Earnings Management: Is it necessarily harmful to the market?

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This paper analyzes how earnings management reflects the manager's private information and how investors respond to the reported(managed) earnings. We analyze two situations: one is that earning management is unrestricted and the other is that isn't. In the first situation, the agent tends to report extreme earnings regardless of his private information where his utility is maximized. In the second situation, i.e., where the earnings management is strictly tied to(a linear combination of) the manager's two private signals which they are unmanaged earnings and additional private information about the firm's future prospects, the reported earnings is related to private information. Risk-averse shareholders collectively design a compensation contract and individually trade in the stock market. In equilibrium the reported earnings fully convey the manager's private information and an imperfect, separate observation of earnings management is not used in the optimal linear contract. When the unconditional expectation of earnings management is constrained to be zero, rational investors behave as if they were functionally fixated to the earnings number.

Key words: Earnings Management, Income Smoothing, Market Efficiency, Compensation Contract

Ⅰ. Introduction

Since Ball and Brown(1968) empirical studies in the financial accounting literature have firmly established that accounting earnings is informative about firms' future prospects and affects stock prices. These findings have also been substantiated by analytical research on the relation between earnings and price based on investors' rational economic behavior(e.g., Kim and Verrecchia[1991]). One important issue that is closely related to the informational role of accounting is discretionary earnings management by managers. This issue arises from the fact that the generally accepted accounting principles(GAAP) are sufficiently flexible to give considerable discretion to managers in reporting earnings. For example, managers

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estimate the useful lives of operational assets and choose the methods of depreciation, and select a valuation method for inventory(e.g., LIFO or FIFO). The existence of such discretion leaves room for managers to manipulate earnings to their own advantages if their compensation is a function of earnings.[1] Therefore, it is essential for capital market researchers to have a firm idea of how rational investors would react to the announcement of potentially managed earnings in order to draw educated conclusions from their observations. For example, suppose after an accounting change the market price at the time of an earnings announcement reacts to the reported earnings number rather than "as-if" earnings calculated using the pre-change accounting methods. This could be interpreted either as the method change itself being indicative of some hidden information, or investors being irrationally fixated to the reported earnings number, which can be viewed as a form of inefficient capital market.

The purpose of this paper is to formalize theoretically a long-held intuition that earnings management has a role of conveying to the market the manager's private information, and thus improving investors' informedness.[2] We do this by borrowing intuition from the principal-agent literature and by incorporating financial markets in our model. In a stylized model we show explicitly how earnings management reflects the manager's private information and affects the informativeness of earnings for contracting(compensating managers) and investment decisions. Our results on how earnings are used in compensation contracts and by investors are linked to some empirical observations.

Our economic setting is one in which the principals are risk-averse shareholders and the agent is the top manager of a firm. A moral hazard problem exists in that shareholders do not observe the manager's productive action choice. Shareholders individually trade in the stock market based on their available information, and share price is endogenously determined. Shareholders also collectively design a compensation contract. We take as given that the manager is allowed to manage earnings.[3] And the con-

1) See Healy(1985) among others for an evidence of income management.
2) See, for example, Schipper(1989). Sankar and Subramanyam(2001)claim that the quality of the investor's information is improved when manager has private information about the firm's future performance. Tuker and Zarowin(2005) provide evidence that income smoothing improves the informativeness of past and current earnings about future earnings and cash flow See, for example, Schipper (1989). Sankar and Subramanyam(2001)claim that the quality of the investor's information is improved when manager has private information about the firm's future performance. Tuker and Zarowin(2005) provide evidence that income smoothing improves the informativeness of past and current earnings about future earnings and cash flow
3) Several studies examine the value of allowing accounting discretion. Demski, Patell and Wolfson(1984) show that

tract is assumed to be a linear function of three publicly available signals.[4] It is based on two measures of outcome, namely, (managed) accounting earnings and the shard price.[5] The contract is also based on an imperfect(public) observation of the earnings management. For example, when an accounting method is changed, the effect of the change on the earnings number can be calculated.

The manager has two sources of private information. He privately observes unmanaged earnings, and possesses additional private information about the firm's future prospects. Equipped with his private information, the manager reports an earnings number that is used for both shareholders' investment and contracting purposes. In order to examine the informational effect of earnings management on the share price as well as on the optimal contract, we adopt a noisy rational expectations model of financial markets in the fashion of Diamond and Verrecchia(1981). In this model the manager's earnings management decision is closely related to both shareholders' investment decision and their design of contract. An equilibrium here is a rational expectations equilibrium in the sense that all decisions are made taking into account these interrelationships. The focus of this paper is on how the manager's private information is reflected in earnings management and how investors respond to the reported earnings.

We analyze two situations. The first situation arises in our model when the manager can freely report any earnings number. In this case the manager always chooses an extreme earnings as long as his compensation depends(either positively or negatively) on earnings management. The only way for shareholders to avoid paying an exorbitant sum to the manager is to make the manager's compensation(a priori) independent of earnings management. This can be done by subtracting an(unbiased) estimate of earnings management(which is separately available) from the reported earnings. In the picture of earnings manipulation, the reported earnings number does not convey the

delegating the choice of accounting system to the informed manager yields a weak Pareto improvement. Verrecchia (1986) and Dye(1988) show that allowing discretionary reporting to managers can result in a Pareto improvement. Natarajan(1991) analyzes a situation in which a discretionary report (interpreted as accruals) issued by the manager is valuable in addition to earnings. Stocken and Verrecchia(2004) find that allowing the manager reporting discretion enhances efficiency when the firm's financial information is useful for investment decision, allowing the manager reporting discretion enhances efficiency.

4) The linearity assumption is mainly made for tractability, and some theoretical justification can be found in Holmstrom and Milgrom (1987). They show that the optimal incentive scheme in their continuous time model is linear in output. Furthermore, their solution corresponds to a static one with a restriction that the contract be linear. The assumptions of our model are consistent with theirs.

5) Outcome itself is assumed unobservable because a firm's true performance is not observed until it is liquidated.

manager's private information. This case mainly captures the behavior and its consequences of short-sighted managers.

We then consider a second situation in which earnings management is strictly tied to(a linear combination of) the manager's two private signals. In this case earnings management has a potential role of conveying information. We believe this case is more interesting and perhaps more realistic under many circumstances because the short-sighted behavior of the manager in the first case may not be self-sustaining in a realistic world. For example, the manager (or the firm) may value a reputation that he uses accounting discretion only prudently following a fixed(implicit) rule and not in an arbitrary fashion. We obtain a number of interesting results in this case. We find that in equilibrium the manager manages earnings in such a way that the reported earnings becomes a sufficient statistic for the manager's private information, namely, the unmanaged earnings and an additional private information, both of which are informative about the firm's future prospects. This is because for any given linear contract the risk-averse manager wants to minimize the error in the reported earnings in order to reduce the risk in his compensation.[6] As a consequence, the informativeness of the reported earnings is maximized.

