Endogenous Accounting Discretion and its
Implications for Bias and Information Content of Accounting Reports

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Abstract

We analyze the design of an accounting information system in the presence of incentive concerns and identify conditions under which bias may arise in the accounting system. By viewing the accounting information system as an endogenous choice variable by firm owners and bias as the consequence of the optimal system, our analysis provides several caveats to the typical view of relations among incentives, bias, and information content of accounting. In short, due to considerations arising from endogenous bias, making inferences about observed biases and informativeness in accounting reports is a delicate exercise.

*Keywords*: accounting discretion; bias; information content
1. Introduction

Biases are commonplace in accounting numbers, in both internal and external reports. Building slack into budgets is one example of an internal reporting bias. Empirical studies on firms’ discretionary accruals choice provide ample evidence of biases in external accounting reports. Much debate exists on the interpretations of observed biases, especially regarding those in external accounting reports. One view is that biases result from managers’ opportunistically exercising reporting discretion to advance their private benefit at owners’ expense. This view suggests that biases reduce the informativeness of accounting numbers. An alternative view is that managers use reporting discretion to communicate private information (e.g., Watts and Zimmerman 1986; Subramanyam 1996; Healy and Palepu 1996). Underlying this alternative view is the notion that biases may be optimally chosen to improve the informativeness of accounting reports. It is unclear, however, how and why creating biases, or equivalently, distorting information, is an optimal way to improve the informativeness of accounting information.

In this paper, we formalize the notion of optimal bias. We model a firm’s decision to optimize its accounting reporting system and identify situations under which biases may arise in the optimal accounting system. In doing so, we seek to underscore the various mechanisms for biases and to explore the concomitant implications for understanding related empirical results on the determinants and consequences of observed biases in reported accounting numbers.

Our study of accounting bias is based on a specific model in which we seek to integrate a number of general observations about the features of accounting information.

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2 See Healy and Wahlen (1999) and Fields et al. (2001) for surveys.
system. First, we take as given that the primitive role of an accounting system is to provide information to assist decision making in uncertain environments. Thus, we focus on a setting where the firm’s decision problem is such that more information is beneficial, thus giving endogenous demand to an (accounting) information system. In other words, we abstract from the multiple roles accounting information often serves and the potential conflicts implied by these multiple goals. Rather, we seek to explore a more fundamental question: given the premise that more information is desired, what’s the optimal accounting system to provide more information in the first place?

Second, a salient feature of the accounting reporting system, as well recognized in the literature and recently summarized in Dye (2002), is essentially a process of classification: a firm is either a going concern or is not; an expenditure is either a periodic expense or an investment; an asset is either short-term or long-term; etc.. Consequently, accounting information is often presented in highly aggregate and categorical terms. While this feature is a result of the specific rules, standards and conventions that govern accounting reporting, more importantly, it reflects the fact that accounting information can only help resolve some, but not all, of the firm’s underlying uncertainty. To capture this feature, we follow the literature and model the accounting information system as providing a partition of the underlying state space. As a result, the accounting information in our model is aggregate and categorical, but is nonetheless informative about the underlying states.

3 Throughout the paper, we use “accounting system”, “information system”, “accounting information system”, and “accounting reporting system” interchangeably.
4 For example, information useful for valuation role is not necessarily useful for stewardship purpose (see Gjesdal (1980)).
5 See also Christensen and Demski (2003), Demski (1980), Dye (1985), and Ijiri (1975) for similar modeling of accounting reports as a partition of the state space.
Last but not least, we explicitly recognize the fact that the quality of an accounting system depends crucially on the incentives of the agents (managers, employees) who design and implement the system. Managers have local expertise on their operating environment and can potentially incorporate their expertise to improve the information content of accounting reports. They can do so, for example, by applying the appropriate accounting rules and estimates that would accurately reflect the underlying economic reality, or by discovering information that would otherwise not be available to the firm, or both. Since managers do not always share the same objectives as firm owners, for them to take actions to improve the accounting information system their preferences need to be explicitly recognized and proper incentives need to be provided.

