

Management Strategic Disclosure and Performance Measures under Fair Value Accounting *

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Abstract

This paper investigates managers' strategic disclosure behavior when they are compensated for providing signal regarding firm future value. The study is motivated by the ongoing debate over historical cost accounting and fair value accounting. Financial reporting has become more and more fair value based in recent years. A direct consequence of such transition is that performance measures based on disclosure are more subject to managers' discretion and measurement errors and become less verifiable. There are only few papers in the literature studying the disclosure of unverifiable information so far. In this paper, I present a model based on Holmstrom and Milgrom's principal-agent framework to investigate what an agent's optimal disclosure strategies are when (1) the principal is unaware of managerial disclosure bias, and (2) the principal is aware of such bias. In both cases, I find that the agent's optimal effort levels are independent of his disclosure bias. Moreover, in the first case, the agent's disclosure strategies are based on the parameters of compensation contracts. However, in the second case, the agent always discloses optimistically given that the principal will adjust his conditional expectation on future firm value based on the observed signal. These preliminary results suggest that managers tend to behave opportunistically when unverifiable information is incorporated in performance measures under fair value accounting.

Key Words: Unverifiable information, adaptive probability assessment, fair value accounting, conservatism, compensation

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1 Introduction

Managers' economic behavior has been closely related to how their performance is measured and compensated. Accounting based information is one of the most important measures that investors rely on to evaluate managers' ability and efforts and make investment decisions. However, managers are the provider of such critical information. Since their compensation is tied to these accounting measures, managers may have incentives to manipulate the information to maximize their own utility. Hence, there is a tradeoff between relevance and reliability in disclosure due to the double role of accounting information. The ongoing debate on whether firms' financial reporting should be fair value based or historical value based can also be viewed as the debate on whether managers' should be compensated for providing unreliable information regarding future firm value.

Until recent financial crisis, the role of accounting measures as information sources has dominated its role as contracting benchmark. Financial Accounting Standards Board (FASB), together with the International Accounting Standards Board (IASB), has been planning a deliberate movement away from historical cost based financial statements and toward fair market value based statements. FASB has released a series of statements to incorporate fair value measurements in financial reporting. For example, SFAS 107 requires disclosure of fair estimates of all recognized financial instruments. SFAS 141 and 142 require firms to measure goodwill at fair value and recognize gains or losses on goodwill in earnings. The recent SFAS 157 and 159 push the use of fair valuing accounting to even greater extent.

Changes in the reporting requirements reflect the changing attitude towards finan-

cial reporting. Many argue that financial reporting should be a faithful representation from management. Hence, some well-established accounting concepts, such as the going-concern principle, the substance-over-form doctrine, and conservatism are supposed to be eliminated.¹

However, the implementation of fair value accounting requires management to provide information on future performance. Managers therefore have great discretion in selecting and producing the information needed. The managerial bias and measurement errors associated with fair value accounting can create very serious problems. A notorious example is the case of Enron. Enron made extensive use of mark-to-market accounting and discounted to present value as much as 29 years of income from customer contracts, a fair value accounting treatment allowed it to record substantial unrealized profits². One might think that tightened regulations on the verifiability of fair value accounting will enhance the reliability of financial reports. However, they do not necessarily enhance the verifiability of disclosure but rather push auditors to become the valuation specialists. When fair value is based on managers' estimates on future firm value and risk, it is very difficult and costly for auditors to judge whether the estimates are free of material errors. To be able to do so, auditors need to have the same information endowment and knowledge about the firm's business as managers do.³

¹The FASB and IASB have embarked on a project to revise the Conceptual Framework. The concept of reliability has been replaced with faithful representation, which is defined to be verifiable, neutral, and complete information.

²Source: "Fact, Fiction, Fair Value Accounting at Enron", Robert G. Halderman, Jr.. The CPA Journal.

³Colleen Cunningham, president and CEO of Financial Executives International (FEI), expressed his concern that relevant information that is unreliable is useless to an investor. He insisted that the nature of the claim being made for an accounting number should be reliable. Fair Value Accounting: Fair for Whom? (Financial Executive, March/April 2004).

Hence, it is not clear how managers will disclose information when their performance is measured under fair value accounting. This paper presents a model to study the possible disclosure behavior when managers can distort the signal that is reported to investors. Managers' compensation is based on both the signal he provides and the realized value he creates. I analyze managerial disclosure behavior under two scenarios. In the first scenario, investors are unaware of the signal distortion. In the second scenario, investors are aware of distortion and adjust their expectation based on their beliefs of distortion. The investors' adjusted responses in turn affect managers' disclosure strategies. The economic intuition of the second case is similar to that of Einhorn (2007).