Since the manager always wants a full communication of his private information, the contract is designed in such a way that the imperfect(costless) observation of earnings management is not used in the contract. This is because a use of such an observation subjects shareholders' wealth to error in the observation, which in turn precludes full communication. This result is consistent with some empirical observations. Healy, Kang and Palepu(1987) and Defeo, Lambert and Larcker(1989) report that, subsequent to accounting changes, managers' salary and bonus are based on reported earnings rather than "as-if" earnings calculated using the pre-change accounting methods.

We later impose a condition that the unconditional expectation of earnings management is zero. This reflects the fact that the effect of earnings management balances out over the lives of assets and liabilities(e.g., a big write-off in this fiscal period tends to increase earnings in succeeding years). Under this condition we show that earnings is managed in such a way that the reported accounting earnings is simply an average of the manager's two private information weighted by their respective precisions. This has a implications that reported earnings becomes, in addition to being a sufficient statistic, a

6) The manner in which the two signals are aggregated here is similar to the results of Banker and Datar(1989).

number that best represents the manager's private information and does not require any adjustments. In other words, investors can simply use the reported earnings as if it is an earnings number appropriately scaled and adjusted for the manager's additional private information. This implies that in this case investors would appear, to the eyes of the researcher, as if they were functionally fixated to accounting earnings.

The plan of the paper is the following. The model is explained in section 2 and the market equilibrium for a given contract is derived in section 3. The expected utility of shareholders and the manager are derived in section 4. The case in which free manipulation of earnings is allowed is examined in section 5. The case in which free manipulation is ruled out is analyzed and our main results are derived in section 6. The effect of imposing the condition of zero expected earnings management is analyzed in section 7 in relation to functional fixation. A brief conclusion is drawn in section 8.

II. The Model

We consider a firm with N identical shareholders.[7] There are three time periods, referred to as periods 0, 1 and 2. There is one risky asset, the firm's shares, and riskless bonds. One riskless bond pays off one unit of consumption good in period 2. The final payoff of one share of the firm before compensation is assumed to be the sum of the level of effort exerted by the manager, denoted by e and a random environmental factor, denoted by $\tilde{u}$. It is assumed that $\tilde{u}$ is normally distributed with mean $\bar{u}$ and precision(inverse of variance) h. Each shareholder is endowed with zero riskless bonds and $\bar{x}>0$ shares. Shareholders have a negative exponential utility function with risk tolerance $r>0$, i.e, $G(W)=-\exp(-W/r)$, where W is the wealth in period 2.

In period 0 the manager and shareholders enter a compensation contract. Given the contract the manager decides how much effort to provide. The manager's utility function is also a negative exponential with risk tolerance $r_a>0$, i.e., $H(W_a)=-\exp(\frac{W_a-C(e)}{r_a})$, where W_a is the manager's compensation. $C(e)$ measures the disutility of providing efforts e in units of wealth. It is assumed that $C(e)=\frac{c}{2}e^2$.

Seven events occur in period 1. First, the manager privately observes unmanaged earnings before compensation represented by a signal $\tilde{y} = e + \tilde{u} + \tilde{\eta}$, where $\tilde{\eta}$ is nor-

7) In order to have a clean analysis, formally there are an infinite number of replicas of one manager and N shareholders. See Kim and Suh (1993) for a similar model without accounting discretion.

mally distributed with mean 0 and precision m . Therefore, unmanaged earnings, $\tilde{y}$, is an unbiased signal about the final payoff $e + \tilde{u}$. Second, the manager privately observes an additional signal about the final payoff of the firm's share, $\tilde{I} = e + \tilde{u} + \tilde{v}$, where $\tilde{v}$ is normally distributed with mean zero and precision n . It is assumed that the manager cannot directly and credibly communicate either $\tilde{I}$ or $\tilde{y}$ to shareholders. Third, the manager reports to shareholders an (accounting) earning number, $\hat{y} \equiv \tilde{y} + \tilde{\theta}$, with an adjustment, $\tilde{\theta}$, to $\tilde{y}$. This reported earning $\hat{y}$ is used by shareholders as a source of information for their portfolio decision in the market, and as a basis of compensation to the manager.

Fourth, shareholders observes an imperfect public signal, $\tilde{O} = \tilde{\theta} + \tilde{r}$, about the magnitude of earnings management, where $\tilde{r}$ is normally distributed with mean zero and precision g>0. Only when g approaches infinity, shareholders perfectly observe $\tilde{\theta}$ and deduce economic earning $\tilde{y}$ by subtracting $\tilde{\theta}$ from $\hat{y}$. Fifth, shareholder i observes a private signal, $\tilde{z}_i = e + \tilde{u} + \tilde{\varepsilon}_i$, about the final payoff, where the error, $\tilde{\varepsilon}_i$, is independently and normally distributed with mean 0 and precision s. In other words, investors have diverse private information of the same quality. Sixth, shareholders trade in a competitive market based on available information, $\hat{y}$, $\tilde{O}$ and $\tilde{z}_i$'s . There is also a separate group of liquidity traders whose aggregate demand(per share) for the risky asset is a random variable, denoted by $\tilde{d}$, which is normally distributed with mean 0 and precision t. Last, the manager is compensated according to the contract. In period 2 the firm liquidates and shareholders consume their final wealth from their portfolios.

Period 1 can be thought of as the end of a fiscal period when financial statements are prepared and made public. By that time corporate managers have pretty good ideas about the performance of the firm during that fiscal period. Under the existing GAAP they also possess a wide range of accounting choices that affect reported accounting earnings. Many accounting choices (e.g., changes in accounting methods) are publicly announced, but many others (e.g., changes in estimates) are not, and in general investors cannot detect the existence and the magnitudes of all discretionary accounting maneuvers by managers. This is reflected by the assumption of an imperfect signal $\tilde{O}$, Managers also have superior knowledge about their firms other than the performance in the current fiscal period. This private knowledge is modeled here as the additional private information $\tilde{I}$.