Towards the goal of carefully exploring the effects of managers’ preferences and incentives on accounting system, we analyze a setting in which accounting reports provide decision-relevant information but can also affect a manager’s payoffs. To better illustrate the main intuition, our analysis proceeds in two related model setups. We start with a setting where the manager (agent) is assumed to have an exogenous preference for biased accounting reports due to, for example, career concerns. He also possesses some private information (due to his local expertise) that could improve the accounting system. The problem of the owner (principal) is to decide whether to provide the manager the authority (discretion) to establish the accounting information system. We find that when discretion is granted, biases naturally arise; and, the optimal discretion decision weighs the extent of information that can be incorporated in the information system via discretion against the extent of biases due to incentive misalignment.

In the second model setup, we endogenize the manager’s preference for reporting biases by considering a scenario in which he can exert (unobservable) effort to reduce environmental uncertainty. In this setting, the principal’s problem is to design an
incentive compensation package to motivate the manager to exert effort. We find that the principal may optimally grant discretion and induce a biased information system through incentive pay. The issue is that if the manager is unable to personally benefit from reduced uncertainty, he has little incentive to exert effort in the first place. Incentive pay and the induced biased accounting system help make reducing uncertainty the manager’s priority. Here, the key insight is that bias is not the result of a manager exploiting a naïve owner, but is instead part and parcel of the optimal compensation package.

The two settings capture in a parsimonious way two closely related incentive environments for managers and the different roles managers may take in setting a firm’s information system. In the first setting, the manager’s desire for bias is implicit and exogenous; the manager’s influence on the information system comes from his superior information advantage. In the second setting, the manager’s preference for bias is endogenously induced by the principal’s optimally chosen incentive pay. Although biases appear in both settings, they do so for slightly different reasons. In the first setting, bias arises as a by-product of granting discretion to managers with an inherent penchant for favorable accounting reports. In the second setting, such a penchant arises as a “necessary evil” to motivate the manager to reduce environmental uncertainty.

The fact that the accounting systems can be biased in both settings is consistent with empirical evidence linking a variety of incentives to reporting biases. At the same time, the fact that both settings describe endogenous biases supports the view that not all accounting biases are signs of managers exploiting “loopholes” to their own advantage; some can be signs of healthy interactions (see, e.g., Bowen et al. 2004). By viewing the

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6 Our results provide a view of empirical relations of bias akin to the view of the relation between risk and incentive pay detailed in Prendergast (2002). We also hope it is consistent with Demski’s (2004) call for endogenous expectations when interpreting accounting phenomena.
information system as a firm’s endogenous choice, this paper introduces several caveats to conventional wisdom, and as such, may yield some insight in understanding seemingly conflicting empirical results on firms’ accounting choices. Consider the relation between interest alignment and reporting bias. One would naturally expect a strong positive relation between the extent of misalignment and the incidence of bias. However, we demonstrate that such a relation may be muted by the fact that severe misalignment can lead a firm to clamp down on discretion or abandon incentive plans, thereby eradicating bias. That is, the relation between interest misalignment and reporting bias can be non-monotonic. The non-monotonicity may help shed light on the mixed empirical evidence on the relation between the strength of corporate governance and the amount of discretionary accruals (e.g., Larcker et al. 2004; Klein 2002).

A multitude of studies have sought to explain the discretionary nature of accounting in the presence of incentive concerns. Of particular interest to this paper are models identifying endogenous bias in reported earnings. Such “earnings management” can arise under optimal contracting, provided the setting entails some aspect of the Revelation Principle being violated (Arya et al. 1998). As such, limited commitment in contracting (e.g., Demski and Frimor 1999; Dye 1988), costly communication (e.g., Demski 1998; Maggi and Rodriguez-Clare 1995), and incomplete contracting (e.g., Healy 1985), can all be sources of endogenous biases.

Our paper contributes to this literature in the following way. First, we show that a biased accounting information system may be crucial in motivating an agent. This identifies an additional benefit of a biased system which is different from the traditional
view (i.e., bias allows incorporation of managerial private information).\(^7\) Second, in our model, managerial discretion is exercised not in ex post impressions management, but in setting the stage for reducing environmental uncertainty that can affect future activities. In this vein and as discussed earlier, the view of accounting information system presented herein is firmly rooted in the perspective of accounting information providing useful information to improve decision-making. Lastly, we show that our main results remain intact even after allowing communication between the principal and the agent. This differentiates our paper from others that restrict communication in contract (e.g., Sankar and Subramanyam (2001) and Stocken and Verrecchia (2004)).