The model in this paper is based on Holmstrom and Milgrom's principal-agent framework. In both scenarios, I show that the agent's optimal effort levels are independent of his disclosure bias. Moreover, in the first case, the agent's disclosure strategies are based on the parameters of compensation contracts. However, in the second case, the agent always discloses optimistically given the principal's responses to signal, which is characterized as a *S*-shaped function of signal.

This paper differs from previous studies in the following sense: (1) the principal does not have prior beliefs on the signal distortion; (2) the principal's assessed probability of misreporting is no longer a constant but a function of the agent's signal; (3) the agent is compensated for providing unverifiable signal.

I organize the remaining sections as follows. Section 2 reviews the previous research on management strategic disclosure. Section 3 presents the principal-agent models under two scenarios. Section 4 concludes.

2 Literature Review

The research on disclosure has focus on how managers disclose their private information and how investors interpret these disclosures. There are two main streams of the literature in this area. One stream believes that both managers and investors are rational and they behave in Bayesian manner. The other stream assumes that not all agents in an economy are rational. For example, Fischer and Verrecchia (1999) show that the market reaction to disclosures is affected by the portion of heuristic traders. Since this paper is based on the framework assuming that all market participants are completely rational and maximize their aggregate utility over period, I mainly review the relevant papers categorized in the first stream.

In the early stage of disclosure research, it is believed that insiders will fully disclose private information because outsiders will discount the quality of goods insiders deal with to the lowest possible value if insiders are known to withhold information (see Grossman and Hart,1980; Grossman, 1981). However, it is unrealistic to assume that outsiders always know insiders' information endowment. A more widely accepted assumption is that there is information asymmetry problem between outsiders and insiders. When outsiders determine the welfare of both, they will require insiders to provide necessary information. Most discussed research questions based on this framework are: (1) what are the insiders' disclosure strategy under various scenarios? (2)why they behave strategically? (3) what kind of disclosure is preferred by insiders? and (4) how they evaluate the disclosure with uncertainties. Extensive studies have specified many scenarios under which managers have incentives to provided noisy disclosure or partial disclosure.

Noisy disclosures are defined as those disclosures that do not reveal managers' information truthfully. Partial disclosure means that managers truthfully reveal part of their information but withhold the rest. Crawford and Sobel(1982) point out that insiders will be better off to send noisy signals to the outsiders when their preferences are different in their well-known "cheap talk". For example, Rogers and Buskirk(2007) show that managers issue biased disclosure to signal good news. Dye (1985) and Jung and Kwon (1988) show that informed managers will withhold some information unless it exceeds a cutoff value. There are various economic reasons why managers may disclose noisy or partial disclosure. Some papers suggest that managers make disclosures to inflate stock prices and lower firms' cost of capital (see Lambert, Leuz and Verrecchia, 2007). For instance, Yermack (1997) and Aboody and Kasznik (2000) find that managers tend to delay announcements of good news and rush forward with announcements of bad news before receiving stock option.

Notably, many studies also shows that how managers will make their disclosures depends on investors' prior beliefs and the market's ability to detect misrepresentation. Jorgensen and Kirschenheiter (2003) suggest that when investors have prior beliefs of distribution of the firm's cash flow, firms are more likely to disclose favorable information. Pae (2005) demonstrates that the optimal disclosure strategy for an informed firm is to report selectively subsets of information when investors are uncertain about the manager's information endowment. Suijs(2007) shows that if a firm is uncertain of investor response, it may prefer to partially disclose its private information (withhold both good and bad news) when the firm needs to acquire capital from an investor. Einhorn (2007) explains the withholding of information as the manager's rational re-

sponse to investors' uncertainty about whether the manager has incentives to shift the firm's market price upward or downward.

Due to the information asymmetry problem, many studies show that the accounting system designed by the principal is always conservative when penalties on managers are sufficiently limited, see Kwon, Newman and Suh (2001). Guay and Verrecchia (2007) show that conservative accounting results in stock prices being higher on average than had the manager acted strategically. In a contracting setting with no moral hazard, Reichelstein (1997) examines incentive systems that achieve goal congruence between a principal and an agent with respect to investment decisions. As he shows, when incentive systems are linear in accounting performance measures and the agent's discount factor is unknown to the principal, the optimal performance measure will use a conservative depreciation schedule, in the sense that the book values of existing projects are less than their net present values, if that performance measure is to attain goal congruence. Dutta and Reichelstein (2002) extend this analysis to a moral hazard setting and show that the same type of depreciation rule is part of an optimal performance measure. They demonstrate that it is optimal for the principal to delegate the investment decision and to base the manager's compensation on the residual income performance measure.