We assume that the manager's compensation takes a linear form:

$$W_a = N\bar{x}(\alpha * + \beta * \hat{y} + \gamma * \tilde{P} + \delta * \tilde{O})$$

where the(reported) earnings(before compensation), $\hat{y}$, the share price, denoted by $\widetilde{P}$, and the information about earnings management, $\widetilde{O}$, are the three available public information. Shareholders in this model make two types of decisions. They collectively decide what contract to give to the manager, and individually select the number of shares to buy or sell. The manager decides how much effort (e) to exert and also makes an earnings management decision($\widetilde{\theta}$). In a rational expectations equilibrium each choice is made correctly taking into account all other decisions made in the economy. Therefore, shareholders must make conjectures about how the manager's earnings management decision ($\widetilde{\theta}$) is made and how the market price reflects traders' information. In particular, we consider situations in which earnings management potentially conveys the manager's private information $\widetilde{y}$ and $\widetilde{I}$ i.e.,

$$\widetilde{\theta} = \pi_0 + \pi_1 \widetilde{y} + \pi_2 \widetilde{I} \tag{1}$$

That is $\widetilde{\theta}$ is a linear function of the manager's two private signals, unmanaged earnings $\widetilde{y}$ and the additional private information $\widetilde{I}$

Note that assumption (1) does not necessarily imply that the reported earnings will convey the manager's private information in equilibrium. The π-variables are chosen by the manager, and the issue here is whether communication occurs through earnings management and, if so, why. Two cases are separately analyzed in this paper regarding (1). In Case 1 π_0 is not restricted. This means that the manager can report any earnings number regardless of their private signals. This case is analyzed here as a reflection of a situation in which the manager is short-term oriented. In Case 2 π_0 is restricted to be zero. There are several reasons why Case 2 is more interesting. First, note the one-period nature of the present model: both consumption and reporting decisions are made only once. Therefore, the present model can be understood as a stationary state in a multi-period model. In that sense the zero-π_0 assumption is consistent with the fact that the effect of any accrual choice balances out in the long-run. Second, to the extent that managers care about their reputation, consistently biased accounting manipulations may be avoided.

For convenience, the strategy of paper is to analyze shareholders' investment decisions and the determination of market equilibrium, the manager's effort and accounting decisions, and the shareholders' contracting decision, one at a time for fixed parameters representing other decisions. In the next section we analyze investment decisions and derive market equilibrium given a fixed compensation contract.

III. Market Equilibrium

Under the assumptions of the model, the final payoff per share, denoted by $\tilde{v}$, is

$$\tilde{v} = e + \tilde{u} - (\alpha * + \beta * \hat{y} + \gamma * \tilde{P} + \delta * \tilde{O})$$

In a rational expectations equilibrium traders make conjectures as to how the market price of a share reflects the information held by market participants, and the conjectures are self-fulfilling. Let such a conjecture be expressed as

$$\begin{aligned}\tilde{P} &= b_0 + b_1\hat{y} + b_2\tilde{O} + b_3 Avr(\tilde{z}_i) + b_4\tilde{d} - b_5\bar{x} \\ &= b_0 + b_1\hat{y} + b_2\tilde{O} + b_3(e+\tilde{u}) + b_4\tilde{d} - b_5\bar{x}, \qquad (2)\end{aligned}$$

where the averaging operator $Avr(\cdot)$ is defined as $Avr(f_i) \equiv \lim_{I\to\infty}\frac{1}{I}\sum_{i=1}^{I}(f_i)$ for any function f_i of i. The second equation follows from the law of large numbers. We now define normalized price signal $\tilde{q}$ as.

$$\begin{aligned}\tilde{q} &\equiv \frac{1}{b_3}(\tilde{P} - b_0 - b_1\hat{y} - b_2\tilde{O} + b_5\bar{x}) \\ &= e + \tilde{u} + B\tilde{d} \qquad (3)\end{aligned}$$

where $B \equiv b_4/b_3$ and $b_3 \neq 0$.[8] The normalized price signal $\tilde{q}$ represents the information each shareholder can extract from the market price $\tilde{P}$ in addition to other available information $\hat{y}, \tilde{O}, \tilde{z}_i$ and conjectures (1) and (2). Given (1) and (2) the information set $\{\hat{y}, \tilde{O}, \tilde{z}_i, \tilde{P}\}$ is equivalent to $\{\hat{y}, \tilde{O}, \tilde{z}_i, \tilde{q}\}$ because one can be generated from the other. Using (3) we can rewrite the manager's compensation per share as $\alpha + \beta\hat{y} + \gamma\tilde{q} + \delta\tilde{O}$.

It is straightforward to calculate the mean and the precision of the final payoff conditional on shareholder i's available information:

$$\begin{aligned}\tilde{\mu}_i &\equiv E[\tilde{v} \mid \hat{y}, \tilde{O}, \tilde{z}_i, \tilde{q}] \\ &= \frac{1}{K}[h(e+\bar{u}) + \frac{(1+\pi_1+\pi_2)mn + \pi_2 g(\pi_2 m - \pi_1 n)}{(1+\pi_1)n + \pi_2^2(g+m)}\hat{y} \\ &\quad + \frac{\pi_2 g\{(1+\pi_1)n - \pi_2 m\}}{(1+\pi_1)^2 n + \pi_2{}^2(g+m)}\tilde{O} + s\tilde{z}_i + \frac{t}{B^2}\tilde{q}] \\ &\quad - (\alpha + \beta\hat{y} + \gamma\tilde{q} + \delta\tilde{O}), \qquad (4)\end{aligned}$$

Where

$$\begin{aligned}K &\equiv Var^{-1}[\tilde{v} \mid \hat{y}, \tilde{O}, \tilde{z}_i, \tilde{q}] \\ &= h + \frac{(1+\pi_1+\pi_2)^2 mn + \pi_2^2 g(m+n)}{(1+\pi_1)^2 n + \pi_2^2(g+m)} \\ &\quad + s + \frac{t}{B^2} \qquad (5)\end{aligned}$$

K is the precision of each shareholder's overall information consisting of the prior (with precision h), two correlated signals $\hat{y}$ and $\tilde{O}$ (with precision being the fraction), the independent private signal $\tilde{z}_i$ (with pre-

8) It can be shown that there is no equilibrium if $b_3 = 0$

cision s), and the normalizes price signal $\widetilde{q}$ (with precision $\frac{t}{B^2}$) that represents the incremental information conveyed by the price. The conditional expectation of the final payoff is simply a weighted average of these five sources of information.

