, and liability ratio. The market information cues include CAPM beta, cash dividend per share, stock dividend per share, net worth return rate, risk-free rate, and stock turnover rate. These information cues were selected based on prior CAPM empirical studies (e.g., Fama and French 1992) and the discounted cash flow model (Copeland and Weston 1992; Elton and Gruber 1991).

[8]The positive effects of monetary incentives on judgment performance are continent on a number of factors. However, the positive effects on the effort have been supported by prior research (e.g., Awasthi and Pratt 1990; Libby and Lipe 1992).

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TABLE 1
Experimental Design and Sample Size

Feedback Types / **Information Reliability**	**Cognitive Feedback (Type *A* Feedback)**	**Task Properties Feedback (Type *B* Feedback)**	**Lens Model Feedback (Type *C* Feedback)**
Perfectly Reliable **($\pm^2$ = 0)**	N = 10 (repeated in 3 consecutive weeks)	N = 10 (repeated in 3 consecutive weeks)	N = 10 (repeated in 3 consecutive weeks)
Less Reliable **($\pm^2$ > 0)**	N = 10 (repeated in 3 consecutive weeks)	N = 10 (repeated in 3 consecutive weeks)	N = 10 (repeated in 3 consecutive weeks)

TABLE 2

Summary of ANOVA Tests for Prediction Performance

	r_a			G			R_s			MAE		
	MS	F	*p*-Value	MS	F	*p*-Value	MS	F	*p*-Value	MS	F	*p*-Value
Between Subjects												
Feedback Type	0.0735	2.291	0.111	0.2050	4.247	0.019	0.0017	0.258	0.773	8.4290	4.874	0.011
Information Reliability	0.3030	9.456	0.003	0.0326	0.675	0.415	0.0006	0.096	0.757	6.8410	3.956	0.052
Feedback Type × Information Reliability	0.0014	0.042	0.958	0.1200	2.482	0.093	0.0104	1.585	0.214	2.7010	1.562	0.219
Within Subjects												
Session	0.2390	13.003	0.000	1.1070	42.95	0.000	0.0262	9.778	0.000	14.776	13.079	0.000
Session × Feedback Type	0.0474	2.580	0.053	0.0460	1.783	0.145	0.0043	1.590	0.000	2.5750	2.279	0.086
Session × Information Reliability	0.0003	0.018	0.968	0.0001	0.003	0.995	0.0078	2.901	0.030	0.4340	0.384	0.620
Session × Feedback Type × Information Reliability	0.0452	2.460	0.062	0.0716	2.778	0.036	0.0076	2.817	0.034	3.3530	2.968	0.037