Raith (2008) suggests that the optimal compensation contract should put some positive weights on the signal of future output besides realized output. However, in his paper, the signal is not subject to managerial discretion. If the signal can be distorted then the contract should be different since managers will take advantage of the discretion.

Finally, the researches mentioned above do not take into account the impact of competitive environment. Due to the proprietary costs, firms may tend to disclose bad news to deter entry, such as in Darrough and Stoughton (1990). They may also issue transparently biased disclosures (biases that can be undone by investors) in an imperfect competition setting to mislead competitors (see Fischer and Verrecchia, 2004).

3 Management Strategic Disclosure

This section models on how managers will distort their disclosure under a linear compensation contract with informed investors versus uninformed investors. The model is based on the framework of the widely used principal agency model by Holmström and Milgrom (1987, 1991). In the two scenarios, the compensation contracts are both linear and the agent is risk averse with exponential utility. The agent will report a signal about the future value that will be created to the principal and his compensation will be partly tied to that signal. The signal can be distorted by managers to a certain extent in both cases. The major difference between the two scenarios is that the principal is not aware of any distortion in the signal that the agent provides in the first scenario while the principal knows ex ante the possibility of signal distortion in the second scenario.

The distortion in the signal is considered to be unverifiable information, which is relevant to future firm value but whose value is difficult to measure and have large variance. An example of such information is the value of goodwill. Goodwill is the claimed price paid for the value created by managers' mergers and acquisitions (M&A) decisions. The value of the goodwill is very difficult to be verified when the deals are just closed and can only be justified in the long run when the synergy value is gradually

realized. Moreover, even though managers have more private information about the deals and intend to provide neutral estimates, it is also not an easy task for them to get an unbiased estimates of goodwill either. The reported goodwill value is sensitive to the assumptions managers make initially and the intrinsic value varies with the firm's economic environment in the subsequent periods. In other words, if the current goodwill value is used to predict its future value, the variance of the error term will be large. Under fair value accounting, managers are given more discretion in reporting assets, liabilities and earnings.⁴ The signal about future firm value is very likely to be distorted intentionally or unintentionally.

This section is organized as follows. In Section 3.1, I study the agent strategic disclosure in a setting that the principal is not aware of any signal distortion basic settings of the model. In Section 3.2, the principal is assumed to be informed of signal distortion and adjust his expectation based on the observed signal. I discuss the factors affecting the principal's expectation and analyze the agent's disclosure behavior.

3.1 Management Disclosure with Uninformed Principal

Consider a two-period model. For a typical firm j , in period 0, agent signs a compensation contract and choose effort level a . The effort level will create firm value

$$V = \theta a + \varepsilon_v \tag{1}$$

in period 1, where θ scales the productivity of effort, and ε is a normally distributed error term with a mean zero and variance σ_v^2 . Following Raith (2008), I assume the performance measure for period 0 will be the signal about the future value shortly after

⁴The changes in the fair value (both realized and unrealized gains and losses) are now recognized in financial statements under SFAS 157.

the agent exerts his effort. The signal takes the form at

$$z = \theta a + \varepsilon_z, \quad (2)$$

where $\varepsilon_z = \varepsilon_v + \zeta$, and ζ is normally distributed with a mean zero and variance σ_ζ^2 . In contrast to Raith(2008)'s model, the true signal in my setting is only observable to the agent. The principal ex ante only knows that the signal is a linear function of the agent's effort and the variance of the error term, σ_z^2 . After receiving the private signal, the agent has certain discretion in reporting the signal to the principal. Therefore, the signal the principal observes is

$$\tilde{z} = \theta a + X + \varepsilon_z, \quad (3)$$

where X is the discretion term the agent adds to the original signal. This construct is consistent with the reality that managers can shift the expected value of their efforts but cannot change investors' belief of the underlying risk. For example, managers of a pharmaceutical company can overstate the expected revenues generating by a new drug that is currently under development. However, the inflated expectation on revenues will not change investors' knowledge on the likelihood that research on the new drug may fail. In this model, X can be interpreted as managerial reporting bias. The manager can have three reporting strategies in period 0:

a. Neutral Reporting

In this case, the manager will truthfully disclose the signal he observes. That is, $\tilde{z} = z$ and $X = 0$.

b. Conservative Reporting

In this case, the manager will report the signal to principal conservatively. That is, $\tilde{z} < z$ and $X < 0$. Notably, the lower bound of X is $-a\theta$ since the agent won't signal a negative firm value. Otherwise, it cannot be guaranteed that both principal and agent will stick to the contract in both periods.

c. Optimistic Reporting

In this case, the manager will report the signal to principal optimistically. That is, $\tilde{z} > z$ and $X > 0$.