The shareholder's expected utility conditional on signal $\hat{y}, \widetilde{O}, \widetilde{z}_i$ and $\widetilde{P}$ is

$$
\begin{aligned}
&E[G \mid \hat{y}, \widetilde{O}, \widetilde{z}_i, \widetilde{P}] \\
&\quad = E[-\exp\{-\widetilde{P}\frac{\overline{x}}{r} - (\widetilde{v} - \widetilde{P})\frac{D_i}{r}\} \mid \hat{y}, \widetilde{O}, \widetilde{z}_i, \widetilde{P}] \\
&\quad = -\exp\{-\widetilde{P}\frac{\overline{x}}{r} - (\widetilde{\mu}_i - \widetilde{P})\frac{D_i}{r} + \frac{1}{2K}(\frac{\widetilde{D}_i}{r})^2\}
\end{aligned}
$$

by using the moment generating function of a normal random variable. The utility maximizing individual(gross) demand for shares, denoted by $\widetilde{D}_i$, can be found as

$$\widetilde{D}_i = rK(\widetilde{\mu}_i - \widetilde{P}). \tag{6}$$

Aggregating over i and applying the zero excess demand condition(in per capita terms) we get

$$
\begin{aligned}
\overline{X} &= Avr(\widetilde{D}_i) + \widetilde{d} \\
&= rK[Avr(\widetilde{\mu}_i) - \widetilde{P}] + \widetilde{d},
\end{aligned}
$$

which can be rewritten as

$$
\begin{aligned}
\widetilde{P} &= Avr(\widetilde{\mu}_i) + \frac{\widetilde{d}}{rK} - \frac{\overline{x}}{rK} \\
&= \frac{1}{K}[h(e+\overline{u}) + \frac{(1+\pi_1+\pi_2)mn + \pi_2 g(\pi_2 m - \pi_1 n)}{(1+\pi_1)^2 n + \pi_2^2(g+m)}\hat{y} \\
&\quad + \frac{\pi_2 g\{(1+\pi_1)n - \pi_2 m\}}{(1+\pi_1)^2 n + \pi_2^2(g+m)}\widetilde{O} + s(e+\widetilde{u}) + \frac{t}{B^2}\widetilde{q}] \\
&\quad - (\alpha + \beta\hat{y} + \gamma\widetilde{q} + \delta\widetilde{O}) + \frac{\widetilde{d}}{rK} - \frac{\overline{x}}{rK.}
\end{aligned} \tag{7}
$$

Since the conjecture (2) must be self-fulfilling in equilibrium, (2) and (7) are equivalent. Therefore,

$$
\begin{aligned}
B &= \frac{b_4}{b_3} \\
&= \frac{\frac{1}{K}(\frac{t}{B} + \frac{1}{r}) - \gamma B}{\frac{1}{K}(s + \frac{t}{B^2}) - \gamma},
\end{aligned}
$$

and B is calculated as

$$B = 1/_{rs} \tag{8}$$

Equation (4)-(8) give a complete characterization of the unique market equilibrium given any $\alpha, \beta, \gamma, \delta, \pi_1$ and π_2 such that $(s + r^2 s^2 t)/_K \neq \gamma$.

Ⅳ. Principal-Agent Problem

In this section we describe the agent's (the manager) and the principal's (the shareholder) problem. The expected utility of the manager, denoted by EH, given a fixed contract, $\alpha + \beta\,\hat{y} + \gamma\,\widetilde{q} + \delta\,\widetilde{O}$, is

$$EH = -\exp[-\frac{N\bar{x}}{r_a}[\alpha + (\beta + \delta)\pi_0 + \{\beta(1 + \pi_1 + \pi_2) + \gamma + \delta(\pi_1 + \pi_2)\}(e + \bar{u})] + \frac{N^2\bar{x}^2}{2r_a^2}\{\{\beta(1 + \pi_1 + \pi_2) + \gamma + \delta(\pi_1 + \pi_2)\}^2 h^{-1} + \{\beta(1 + \pi_1) + \delta\pi_1\}^2 m^{-1} + (\beta + \delta)^2 \pi_2^2 n^{-1} + \delta^2 g^{-1} + \frac{\gamma^2}{r^2 s^2 t}\} + \frac{ce^2}{2r_a}] \quad (9)$$

by using the moment generating function of a normal random variable. The exponent in the manager's expected utility in (9) is simply a combination of the mean and the variance of the uncertain compensation and the private cost (disutility) of exerting effort.

Talking a monotonic transformation of (9) we get

$$H = -r_a \ln(-EH) = N\bar{x}[\alpha + (\beta + \delta)\pi_0 + \{\beta(1 + \pi_1 + \pi_2) + \gamma + \delta(\pi_1 + \pi_2)\}(e + \bar{u})] - \frac{ce^2}{2} - \frac{N^2\bar{x}^2}{2r_a}[\{\beta(1 + \pi_1 + \pi_2) + \gamma(\pi_1 + \pi_2)\}^2 h^{-1} + \{\beta(1 + \pi_1) + \delta\pi_1\}^2 m^{-1} + (\beta + \delta)^2 \pi_2^2 n^{-1} + \delta^2 g^{-1} + \frac{\gamma^2}{r^2 s^2 t}]. \quad (10)$$

By (10) we represent the expected utility of the manager in terms of certainty equivalents. Given a contract characterized by α, β, γ and δ the manager's problem is to choose the effort level e and the earnings management variables π_0, π_1 and π_2.

In order to describe shareholders' problem of designing a contract, we first calculate the expected utility of a shareholder.

Lemma 1: For any given $\alpha, \beta, \gamma, \delta, \pi_0, \pi_1$ and π_2, *the ex ante utility of a shareholder, denoted by EG,* is

$$EG = -(1 + \frac{s + r^{-2}t^{-1}}{K})^{-\frac{1}{2}} \exp[-\frac{\bar{x}}{r}[-\alpha - (\beta + \delta)\pi_0 + \{1 - \beta(1 + \pi_1 + \pi_2) - \gamma - \delta(\pi_1 + \pi_2)\}(e + \bar{u})] + \frac{\bar{x}^2}{2r^2}\{\{1 - \beta(1 + \pi_1 + \pi_2) - \gamma - \delta(\pi_1 + \pi_2)^2\}h^{-1} + \{\beta(1 + \pi_1) + \delta\pi_1\}^2 m^{-1} + (\beta + \delta)^2 \pi_2^2 n^{-1} + \delta^2 g^{-1} + \frac{\gamma^2 (K + s)}{r^2 s^2 t(K + s + r^{-2}t^{-1})}\}]$$

The exponent in the expected utility in Lemma 1 is a combination of mean and the variance of the final payoff plus some additional terms that represent gains from trades.[9] Talking a monotonic transformation of the shareholder's utility we get

$$G \equiv r\ln(-EG) = \frac{r}{2}\ln(1 + \frac{s + r^{-2}t^{-1}}{K}) + \bar{x}[-\alpha - (\beta + \delta)\pi_0 + \{1 - \beta(1 + \pi_1 + \pi_2) - \gamma - \delta(\pi_1 + \pi_2)\}(e + \bar{u})]$$

9) See Kim and Suh (1993) for an interpretation of the expected utility in a similar situation but without earnings management.

$$-\frac{\bar{x}^2}{2r}[\{1-\beta(1+\pi_1+\pi_2)-\gamma-\delta(\pi_1+\pi_2)\}^2 h^{-1} + \frac{\gamma^2(K+s)}{r^2 s^2 t(K+s+r^{-2}t^{-1})}] \qquad (11)$$

Similarly to (10), equation (11) is a representation of a shareholder's expected utility in terms of certainty equivalents.