The paper proceeds as follows. Section 2 presents the model and results in a setting with implicit managerial incentives. Section 3 appends the basic model and results to incorporate explicit incentive contracts. Section 4 outlines implications of the analysis. Finally, Section 5 concludes.

2. Implicit Incentives Setting

2.1 Model

Let \( s = k + \varepsilon \), denote an unobservable random variable reflecting the productive environment in which a firm operates. The firm is operated by a manager (agent) who takes an action, \( a \), before \( s \) realizes. It is common knowledge that \( \varepsilon \) follows a uniform distribution over the support of \([-d,+d]\), \( d>0 \).\(^8\)

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\(^7\) Dutta and Giger (2002) show that bias can arise endogenously in a contractual setting, though their focus is on how bias helps improve risk sharing in an agency relation and not how bias relates to the informativeness of accounting reports for decision-making purposes.

\(^8\) Other than helping to obtain a closed-form solution and to illustrate the main intuition without unnecessary algebraic complexity, assuming a uniform distribution is by no means excessively restrictive as the main qualitative result of our analysis carries through to any symmetric distribution.
To reflect the agent’s expertise and proximity to operations, we assume that the agent observes $k$ while the firm owner (principal) only knows that $k$ follows a distribution with a mean of zero and variance of $\sigma_k^2$. As to $d$, we assume in this section that its value is fixed and commonly known to both parties to highlight the main intuition. In Section 3, we will relax this assumption and analyze the situation where $d$ can be endogenously affected by the agent’s effort.

The firm's payoff given $a$ and $s$ is $s - |a - s|$. The first term in the payoff reflects that a higher $s$ is better, while the second term reflects a benefit gleaned from matching actions to the circumstance. For example, while a firm unequivocally benefits from higher demand (captured by a high realized value of $s$), the benefits are best gleaned when production matches the level of demand. It is the desire to match actions to the firm’s environment that gives rise to value of an accounting system.

To elaborate, the firm installs an accounting system that provides a partition of $s$ (reflected in a cutoff, $m$) prior to $a$ being chosen. The system yields a (binary) public signal: if $s \geq m$ (i.e., $s$ falls in the interval $[m, k + d]$), the report is “High”, if $s < m$ (i.e., $s$ falls in the interval $[k - d, m]$), the report is “Low.” The choice of $m$ invariably affects the value of the accounting system to the principal.

To abstract from mismatched decision priorities, the agent’s action, $a$, is presumed to impose no personal cost on the agent. Given act-indifference on the agent's part, the agent will always choose the firm’s preferred action, given the information available to the agent. We formalize the notion of information content in this setting as follows.

**Definition 1.** An accounting system is said to be (weakly) more informative if it generates a higher expected payoff for the principal.
The main tension of the basic model is that the agent may have a different preference for the accounting system than the principal. In particular, assume that given \(a, s\), and the accounting report, the agent’s utility is

\[
U_{\text{agent}} = \alpha s - |a - s| + (1 - \alpha) I(\text{High}) b
\]

where \(b \geq 0\) and \(I(\text{High})\) is an indicator function equal to 1 (0) if the accounting signal is High (Low).

The first term in the agent’s utility function, in particular, \(\alpha \in (0,1)\), captures the degree of interest alignment between parties: higher \(\alpha\) implies that the agent’s preferences more closely mirror those of the principal. Many sources can contribute to a misaligned preference. For example, the agent may have a shorter-time horizon than the firm and the realization of the firm’s final payoff may be beyond the agent’s horizon. Alternatively, \(\alpha\) can be interpreted as capturing (inversely) the degree of difficulty to use the firm’s final output to motivate the agent to act in the firm’s interest. For example, the firm may lack congruent performance measures for the final payoff \(s - |a - s|\) (in the spirit of Baker (1992), Feltham and Xie (1994)) and/or the realized value of the payoff can only be measured with noise. When this is the case, the agent’s wealth constraint and/or risk aversion imply that there is an optimal limit on how much the firm should tie the agent’s compensation to the final output, and this limit is captured by \(\alpha\). \(^9\)

When \(b\) is strictly positive, the second term in the agent’s preference reflects an implicit incentive for favorable accounting treatment. Such a preference may arise, for