At period 0, the manager simultaneously decides his effort level, a , and the reporting bias, X . However, the agent cannot discretionally distort the signal at no costs. Since the agent is compensated based on the signal in period, his compensation is also associated with the "surprise" in period 1 when the value is realized. I assume that the compensation contracts are as follows:

$$w_0 = \alpha_0 + \beta_0 \tilde{z} \quad \text{and} \quad w_1 = \alpha_1 + \beta_1 (V - \tilde{z}) + \gamma V, \quad (4)$$

where $V - \tilde{z}$ is the "surprise" term. If $V - z > 0$, then it is positive surprise to the principal and vice versa. Theoretically, β_1 should be positive, which means the agent will be punished if the principal sees a negative surprise.

Assume both principal and agent can commit to a two-period contract and neither of them discount payoffs between periods. The agent's wage of period 0 will be paid in period 1 together with the wage of period 1. The model allows the agent to have unrestricted access to a credit market and can borrow or save any amount at zero interest, without loss of generality, see Chiappori et al. (1994). Let $b(\tilde{z})$ denote the agent's net borrowing in period 0 as a function of \tilde{z} . Therefore, the agent's consumption in each period is $c_0 = w_0 + b$ and $c_1 = w_1 - b$. Following Raith (2008), I further assume

that the principal is risk-neutral and the agent is risk averse with a time separable utility function of net consumption in each period $t=0,1$:

$$U(c_0, c_1, a) = u(c_0 - d(a)) + u(c_1), \quad (5)$$

where $u(x) = -\exp[-rx]$, r is the agent's constant absolute risk aversion coefficient, and $d(a) = \frac{k}{2}a^2$ is the agent's disutility of effort expressed in monetary terms, with scaling parameter k . The reservation wage is \underline{w} .

Since the principal is risk neutral, his net payoff is $V - w_0 - w_1$. After substitute equation (4) into the payoff function and combine the constants, the principal's payoff function becomes $(1 - \gamma - \beta_1)V - \alpha - (\beta_0 - \beta_1)\tilde{z}$. The principal chooses contract parameters γ, β_0, β_1 and α to maximize his net payoff subject to the agent's individual rationality and incentive compatibility constraints and his optimal borrowing decision. The principal-agent problem is as follows:

$$\max_{\alpha, \beta_0, \beta_1, \gamma} E_{z,V}[(1 - \gamma - \beta_1)V - \alpha - (\beta_0 - \beta_1)\tilde{z}], \quad s.t. \quad (6)$$

$$E_{z,V}\{u(b - \frac{1}{2}ka^2) + u[\alpha + (\beta_1 - \beta_0)\tilde{z} + (\gamma + \beta_1)V - b]\} \geq 2u(\underline{w}), \quad (7)$$

$$a \in \operatorname{argmax}_{a'} E_{z,V}\{u(b - \frac{1}{2}ka'^2) + u[\alpha + (\beta_1 - \beta_0)\tilde{z}(\alpha') + (\gamma + \beta_1)V(a') - b]\}, \quad (8)$$

$$X \in \operatorname{argmax}_{X'} E_{z,V}\{u(b - \frac{1}{2}ka^2) + u[\alpha + (\beta_1 - \beta_0)\tilde{z}(X') + (\gamma + \beta_1)V(a) - b]\}, \quad (9)$$

$$X \geq -a\theta \quad (10)$$

$$b \in \operatorname{argmax}_b u(b' - \frac{1}{2}ka^2) + E_V u[\alpha + (\beta_1 - \beta_0)\tilde{z} + (\gamma + \beta_1)V(a) - b'], \quad (11)$$

Notably, since in this model the principal is not aware of any signal distortion but expects the variance of the random error term of signal, ε_z , to be $\sigma_V^2 + \sigma_\zeta^2$, as defined

above. Hence, the theoretical coefficient of a regression of V on \tilde{z} is:

$$\varphi = \frac{Cov(V, \tilde{z})}{Var(\tilde{z})} = \frac{\sigma_V^2}{\sigma_V^2 + \sigma_\zeta^2}.$$

Then we can show:

$$a = \frac{(\beta_0 + \gamma)\theta}{k}.$$

Proposition 1a: The agent's choice of effort level is neither affected by being given the discretion in reporting signal nor the potential punishment of reporting distorted signal.

The effort level a is a function of only the compensation on signal (β_0) in period 0 and the compensation on realized value (γ in period 1, given the scaling parameters. This result suggests that the agent will put the same effort to maximize his utility no matter how much distortion he may include in the signal. The implication for financial reporting is that less reliable financial reporting such as fair value accounting does not affect the optimal efforts the managers would put.