The principals' problem is to maximize (11) with respect to choice variables $\alpha, \beta, \gamma, \delta, \pi_0, \pi_1$ π_2 and e subject to the following three constraints:

$$H \geq \overline{H} \qquad (12)$$

$$e \in \arg\max(H) \qquad (13)$$

$$(\pi_0, \pi_1, \pi_2) \in \arg\max(H). \qquad (14)$$

Among the three constraints, the first one is the minimum utility condition in which $\overline{H}$ is the manager's opportunity wage. The second constraint gives the manager's utility-maximizing choice of his effort level for any given contract. The third constraint comes from the manager's reporting decision.

In the next section we first analyze Case 1 in which the manager can report any earning number independently of his private information.

Ⅴ. The Case of Unrestricted Earnings Management

This case is one in which the manager chooses the constant term, π_0, as well as the coefficients, π_1 and π_2 of his two private information signals. Therefore, the manager can arbitrarily choose an earnings number independently of his private information. In this case the manager always chooses to report an extreme earnings number for any contract with a non-zero weight on θ. In order to prevent this, the principal's choice $\beta+\delta$ must be zero. This is because for $\delta=-\beta$ the contract is in the term of

$$\alpha+\beta\hat{y}+\gamma\tilde{q}+\delta\tilde{O}=\alpha+\beta(\hat{y}-\tilde{O})+\gamma\tilde{q},$$

which is independent of θ. Therefore, the earnings management decision does not affect the manager's wealth. The principal always uses the imperfect signal $\tilde{O}$ about the magnitude of earnings management to offset (on average) its effect on the manager's wealth. The precision of(the error of) $\hat{y}-\tilde{O}=\tilde{y}-\tilde{r}$ is $1/(m^{-1}+g^{-1})$ which in less than m, because $\tilde{O}$ is an imperfect signal. This case is equivalent to one in which earnings is not managed (as in Kim and Suh[1993]) and has the precision $1/(m^{-1}+g^{-1})$

In this picture of earnings manipulation, earnings management has no beneficial roles, and its value is negative. In other words, the agency is worse off by allowing the discretion to manage earnings to the manager. This arises because the use of an imperfect observation of the magnitude of earnings management in the contract subjects the wealth of the contracting parties to risks due to the error in the observation. Although this picture may capture some interesting aspects of earnings management, our main focus is on a much brighter picture(Case 2) for the following reasons. First, the short-sighted nature of the manager's behavior may not be sustainable in a more realistic world. For example, managers' reputation can affect their compensation in the long-run, and may prevent such behavior. More importantly, to the extent that free earnings manipulation is discouraged, an analysis of the other extreme is useful. By considering a case in which free manipulation is ruled out, other interesting roles of earnings management can be identified, and a balanced intuition can be obtained.

Ⅵ. Earnings Management

In the rest of this paper we assume that $\pi_0 = 0$, i.e., that earnings management is strictly tied to the manager's private information. Given a contract $\alpha + \beta\hat{y} + \gamma\tilde{q} + \delta\tilde{O}$, the expected utility of the manager, denoted by H, at the time of the contract is

$$\begin{aligned} H = N\bar{x}[\alpha + \{\beta(1+\pi_1+\pi_2) + \gamma \\ + \delta(\pi_1+\pi_2)\}(e+\bar{u})] - \frac{ce^2}{2} \\ - \frac{N^2\bar{x}^2}{2r_a}[\{\beta(1+\pi_1+\pi_2) + \gamma + \delta(\pi_1+\pi_2)\}^2 h^{-1} \\ + \{\beta(1+\pi_1) + \delta\pi_1\}^2 m^{-1} \\ + (\beta+\delta)^2\pi_2^2 n^{-1} + \delta^2 g^{-1} + \frac{\gamma^2}{r^2 s^2 t}] \end{aligned} \tag{15}$$

Similarly, the principal's expected utility, G, is given by

$$\begin{aligned} G = \frac{r}{2}\ln(1 + \frac{s + r^{-2}t^{-1}}{K}) \\ + \bar{x}[-\alpha + \{1 - \beta(1+\pi_1+\pi_2) - \gamma \\ - \delta(\pi_1+\pi_2)\}(e+\bar{u})] \\ - \frac{\bar{x}^2}{2r}[\{1 - \beta(1+\pi_1+\pi_2) - \gamma - \delta(\pi_1+\pi_2)\}^2 h^{-1} \\ + \{\beta(1+\pi_1) + \delta\pi_1)\}^2 m^{-1} + (\beta+\delta)^2\pi_2^2 n^{-1} + \delta^2 g^{-1} \\ + \frac{\gamma^2(K+s)}{r^2 s^2 t(K+s+r^{-2}t^{-1})}] \end{aligned} \tag{16}$$

Note that both (15) and (16) represent the manager and shareholder's expected utility in terms of certainty equivalents.

Given a contract $\alpha + \beta\hat{y} + \gamma\tilde{q} + \delta\tilde{O}$, the manager's problem is to choose not only the effect level e but also the earnings management variables π_1 and π_2. The effort selection constraint (13) is represented by the first-order condition given by

$$N\bar{x}\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}-ce=0 \quad (17)$$

The first-order conditions with respect π_1 and π_2 are, respectively,

$$\begin{aligned}(\beta+\delta)(e+\bar{u}-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma \\ +\delta(\pi_1+\pi_2)\}h^{-1} \\ +\{\beta(1+\pi_1)+\delta\pi_1\}m^{-1}])=0\end{aligned} \quad (18)$$

and

$$\begin{aligned}(\beta+\delta)(e+\bar{u}-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma \\ +\delta(\pi_1+\pi_2)\}h^{-1} \\ +(\beta+\delta)\pi_2 n^{-1}])=0\end{aligned} \quad (19)$$

The principal's problem is to maximize (16) with respect to choice variables, $\alpha,\beta,\gamma,\delta,\pi_1,\pi_2$ and e, subject to (12), (17), (18), and (19). It is easy to check that (17), (18), and (19) describe a unique optimal e, π_1 and π_2 given the contract.

The following proposition is now obtained by solving the above problem. All the proofs not shown in the text are provided in the appendix.

Proposition 1

1. $\delta=0$
2. $\pi_2 n^{-1}=(1+\pi_1)m^{-1}$.
3. $\hat{y}$ is a sufficient statistic for $(\tilde{y},\tilde{I})$.