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\(^9\) We could introduce noisy measurement of the final output and assume risk aversion on the agent’s part to endogenize \(\alpha\) in a fairly straightforward way. We choose not to impose this layer of analysis as it seems to complicate the model without bringing much new insight.
example, due to an agent’s focus on outside opportunities and the resulting desire to posture via publicly observed accounting reports (e.g., Gibbons and Murphy, 1992). While the assumption of a preference for high accounting reports is common in prior literature and has reasonable empirical support, it is nonetheless somewhat arbitrary and (deservedly) brings to question the robustness of our results to this assumption. We note, however, that we rely on this assumption only in this section in order to help illustrate the main idea. In Section 3, the agent does not have this exogenous preference (i.e., $b=0$) and yet accounting bias may still be (optimally) induced by the principal.

The divergence in preferences gives rise to a decision of who will choose $m$, the firm’s accounting policy. Either the principal can provide the agent discretion (regime D) or can unilaterally stipulate $m$, thereby removing discretion (regime ND). The timeline of the events is as follows. At time 1, the principal decides on whether to adopt the discretion regime or the no-discretion regime when setting up the accounting information system. At time 2, the agent (privately) observes $k$ and $m$ is chosen by the relevant party. At time 3, the accounting report is generated, after which the agent chooses $a$, conditional on his knowledge about $m$, $k$, and $d$. Finally, the underlying state $s$ is realized and so are the payoffs. The timeline is summarized in Figure 1.

\begin{figure}[h]
\centering
\begin{tabular}{c|c|c|c}
$t=1$ & $t=2$ & $t=3$ & $t=4$
\hline
The principal adopts a discretion regime. & The agent (privately) learns $k$. $m$ is chosen by the relevant party. & The accounting signal is observed. & $s$ and payoffs are realized.
\end{tabular}
\caption{Timeline of Implicit Incentive Setting.}
\end{figure}
As one may intuit, providing discretion to the agent affords a $k$-contingent $m$ while also introducing the potential for biases in the system. The next definition formalizes the notion of such discretion-induced biases.

**DEFINITION 2.** Bias in accounting classification is the expected deviation of $m$ from $s$, i.e., bias equals $|E[s-m]|$.

Intuitively, if the accounting system classifies a below-average $s$ as *High* or an above-average $s$ as *Low*, it is presenting a biased view. Consistent with this benchmark, it turns out that the optimal choice of $m$ in the absence of misaligned interests, $m^{FB}$, is unbiased. This is confirmed in the following Lemma.

**LEMMA 1.** The first-best choice of $m$, $m^{FB}$, equals $k$.

Intuitively, the best the principal can do is to equally partition the state space so as to reduce the incidence of large deviations of $a$ from $s$. Doing so yields an unbiased report. Thus, any biases that arise in equilibrium are a consequence of misaligned interests. We turn to this issue next.

### 2.2 Main Results

Consider first the outcome under no discretion (ND). In this case, the principal must choose $m$ without knowing $k$. Consistent with Lemma 1, the best she can do is to pick an $m$ that splits the distribution of $s$ evenly. With $k$ known, such a split would entail setting $m = k$; without knowing $k$, the principal must rely instead on expected $k$, i.e., $m = E[k] = 0$.

Under discretion (D), the agent has $k$ at his disposal when choosing $m$. However, he also seeks to secure a *High* accounting report. With perfectly aligned interests, his
chosen $m$ would simply be $k$ (from Lemma 1). On the other hand, if his entire focus is on securing a *High* report, he would set the bar low (decrease $m$) to ensure $s$ is above the hurdle. With both incentives at play, he opts for a middle ground in which $m$ is close to, but below, $k$. The extent to which $m$ deviates from $k$ depends on the level of interest alignment ($\alpha$). Consistent with this intuition, the following proposition identifies the outcomes under each regime.\footnote{Throughout the paper, we assume $d$ is sufficiently large relative to the limits of the $k$-distribution that the solutions obtained using first-order conditions are interior.}

**PROPOSITION 1.**

(i) Under no discretion, the optimal cutoff is $m^{ND} = 0$

(ii) Under discretion, the optimal cutoff is $m^{D} = k - \frac{1 - \alpha}{\alpha} b$.