Proposition 1b:

The agent will provide conservative signal ($X < 0$) when

$$(\beta_1 + \gamma)\varphi < \beta_1 - \beta_0;$$

The agent will provide optimistic signal ($X > 0$) when

$$(\beta_1 + \gamma)\varphi > \beta_1 - \beta_0.$$

The agent can provide either optimistic, neutral or conservative signal when

$$(\beta_1 + \gamma)\varphi = \beta_1 - \beta_0.$$

Proof: See Appendix.

Note that $(\beta_1 + \gamma)$ is the aggregate compensation coefficient on realized value and $(\beta_0 - \beta_1)$ is the aggregate compensation coefficient on signal. Hence, $(\beta_1 - \beta_0)$ can be interpreted as the net punishment for "surprises". φ is the ratio of the volatility of firm value with respect to the volatility of signal, a ratio that is exogenously determined and not under control of both principal and agent. This ratio can be viewed as a measure of a firm's business risk versus reporting risk.

Proposition 1b suggests that (1) if the risk adjusted compensation on realized value is less the net punishment for "surprises", the agent will report conservatively; and (2) if the risk adjusted compensation is greater the net punishment for "surprises", the agent will report optimistically. Intuitively, the result of the first case means that if the signal about future firm value is very noisy (i.e. large ϵ_z) and the compensation for realized value is not large to compensate the risk the agent bears for the potential punishment of shock, the agent will choose to report signal conservatively. Similar logic applies to the second case.

Finally, if the risk adjusted compensation on realized value is equal to the net punishment for "surprises". Agent has no compensation incentives to provide biased signal.

3.2 Management Disclosure and Informed Principal

In this section, the model is based on the setting that the principal is aware of potential distortion in the signal that the agent reports to him, even though the agent's private signal is still not observable. The agent's compensation contract is the same as

the one in Section 3.1. Since the principal doesn't have prior beliefs on how the signal would be distorted, he can only assess the likelihood that the signal is conservatively, neutrally or optimistically distorted.

For simplicity, I set the firm value to be zero in period 0. The firm value in period 1 will be V which is created by the agent. The principal will set the parameters of compensation contracts based on his conditional expectation of future firm value.

In Subsection 3.2.1, I discuss the factors the principal takes into account to evaluate the signal provided by the agent. These factors will determine the principal conditional expectation of future firm value. I present a preliminary model to capture the relation between the expectation and the observed signal (\tilde{z}). In Subsection 3.2.2, I analyze the strategic disclosure behavior under the this setting.

3.2.1 Factors for Principal to Evaluate Signal

Since the distortion in signal should not change the underlying risk of firms' business, it is reasonable to assume that ε_V and ε_z will stay the same. Reporting bias will only shift the principal's expected mean of future firm value but not the variance. Hence, the following factors are associated with the principal's expected firm value: (1) the likelihood of each reporting type, i.e., the probabilities that the observed signal is conservative, neutral or optimistic; (2) the inflated or deflated expected firm value due to signal distortion.

(1) The Likelihood of Reporting Type

In this model, the signal the agent provides is considered to be unverifiable information. This means the principal has no prior beliefs regarding the distribution of

the distortion. Under fair value accounting, many measures will be unverifiable in the sense the neither auditors or regulators can disentangle the management intentional distortion from the reported signals. There are many examples such as the value of goodwill or core deposit intangibles.

Therefore, I assume that the principal assign probabilities to each reporting type based on the magnitude of the signal. That is, given the observed signal \tilde{z} , the probability that it is a conservative signal is $P_c(\tilde{z})$. Similarly, the probabilities that it is a neutral signal or optimistic signal are $P_N(\tilde{z})$ and $P_o(\tilde{z})$. Moreover, $P_c + P_N + P_o = 1$.

I define the probability functions of conservative reporting and optimistic reporting as inverted S -shaped and S -shaped functions of signal \tilde{z} . Namely,

$$P_c(\tilde{z}) = b_1 + b_2 * \arctan[-b_3 * (\tilde{z})], \quad \text{and}$$

$$P_o(\tilde{z}) = b_1 + b_2 * \arctan[b_3 * (\tilde{z})],$$

where b_1, b_2 and b_3 are all positive constants. The smaller the b_2 , the principal is less sensitive to the changes in the signal. The probabilities are determined once the signal is observed. Figure 1 gives a visual illustration of the above two assessment functions.