Proposition 1 says that in equilibrium the manager will choose π_1 and π_2 in such a way that the reported earning $\hat{y}$ becomes a sufficient static for the agent's private information signal $\tilde{y}$ and $\tilde{I}$. That is, by the condition $\pi_2 n^{-1}=(1+\pi_1)m^{-1}$, the accounting earnings, $\hat{y}$, becomes

$$\begin{aligned}\hat{y}&=\tilde{y}+\tilde{\theta}\\ &=(1+\pi_1)\tilde{y}+\pi_2\tilde{I}\\ &=\frac{\pi_2}{n}(m\tilde{y}+n\tilde{I}),\end{aligned} \quad (20)$$

where m and n are the precisions of the independent error terms of $\tilde{y}$ and $\tilde{I}$, respectively. As a result, the reported earnings, $\hat{y}$, becomes a sufficient statistic for $\tilde{y}$ and $\tilde{I}$. Therefore, a separate observation of earnings management, $\tilde{O}$, will not be used in a contract since it becomes a pure noise given $\hat{y}$.

The first part of Proposition 1 obtained despite the assumption that the observation, $\tilde{O}$, about earnings management is costless and is informative about the manager's discretion. This is because it is in the best interest of the manager to maintain the income management ratio at $(1+\pi_1)/\pi_2=m/n$ in order to minimize noise in the contract. In other words, the manager has an incentive to have $\hat{y}$ to be a sufficient statistic, which makes $\tilde{O}$ a pure noise. As a consequence, a separate observation of earnings management is not used in the contract because its use only increases the variance of both shareholders' and the managers' wealth. Related to this result, Kim and Suh(1991) show that the value of information systems for incentive purposes is increasing in the variance of its likelihood ratio when distributions belong to normal family. When the distribution is normal, the variance of its likelihood ratio, denoted by $\frac{f_e}{f}(\hat{y}|e)$, can be expressed as

$$Var[\frac{f_e}{f}(\hat{y}\,|\,e)] = \frac{[E_e(\hat{y}\,|\,e)]^2}{\sigma_f^{\ 2}}$$
$$= \frac{(1+\pi_1+\pi_2)^2}{(1+\pi_1)^2 m^{-1} + \pi_2^2 n^{-1}}\ .$$

It is easy to show that the optimal choice of π_1 and π_2 as described in Proposition 1 also maximizes the variance of the likelihood ratio. Thus, the manager's discretionary accounting choice maximizes the stewardship value of accounting reports.

In order to see the effect of the earnings management by the manager on the shareholders' investment decision, first note that, by using the condition $\pi_2 n^{-1} = (1+\pi_1)m^{-1}$, (4) can be rewritten as

$$\tilde{\mu}_i = \frac{1}{K}[h(e+\bar{u}) + \frac{n}{\pi_2}\hat{y} + s\tilde{z}_i + r^2 s^2 t\tilde{q}] - (\alpha + \beta\hat{y} + \gamma\tilde{q}), \qquad (21)$$

where the total precision, K, is

$$K = h + m + n + s + r^2 s^2 t \qquad (22)$$

By using (20) we can further rewrite (21) as

$$\tilde{\mu}_i = \frac{1}{K}[h(e+\bar{u}) + m\tilde{y} + n\tilde{I} + s\tilde{z}_i + r^2 s^2 t\tilde{q}] - (\alpha + \beta\hat{y} + r\tilde{q}) \qquad (23)$$

These results are summarized in the following proposition.

Proposition 2 *In equilibrium the precision of each shareholder's information, K, is maximized. This occurs as a consequence of the combination of the manager's earnings management and shareholder's decision of not using their imperfect observation of earnings management in the contract. Moreover, each shareholder becomes as informed as in the case where she could perfectly observe the manager's private information, the unmanaged earnings,* $\tilde{y}$*, plus the additional private information,* $\tilde{I}$

Proposition 2 says that in equilibrium the voluntary choice of earnings management by the manager in conjunction with shareholders' decision not to directly monitor the manager's earnings management (by having $\delta = 0$) results in the most informationally efficient market. Equations (21), (22), and (23) show that, by simply using the managed accounting earnings, $\hat{y}$, with appropriate scaling (by multiplying by n/π_2), shareholders can make as informed investment decisions as in the case where they each observe the manager's private information, $\tilde{y}$ and $\tilde{I}$.

Ⅶ. Functional Fixation

We have shown that, when free earnings manipulation is ruled out, the manager can successfully communicate his private information through earnings management. However, the exact pattern of earnings management is indeterminate. This is because for any given pattern of earnings management, i.e., π_1 and π_2 such that $(1+\pi_1)n=\pi_2 m$, there exists β that satisfies all the equilibrium conditions. In other words, while $\beta(1+\pi_1)$ and $\beta\pi_2$ are determined, π_1, π_2 and β are not separately determined. This is not satisfying because both earnings management and the use of accounting earnings in compensation contracts are separately important issues and to some extent separately observable. In this section, we derive equilibrium earnings management and the weight of managed accounting earnings in incentive contracts by imposing the condition of zero expected earnings management.

Since the effect of any earnings management reverses itself over the lives of the assets and liabilities involved, a fixed pattern of earnings management is sustainable only if the unconditional expectation of earnings management is zero. The following lemma shows the equilibrium pattern of earnings management under this condition.

Lemma 2 *The manager's choice of earnings management under the condition of zero unconditional expectation of earnings management is given by* $\pi_1 = -n/(m+n)$ *and* $\pi_2 = n/(m+n)$. *That is, the earnings management,* $\tilde{\theta}$, *in equilibrium becomes*

$$\tilde{\theta} = \frac{n}{m+n}(\tilde{I}-\tilde{y}).$$

Lemma 2 is now used in conjunction with (21) to generate the following proposition.

Proposition 3 *under the condition of zero unconditional expectation of earnings management, in equilibrium shareholders simply use the (managed) reported earnings without*

. Moreover, the reported accounting earnings is given the combined precision, m+n, of the manager's two private information, the unmanaged earnings $\tilde{y}$ *with precision m and the additional private information* $\tilde{I}$ *with precision n. That is,*

$$\tilde{\mu}_i = \frac{1}{K}[h(e+\bar{u})+(m+n)\hat{y}+s\tilde{z}_i+r^2s^2t\tilde{q}] \\ -(\alpha+\beta\hat{y}+\gamma\tilde{q})$$

where $K = h + m + n + s + r^2 s^2 t.$

Proposition 3 says that in equilibrium shareholders treat managed accounting earnings number as the best representation of the manager's private information that does not require any adjustments. This is because accounting earnings becomes in equilibrium

$$\begin{aligned}\hat{y} &= \tilde{y} + \tilde{\theta} \\ &= \tilde{y} + \pi_1 \tilde{y} + \pi_2 \tilde{I} \\ &= \frac{1}{m+n}(m\tilde{y} + n\tilde{I}),\end{aligned} \tag{24}$$

and its variance is

$$Var(\hat{y}) = h^{-1} + (m+n)^{-1}. \tag{25}$$

Equations (24) and (25) show that the reported accounting earning, $\hat{y}$, is the average of the two private signals of the managers, $\tilde{y}$ and $\tilde{I}$, weighted by their precisions. The precision (the inverse of the variance of the error term) of the created signal is indeed m+n, confirming the result of full communication.