An immediate implication of Proposition 1 is that discretion leads to biases that in turn yield loss of information content ($m^{D} < m^{FB}$). At the same time, however, no discretion also yields loss of information content. In this case, the loss of information is not manifest in bias ($m^{ND} = E[m^{FB}]$). Instead, the loss of information arises due to an inability to tailor the accounting system to the realized $k$.

The principal’s choice of regimes amounts to choosing the regime that entails less loss in information. Accordingly, if the amount of uncertainty resolved by knowing $k$ is high or the degree of interest alignment ($\alpha$) is high, providing managerial discretion is the right track. Alternatively, if conditioning $m$ on $k$ is not too helpful or the principal and agent have severe interest misalignment, no discretion can be the way to go. This thinking is formalized in Proposition 2 which presents two alternate means of reflecting the principal’s preferred discretion regime.
PROPOSITION 2.

(i) The firm opts to provide the agent discretion if and only if \( \sigma_k^2 \geq \left[ \frac{b(1-\alpha)}{\alpha} \right]^2 \).

(ii) The firm opts to provide the agent discretion if and only if \( \alpha \geq \frac{b}{b + \sigma_k} \).

Proposition 2 affords a comparison of biases and information content across a variety of circumstances. Of particular interest is the effect of the degree of interest alignment, \( \alpha \), on these primitives. While one may conjecture that interest misalignment and bias go hand-in-hand, such a conclusion turns out to be hasty. For a given discretion regime, the intuitive relationship does hold. However, discretion regime too changes with \( \alpha \), making the relationship non-monotonic. In particular, for low \( \alpha \)-values, there may be no bias (i.e., no discretion), while for higher \( \alpha \)-values bias can arise. For such higher \( \alpha \)-values, though, bias is decreasing in \( \alpha \). The effect of \( \alpha \) on information content is more straightforward, as greater interest-alignment invariably leads to benefits to the principal.

COROLLARY 1.

(i) The relationship between bias and \( \alpha \) is non-monotonic.

(ii) Accounting informativeness is (weakly) increasing in \( \alpha \).

Corollary 1 implies that, as \( \alpha \) varies, there is not a discernible relationship between bias and information content. Such a complex relationship is induced by the fact that as \( \alpha \) changes, the underlying degree of discretion too is changing. Figure 2 provides a graphical depiction of these relationships.
2.3 Allowing Communication

An implicit assumption in the previous analysis is that the agent is unable to communicate his private knowledge about $k$ to the principal. When communication is allowed, the principal could first elicit the agent to report $k$ and then set the cutoff $m$ accordingly in an unbiased fashion. This implies that the principal can do at least as well as, and may even do better, with communication than without. Intuitively, one might conjecture that the region where the Discretion regime dominates and biases in information system are present should shrink. Following Dessein (2002), we now show that such intuition is incomplete and Proposition 1 and 2 are not affected by communication.

For simplicity, assume that $k$ is uniformly distributed over $[-L, L]$.$^{11}$ Under the No-Discretion regime with communication, it is straightforward to verify that our setting is essentially a cheap talk game first studied in the seminal paper by Crawford and Sobel.

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$^{11}$ Results here are not driven by the uniform distribution assumption. See Dessein (2002) for applications to general distribution functions.
(1982). When the principal knows $k$, she would prefer to set $m = k$, while the agent would prefer to set $m = k - \frac{1-\alpha}{\alpha} b$. Thus, the divergent interest between the principal and the agent is represented by $\frac{1-\alpha}{\alpha} b$. It is well known that in a cheap talk setting all equilibria are partitional in nature and these partitions satisfy the following property.

**LEMMA 2** (Crawford and Sobel). Communication equilibria are characterized by a set of partitions on $k, \{p_0, p_1, ..., p_i, p_{i+1}, ..., p_N\}$ such that $p_{i+1} - p_i = p_i - p_{i-1} - 4 \frac{1-\alpha}{\alpha} b$, or, equivalently, $p_{i+1} - p_i = p_i - p_0 - 4i \frac{1-\alpha}{\alpha} b$.