The above probability functions have two characteristics: monotonicity and varying rate of adjustment. Monotonicity means that the probability of optimistic (conservative) reporting is increasing (decreasing) in the magnitude of signal. That is, the higher the signal, \tilde{z} , the more likely the reporting is optimistically distorted; on the contrary, the lower the signal, the more likely the reporting is conservatively distorted. Varying rate of adjustment means that when the value signal is at different ranges (e.g. low, medium and high), the sensitivities of the probability the principal assigns to the

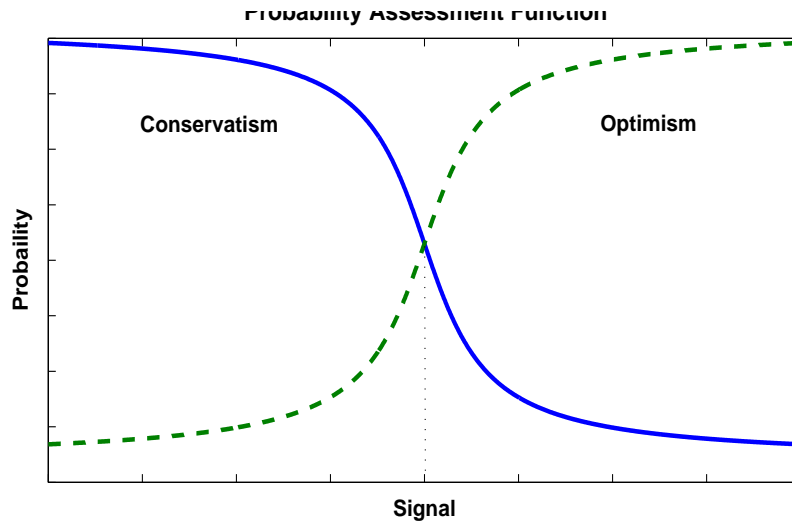


Fig.1. Principal's Probability Assessment Function

changes of signal are different. For example, when the signal is extremely high, the principal will consider the signal to be optimistic with probability almost equal to one. An increase in the signal will only marginally increase the the likelihood of optimism. However, when the signal is in a more reasonable level, the probability assign to each reporting type will be very sensitive to the changes of the signal.

(2) The inflated or deflated expected firm value given the Reporting Type

As stated above, the signal distortion, X , will affect the principal's expected firm value in period 1. The conservative reporting will bias the expectation downward while optimistic reporting will bias expectation upward. The shift in the mean of the distribution is X . The principal has the incentive to undo the distortion as much as he can based on what he knows. Specifically, if the principal considers the agent's reporting is conservative, the expected future firm value will be the firm value implied by the signal plus some adjustment value; on the contrary,if the principal considers the

agent's reporting is optimistic, the expected future firm value will be the firm value implied by the signal minus some adjustment value.

In analogous to Einhorn (2007) and Guay and Verrecchia (2007)'s models, I characterize the principal's conditional expected firm value are as follows:

$$E(V|N) = E(\tilde{z}) \quad \text{with probability } P_N, \quad (12)$$

$$E(V|C) = E(\tilde{z}) + \rho * \sigma_V \quad \text{with probability } P_c, \quad (13)$$

$$E(V|O) = E(\tilde{z}) - \rho * \sigma_V \quad \text{with probability } P_o, \quad (14)$$

where ρ is a positive adjustment coefficient that the principal applies to revalue the firm given a certain type of reporting. The smaller the ρ , the less sensitive the principal is to signal distortion and therefore less expectation adjustment. For example, when there is market frenzy (e.g. internet bubble), investors tend to accept more biased reporting whose credibility would be questioned in ordinary periods.

Taking the above two factors into account, the principal estimates the expected firm value under unverifiable information using Bayes' Rule. The adjusted unconditional mean of future firm value is

$$E(V) = P_N * E(\tilde{z}) + P_c * [E(\tilde{z}) + \rho * \sigma_V] + P_o * [E(\tilde{z}) - \rho * \sigma_V], \quad (15)$$

which can be further simplified as

$$E(V) = E(\tilde{z}) + (P_c - P_o)\rho * \sigma_V, \quad (16)$$

where P_c and P_o are functions of \tilde{z} . Based on their defined function forms, we further know that $\frac{dP_c}{d\tilde{z}} = \frac{-b_2b_3}{1+b_3^2\tilde{z}^2}$ and $\frac{dP_o}{d\tilde{z}} = \frac{b_2b_3}{1+b_3^2\tilde{z}^2}$.

Since \tilde{z} still has the same variance as z , the distribution of adjusted V conditional on \tilde{z} will be

$$E[V|\tilde{z}] = \varphi\tilde{z} + (1 - \varphi)(\theta a + X) + (P_c - P_o)\rho * \sigma_V \quad (17)$$

Note that in this case, \tilde{z} is not a mean preserving random variable anymore. Given equation (17) as the principal's adjusted conditional expectation, I will discuss the principal and agent maximization problem in Section 3.2.2.