In order to link Proposition 3 to the empirical capital market research, the following proposition is obtained.

Proposition 4 *Under the condition of zero unconditional expectation of earnings management, the equilibrium price when earnings is announced is*

$$\begin{aligned}\tilde{P} = \frac{1}{K}[h(e+\bar{u}) + (m+n)\hat{y} + s(e+\tilde{u}) + r^2 s^2 t\tilde{q}] \\ -(\alpha + \beta\hat{y} + \gamma\tilde{q}) + \frac{\bar{d}}{rK} - \frac{\bar{x}}{rK},\end{aligned}$$

where $K = h + m + n + s + r^2 s^2 t.$

Propositions 3 and 4 have an interesting implication to the research dealing with the market reaction to the announcement of accounting information. Note that, as shown in Proposition 3, investors simply use the reported earnings as an informative signal without any adjustments. Proposition 4 shows that the market price reflects these beliefs of investors(with market noise). Therefore, an empirical market researcher would find in this situation that the announcement of accounting earnings affected the share price as reported. This behavior may appear to a market researcher as an irrational behavior because the reported earnings have been managed by the manager.[10] However, our results show that it is indeed a rational behavior in equilibrium.

A few examples are now provided in which the reported earnings may reflect the manager's private information. One example is that $\tilde{I}$ is some information regarding the

10) See, for example, Hand(1990) for a discussion of so called functional fixation.

potential success of R&D efforts of a firm. Suppose the manager privately knows that the project is very likely to succeed. Since all R&D expenditures are written off as incurred under the GAAP, $\tilde{y}$ will then understate the firm value. In this case the manager may decide to increase the reported earnings $\hat{y}$ (by use of some accounting discretion) in order to make it a better estimation of the firm value. Another example is the case in which a firm's assets include large uncollectible accounts receivable, which, according to the manager's unfavorable private information $\tilde{I}$, should be written off. Since $\tilde{y}$ overstates the firm value in this case, the manager may reduce reported earnings by choosing a negative $\tilde{\theta}$. Discretionary changes in depreciation methods can be another example. Suppose, at the beginning of a period, a firm uses a straight-line depreciation method for its operational assets. During the period, however, the manager observes a heavy use of its factory machines in order to meet a sudden increase in customer demand which results in a substantial decline in productivity. In this case, since $\tilde{y}$ is likely to overstate the firm value, the manager may switch to a double-declining depreciation method.[11)]

Ⅷ. Conclusion

We have shown in this paper that under certain circumstances the managers of firms can successfully communicate their private information through discretionary earnings management. When the unconditional expectation of earnings management is constrained to be zero, rational investors behave in equilibrium as if they were functionally fixed to accounting earnings numbers.

By incorporating financial markets in our mode, we have been able to show explicitly the effect of earnings management on the informativeness of earnings and how earnings are used for contracting and investment decisions. In particular, we have demonstrated how investors attain maximum informedness (K) and appear to be functionally fixated to the earnings number. However, the use of rational expectations paradigm has naturally led us to adopt the linearity assumptions on contracts and income management. Also, our one-period model and the resulting static nature of the equilibrium have prevented us from analyzing the dynamics of earning management. Additional research on this important topic would be

11) This example is also consistent with Suh(1990), who shows that if the agent's compensation is increasing in accounting income, in equilibrium he will choose the accelerated depreciation method when he observes un favorable future productivity while choosing the straight-line depreciation method if he observes favorable future productivity. Thus, accounting income smoothing obtains through an accounting choice in his model.

valuable. Hopefully, the usefulness of the intuition gained from the results may weigh favorably against the limitations of the paper.

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〈Appendix〉

Proof of Lemma 1: The calculation of the expected utility of a shareholder is a long but straightforward integration. The calculation in a similar situation is provided in Kim and Suh (1993), and is not repeated here. The integrating process is exactly the same and the only differences in the result are in the mean and the variance of the compensation.

Proof of Proposition 1: We first established that $\beta+\delta\neq 0$. Assume the contrary, i.e., $\beta+\delta=0$. Then the agent has no incentive to manage earnings, i.e., $\pi_1=\pi_2=0$. In this case the principal's problem is to maximize (16) subject to (12) and (17) with $\pi_1=\pi_2=0$. Thus the question becomes whether $\beta+\delta=0$ is consistent with the interior optimal solution to the principal's problem.

First, $\lambda = 1/N$ from the first-order condition with respect to α is used in the first-order condition with, respect to β,γ,δ and e to generate, respectively,

$$\begin{aligned}&\frac{\bar{x}}{r}[\{1-\beta(1+\pi_1+\pi_2)-\gamma-\delta(\pi_1+\pi_2)\}(1+\pi_1+\pi_2)h^{-1}\\&-\{\beta(1+\pi_1)+\delta\pi_1\}(1+\pi_1)m^{-1}-(\beta+\delta)\pi_2^2n^{-1}]\\&-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}(1+\pi_1+\pi_2)h^{-1}\\&+\{\beta(1+\pi_1)+\delta\pi_1\}(1+\pi_1)m^{-1}-(\beta+\delta)\pi_2^2n^{-1}]\\&+N\mu(1+\pi_1+\pi_2)=0;\end{aligned} \tag{26}$$

$$\begin{aligned}&\frac{\bar{x}}{r}[\{1-\beta(1+\pi_1+\pi_2)-\gamma-\delta(\pi_1+\pi_2)\}h^{-1}-\frac{\gamma(K+s)}{r^2s^2t(K+s+r^{-2}t^{-1})}]\\&-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}h^{-1}+\frac{\gamma}{r^2s^2t}]+N\mu=0;\end{aligned} \tag{27}$$

$$\begin{aligned}&\frac{\bar{x}}{r}[\{1-\beta(1+\pi_1+\pi_2)-\gamma-\delta(\pi_1+\pi_2)\}(\pi_1+\pi_2)h^{-1}\\&-\{\beta(1+\pi_1)+\delta\pi_1\}\pi_1m^{-1}-(\beta+\delta)\pi_2^2n^{-1}+\delta g^{-1}]\\&-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}(\pi_1+\pi_2)h^{-1}\\&+\{\beta(1+\pi_1)+\delta\pi_1\}\pi_1m^{-1}+(\beta+\delta)\pi_2^2n^{-1}+\delta g^{-1}]\\&+N\mu(\pi_1+\pi_2)=0;\end{aligned} \tag{28}$$

$$\bar{x}-\frac{Ce}{N}-C\mu=0 \tag{29}$$

plus (12) and (17).
since $\beta+\delta=0$ and $\pi_1=\pi_2=0$, (28) becomes

$$-\frac{\bar{x}}{r}\delta g^{-1}-\frac{N\bar{x}}{r_a}\delta g^{-1}=0,$$

which implies that $\delta=0$ since $g^{-1}>0$. As a results, $\beta=0$. Then, (26) and (27) become

$$\frac{\bar{x}}{r}(1-\gamma)h^{-1}-\frac{N\bar{x}}{r_a}\gamma h^{-1}+N\mu=0, \tag{30}$$

$$\frac{\bar{x}}{r}[(1-\gamma)h^{-1}-\frac{\gamma(K+s)}{r^2s^2t(K+s+r^{-2}t^{-1})}]-\frac{N\bar{x}}{r_a}[\gamma h^{-1}+\frac{\gamma}{r^2s^2t}]+N\mu=0 \tag{31}$$