Lemma 2 shows that in order for informative communication to be feasible (i.e., there are at least two partition elements in the equilibrium), adjacent partition elements must differ by $4 \frac{1-\alpha}{\alpha} b$ in length. This implies that informative communication necessarily involves large noise for small value of reported $k$’s, which makes underreporting of $k$ very costly for the agent. Proposition 3 below shows that when informative communication is feasible, the noise needed to induce meaningful communication is so large that granting the agent discretion always dominates communication with no discretion.

**PROPOSITION 3.** If $k$ is uniformly distributed over $[-L, L]$, the principal grants discretion to the manager whenever $\frac{1-\alpha}{\alpha} b$ is such that informative communication is feasible.

Proposition 3 implies that it is without loss of generality to compare discretion regime to no-discretion regime without communication, as whenever meaningful communication is feasible it always is dominated by discretion.
3. Explicit Incentives Setting

Continue with the model in the previous setup, setting \( b = 0 \), i.e., there is no assumed preference and implicit incentive for favorable accounting treatment. In addition, assume that the agent, before observing \( k \), can exert a costly (unobservable) effort, \( e \), to reduce \( d \), the extent of residual uncertainty in \( s \). Thus, for a given effort \( e \) and for a given cutoff \( m \), a High report indicates that \( s \in [m, k + d_e] \), while a Low signal indicates \( s \in [k - d_e, m] \). Because \( d_e \) reflects residual uncertainty about \( s \), smaller \( d_e \) (hence higher \( e \) effort) is preferred by the principal as it leads to a smaller expected loss from mismatched actions. However, since \( e \) is costly for the agent, as in standard agency settings, this preference for high effort is not shared by the agent. For simplicity and without loss of generality, we assume \( e \) can take two values, 0 (shirk) or 1 (work) and \( d_1 < d_0 \). The agent’s cost of effort, \( C_e \), is summarized as \( C_1 = C > C_0 = 0 \).

Because \( e \) is unobservable, the principal relies on incentive pay to motivate the agent to work. Here, since \( s \) is not observable, the only publicly observable signal is the accounting system signal indicating whether \( s \) falls into the High or Low region. As a result, the agent's realized compensation can take only two values, one corresponding to the High accounting report (denoted \( A_H \)) and the other to the Low report \( (A_L) \). Thus, the incentive contract specifies \( (A_L, A_H) \), where \( A_i \geq 0 \) (the principal pays the agent, not the other way around). In this case, the agent’s utility given \( a, s \), and the accounting report is simply

\[
U_{Agent} = \alpha[s - |a - s|] + (1 - \alpha)[I(\text{High})(A_H - A_L) - C_e + A_L]
\]

The timeline of events for the appended model is summarized in Figure 3.
The principal adopts a discretion regime and stipulates contractual payments, $A_L$ and $A_H$.

The agent chooses $e$. The agent (privately) learns $k$. $m$ is chosen by the relevant party.

The accounting signal is observed. The agent chooses $a$.

$s$ and payoffs are realized.

**FIGURE 3.** Timeline of Explicit Incentive Setting.

For simplicity, we assume the agent’s reservation wage, $U$, is sufficiently small that the non-negative payment constraints ensure that it is satisfied. We also make the following parametric assumption on $C$, denoted (A1).

$$\frac{\alpha(d_0 - d_1)}{4(1 - \alpha)} < C < \min\left\{\frac{d_0 - d_1}{4(1 - \alpha)}, \frac{\alpha(d_0 - d_1)}{2(1 - \alpha)}\right\}.$$  \hfill (A1)

The first term in the upper bound in (A1) ensures that the social benefit of effort exceeds its cost. The lower bound and the second term in the upper bound together ensure that the agent’s cost of effort is high enough that incentive pay is required to motivate effort but not too high so as to render incentive pay impractical. That is, the assumption on $U$ and the bounds on $C$ together guarantee there is a salient incentive problem.

Lemma 3 characterizes the principal’s optimal discretion regime choices under the explicit incentives setting.

**LEMMA 3.** In the explicit incentives setup, the firm opts to provide the agent discretion.

One notable difference arising in this explicit incentives setup is that discretion dominates no discretion. This is because with no discretion, the principal’s choice of $m$
cannot influence the agent’s effort choice ($m$ is established after $e$ is chosen). Thus, the best the principal can do under no discretion is to provide minimum compensation (set $A_L = A_H = 0$) and set $m = 0$ (as in section 2). Such a result can be improved upon with discretion and $A_L = A_H = 0$: with no incentive pay, the two parties’ priorities over accounting system choice are aligned, ensuring $m = k$.