3.2.2 Manager's Optimal Disclosure Strategy

Since the signal is no longer a mean preserving random variable and the relation between principal expected future value and signal is nonlinear, I assume the agent is risk neutral in this case for simplicity. Hence, to maximize the agent's expected total utility is equivalent to maximize the agent's expected total consumptions over the two periods. The consumptions in period 0 and 1 are as follows:

$$C_1 = b - \frac{k}{2}a^2 \quad (18)$$

$$\begin{aligned} C_2 &= \alpha + (\beta_0 - \beta_1)\tilde{z} + (\beta_1 + \gamma)E(V|\tilde{z}) - b \\ &= \alpha + [\beta_0 - \beta_1 + (\beta_1 + \gamma)]\tilde{z} + (\beta_1 + \gamma)(1 - \varphi)(\theta a + X) \\ &\quad + (\beta_1 + \gamma)(P_c - P_o)\rho\sigma_v - b. \end{aligned} \quad (19)$$

Therefore, the agent maximizes his expected utility $E[U(C_1) + U(C_2)]$. Solve this problem and we can have

$$a = \frac{(\beta_0 + \gamma)\theta}{k}.$$

Proposition 2a: The agent will put the same efforts to maximize firm value no matter how the principal interprets the signal he provides.

Proposition 2b: The agent will always provide optimistic signal. It is never be optimal for him to report neutrally.

Proof: See Appendix.

Intuitively, the above results suggest that how investors infer the bias and noise in financial reporting will not affect managers' business decision but only change their reporting behavior. However, even though the sophisticated principal can somehow disentangle certain signal distortion, the agent will never report neutrally regardless of how the compensation parameters are set.

3.2.3 Model Discussion

The model of the informed principal model treat negative distortion and positive distortion equally and does not impose upper bound on X . However, in reality, the costs for managers to report conservatively versus optimistically are asymmetric. For example, managers are more likely to be sued if there is a huge negative shock to investors (i.e. the signal is much greater than the realized value). Also, although the signal is unverifiable, managers will have to restate their financial reporting if the realized value is far off from the signal he provides earlier. Given litigation risk and the constraints of regulation, managers may have different incentives in bias reporting upwardly versus downwardly.

The model is based on the assumption that the agent is risk neutral. Baldenius (2003) claims that the manager can have a risk neutral utility with respect to his excess compensation. Since the compensation associated with misreporting is more or less analogical to excess compensation (managers do not have to put any efforts

in producing biased signal), it is not unreasonable to assume that their risk aversion coefficient is almost zero if this part of compensation takes up a large portion in the total compensation.

4 Conclusions

The debate on historical-cost accounting and fair value accounting has attracted tremendous attention in recent years. This paper is motivated to study the management strategic disclosure behavior if performance measures are under fair value accounting. I present a model based on Holmstrom and Milgrom's principal and agent framework to investigate what an agent's optimal strategies are when the principal is unaware of signal distortion and when the principal is aware of such distortion. The model characterizes the principal's assessed probability of reporting bias as a S -shaped function of the observed signal. In both cases, the agent's optimal effort levels are found to be independent of his reporting bias. In the first case, managers disclosure strategies are based on the parameters of compensation contracts. However, in the second case, managers will always disclose optimistically given the principal will adjust their conditional expectation on future firm value based on the reported signal. To sum up, it seems that the compensation on providing signal and creating firm value should not be related to each other. The implication for standard setter regarding fair value accounting is that the information role of accounting is not compatible with its contracting role.

5 Appendix: Proofs

Proof of Proposition 1:

First I start from the maximization problem of the agent. The agent's consumption in period 1 is $w - b = \alpha + (\beta_1 + \gamma)V + (\beta_0 - \beta_1)\tilde{z} - b$, which is normally distributed conditional on z and has a certainty equivalent of

$$CE_2(b) = \alpha + (\beta_0 - \beta_1)\tilde{z} + (\beta_1 + \gamma)E[V|\tilde{z}] - b - \frac{r}{2}Var(V|\tilde{z}), \quad (20)$$

where

$$E[V|\tilde{z}] = \varphi\tilde{z} + (1 - \varphi)\theta a, \text{ and} \quad (21)$$

$$Var(V|\tilde{z}) = \sigma_v^2 - Cov(V, \tilde{z})\frac{1}{Var(\tilde{z})}Cov(V, \tilde{z}) = (1 - \varphi)\sigma_v^2. \quad (22)$$