Subtracting (31) from (30) yeilds

$$\frac{\bar{x}\gamma(K+s)}{r^2s^2t(K+s+r^{-2}t^{-1})}+\frac{N\bar{x}\gamma}{r_ar^2s^2t}=0$$

which implies that $\gamma=0$. This is a desired contradiction since the agent's effort selection constraint (17) is violated.

(a) Since $\beta+\delta\neq 0$, (18) and (19) become

$$e+\bar{u}-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}h^{-1}+\{\beta(1+\pi_1)+\delta\pi_1\}m^{-1}]=0.$$

and

$$e+\bar{u}-\frac{N\bar{x}}{r_a}[\{\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)\}h^{-1}+(\beta+\delta)\pi_2n^{-1}]=0.$$

Solving for π_1 and π_2 we get

$$\pi_1=\frac{hm(e+\bar{u})-\frac{N\bar{x}}{r_a}\{\beta(h+m+n)+\gamma m\}}{\frac{N\bar{x}}{r_a}(\beta+\delta)(h+m+n)} \tag{32}$$

and

$$\pi_2=\frac{hm(e+\bar{u})-\frac{N\bar{x}}{r_a}\gamma m}{\frac{N\bar{x}}{r_a}(\beta+\delta)(h+m+n)} \tag{33}$$

Then

$$\beta(1+\pi_1+\pi_2)+\gamma+\delta(\pi_1+\pi_2)=\frac{h\{(m+n)(e+\overline{u})+\frac{N\overline{x}}{r_a}\gamma\}}{\frac{N\overline{x}}{r_a}(h+m+n)},$$

$$\beta(1+\pi_1)+\delta\pi_1=\frac{m\{h(e+\overline{u})-\frac{N\overline{x}}{r_a}\gamma\}}{\frac{N\overline{x}}{r_a}(h+m+n)},$$

and

$$(\beta+\delta)\pi_2=\frac{n\{h(e+\overline{u})-\frac{N\overline{x}}{r_a}\gamma\}}{\frac{N\overline{x}}{r_a}(h+m+n)}.$$

Substituting these expressions in to (15) and (16) shows that both H and G are decreasing in $\delta^2 g^{-1}$. Since $g^{-1}>0$, it follows that $\delta=0$

(b) Since $\delta = 0$,

$$\beta(1+\pi_1)=\frac{m\{r_a h(e+\overline{u})-N\overline{x}\gamma\}}{N\overline{x}(h+m+n)}, \tag{34}$$

and

$$\beta\pi_2=\frac{n\{r_a h(e+\overline{u})-N\overline{x}\gamma\}}{N\overline{x}(h+m+n)}, \tag{35}$$

Dividing (34) by (35) yields

$$\frac{1+\pi_1}{\pi_2}=\frac{m}{n}.$$

(c) Using $n^{-1}=(1+\pi_1)m^{-1}$, $\hat{y}$ can be written as

$$\begin{aligned}\hat{y} &= \tilde{y}+\tilde{\theta}\\ &=(1+\pi_1)\tilde{y}+\pi_2\tilde{I}\\ &=\frac{\pi_2}{n}(m\tilde{y}+n\tilde{I}),\end{aligned}$$

where m and n are the precisions of the independent error terms of $\tilde{y}$ and $\tilde{I}$, respectively. Since $\tilde{y}$ is a multiple of the average of $\tilde{y}$ and $\tilde{I}$ weighted by their precisions, $\hat{y}$ becomes a sufficient statistic for $\tilde{y}$ and $\tilde{I}$.

Proof of Proposition 2: What remains to be shown is that K is maximized as a consequence of the combination of the manager's choice of π_1 and π_2 and shareholders' decision on β and δ. K is first rewritten as

$$K = h + \frac{(1+\pi_1+\pi_2)^2 mn + \pi_2^2 g(m+n)}{(1+\pi_1)^2 n + \pi_2^2 (g+m)} + s + r^2 s^2 t$$

$$= h + m + n - \frac{\{(1+\pi_1)n - \pi_2 m\}^2}{(1+\pi_1)^2 n + \pi_2^2 (g+m)} + s + r^2 s^2 t$$

which is maximized only if $(1+\pi_1)n - \pi_2 m = 0$

Proof of Lemma 2: From the restriction

$$E[\tilde{\theta}] = (\pi_1 + \pi_2)(e + \bar{u}) = 0,$$

we have $\pi_1 + \pi_2 = 0$. This can be used in conjunction with condition $\pi_2 = (1+\pi_1) n/m$ to generate

$$\pi_1 = -\frac{n}{m+n}$$

and

$$\pi_2 = \frac{n}{m+n}$$

이익조정: 주식시장에 반드시 악영향만 있는 것일까?

Oliver Kim* · 서윤석**

요 약

본 논문은 noisy rational expectations 모형을 이용하여 회계이익과 주가와 연동된 경영자의 선형 보상계약을 도출하고 경영자의 사적정보로 인해 이익이 조정될 수 있는 가능성을 고려한다. 본 논문의 주요결과는 다음과 같다. 경영자와 주주가 각자의 이해를 극대화하고 주식시장에서 투자자들의 사전적 기대(conjectures)가 균형에서 현실화 (self-fulfilled)되는 가정 하에서 경영자는 자기의 모든 사적정보를 완전히 이익조정에 반영하게 된다. 뿐만 아니라 이렇게 조정된 회계이익의 정보력(informativeness)은 경영자의 사적정보와 모든 공적 정보를 완전히 반영하게 되어 주식시장을 더욱 효율적으로 만드는 효과가 있다. 주주들의 경영자의 이익조정에 대한 사전적 기대치가 zero인 경우 주가의 회계이익에 대한 반응은 마치 투자자들이 회계이익에 대해 functional fixation을 갖는 것처럼 보이게 된다.

주제어: 이익조정, 이익유연화, 시장효율성, 경영자 보상 계약

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