Substitute equation (20) and (21) into (19), we have

$$CE_2(b) = \alpha + (\beta_0 - \beta_1)\tilde{z} + (\beta_1 + \gamma)[\varphi\tilde{z} + (1 - \varphi)\theta a] - b - \frac{r}{2}(\beta_1 + \gamma)^2(1 - \varphi)\sigma_v^2. \quad (23)$$

Since the end of period 0, the agent borrows b . The first order condition for utility maximization with respect to b is

$$u'(b - \frac{k}{2}a^2) = E_v[u'(w - b)], \quad (24)$$

where $u'(x) = -ru(x)$. Hence, the expected marginal utility is equal to its certainty equivalence. Namely, $b - \frac{k}{2}a^2 = CE_2(b)$. Solve this equation and we can get the expression for b in terms of \tilde{z} . Substitute the expressions of b and $\tilde{z} = \theta a + X + \varepsilon_z$ into the agent's total expected utility function, we have

$$\begin{aligned} U(\varepsilon_z) = & 2u\left(\frac{1}{2}\left\{-\frac{k}{2}a^2 + \alpha + (\beta_0 - \beta_1)(\theta a + X + \varepsilon_z) + (\beta_1 + \gamma)[\varphi(\theta a + X + \varepsilon_z) + (1 - \varphi)\theta a] \right. \right. \\ & \left. \left. - \frac{r}{2}(\beta_1 + \gamma)^2(1 - \varphi)\sigma_v^2\right\}\right). \end{aligned} \quad (25)$$

Therefore, the certainty equivalent for the agent's aggregate utility is

$$CE_1 = -\frac{1}{2}ka^2 + \alpha + (\beta_0 + \gamma)\theta a + (\beta_0 - \beta_1 + \beta_1\varphi + \gamma\varphi)X - \frac{r}{2}\sigma_v^2\{(\beta_1 + \gamma)^2(1 - \varphi) + \frac{1}{4\varphi}[(\beta_1 + \gamma)\varphi + \beta_0 - \beta_1]\} \quad (26)$$

The agent chooses a and X to maximize CE_1 , which leads to

$$a = \frac{(\beta_0 + \gamma)\theta}{k}, \quad (27)$$

which is independent of X . Also, whether X is positive or negative depends on the relation between $(\beta_1 + \gamma)\varphi$ and $\beta_1 - \beta_0$.

Proof of Proposition 2:

The agent's expected total utility is as follows:

$$\begin{aligned} E[U(C_1) + U(C_2)] &= -\frac{1}{2}ka^2 + \alpha + (\theta a + X)[\beta_0 - \beta_1 + (\beta_1 + \gamma)\varphi] + (\beta_1 + \gamma)(1 - \varphi)(\theta a + X) \\ &\quad + (\beta_1 + \gamma)(P_c - P_o)\rho\sigma_v \\ &= -\frac{1}{2}ka^2 + \alpha + (\theta a + X)(\beta_0 + \gamma) + (\beta_1 + \gamma)(P_c - P_o)\rho\sigma_v. \end{aligned} \quad (28)$$

Hence, the first-order conditions are

$$\frac{\partial EU(C)}{\partial a} = -ka + (\beta_0 + \gamma)\theta \quad \text{and} \quad (29)$$

$$\frac{\partial EU(C)}{\partial X} = (\beta_0 + \gamma) - (\beta_1 + \gamma)\rho\sigma_v \frac{2b_2b_3}{1 + b_3^2(X + a\theta)^2}. \quad (30)$$

The second order condition is:

$$\frac{\partial^2 EU(C)}{\partial X^2} = 4(\beta_1 + \gamma)\rho\sigma_v \frac{b_2b_3}{1 + b_3^2(X + a\theta)^3} > 0. \quad (31)$$

Set equation (29) equal to zero, we have the optimal effort level takes the following form:

$$a = \frac{(\beta_0 + \gamma)\theta}{k} \quad \text{and}$$

Since the second order condition of expected utility with respect to X is positive, it means the first order derivative is increasing. Therefore, the agent's utility is positively related to the signal distortion when the distortion becomes sufficiently large. This is because if $(\beta_0 + \gamma) > 2(\beta_1 + \gamma)\rho\sigma_v b_2 b_3$,

$$\frac{\partial EU(C)}{\partial X} > 0,$$

which means, higher the X , the greater the expected utility; if $(\beta_0 + \gamma) < 2(\beta_1 + \gamma)\rho\sigma_v b_2 b_3$, then

$$\frac{\partial EU(C)}{\partial X} \Big|_{X=-a\theta} < 0.$$

Since the second order derivative is positive, the expected utility will decrease when the signal become less conservative but will increase at an increasing rate when X becomes sufficiently large.

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