Lemma 3 implies that the principal’s problem instead becomes whether to provide nontrivial incentive pay and thereby introduce biases in the chosen accounting system. Under discretion and no incentive pay, the agent’s preference for the accounting system choice is perfectly aligned with the principal, hence the agent will choose the unbiased accounting system but he would have no incentive to exert effort. Incentive pay would induce a biased accounting system (similar to the bias shown in the previous section), and at the same time, provide the agent incentive to exert effort. The incentive comes from the observation that conditional on a biased cutoff, a lower $d$ increases the likelihood of favorable accounting treatment. Thus, the principal’s choice of incentive pay trades off the benefit in inducing effort against the cost of inducing bias. The next proposition confirms this intuition, showing that the agent’s choice of cutoff $m^D$ is a function of the spread in contractual payments, denoted $A \equiv A_h - A_l$.

**Proposition 4.** For a given $A$, the optimal cutoff for any $e$ is $m = k - \frac{1 - \alpha}{\alpha} A$.

Note that the agent’s accounting choice in the explicit incentive setting mirrors that with implicit incentive setting studied in the previous section (with $A$ replacing $b$). Hence, if $A > 0$ in equilibrium, the implications of the two settings are remarkably similar. The added wrinkle here is that the extent of incentives, $A$, is also endogenous. Intuitively, the principal can set $A$ high enough that the agent would willingly undertake effort. And, for large $\alpha$-values, the $A$ required to induce effort (and the ensuing bias) is
sufficiently small that the principal finds explicit incentive pay worthwhile. Proposition 5 below summarizes the endogenous choice of explicit pay as a function of $\alpha$. In the proposition, $A^*$ denotes the spread in payments under the optimal contract.

**PROPOSITION 5.** There exists $\alpha$ such that $A^* > 0$ if and only if $\alpha > \alpha_0$. Further, for $\alpha > \alpha_0$ $A^*$ is decreasing in $\alpha$.

Recall, while $A$ introduces bias, it also encourages the agent to exert effort to shrink the $\varepsilon$-interval so as to increase the probability of a High report. In fact, it is the accounting bias that serves as the linchpin for effort (the incentive pay $A$ is only the conduit through which effort is motivated). As such, much like the relation between $\alpha$ and bias was non-monotonic before, the same can be said of the relation between $\alpha$ and incentive pay in this setting. This observation, together with the effects of $\alpha$ on the other key attributes discussed before, is highlighted in Corollary 2.

**COROLLARY 2.**

(i) The relationship between incentive pay, $A^*$, and $\alpha$ is non-monotonic.

(ii) The relationship between bias and $\alpha$ is non-monotonic.

(iii) Accounting informativeness is (weakly) increasing in $\alpha$.

Part (i) of Corollary 2 highlights the fact that $\alpha$ drives both the desire to offer incentive pay and the extent of incentives required when incentive pay is introduced. Higher $\alpha$ increases the desire to introduce incentive pay but also reduces the required level of incentives when such pay is employed. Thus, the net effect is non-monotonic. Parts (ii) and (iii) mirror the results in Corollary 1. In this case, explicit pay driven by the agent’s moral hazard is the source of endogenous discretion and bias; still, the same basic tension results.
We conclude this section with a brief digression on communication. As in the previous section, the essence of the result can also carry forward to circumstances wherein the principle elicits reports from the agent. When the principal has the full ability to commit to a contract that stipulates the information system cutoff $m$ and compensation $A$ as a function of the manager’s report, the Revelation Principle assures that a centralized (no discretion) equilibrium is without loss of generality. Nonetheless, the optimal mechanism that motivates the agent introduces ex post bias in the information system. Intuitively, with agent truth-telling in equilibrium, an ex post unbiased information system means that the principal sets $m=k$, under which the probability of obtaining the High accounting report is the same regardless of the agent’s effort choice. Hence, the agent does not have incentives to exert effort in the first place. In other words, a biased information system is a necessary condition to induce effort even when a complete mechanism with reporting is in place.

4. Discussion and Implications

The previous sections have outlined two stylized models for the sake of providing crisp comparisons of key fundamental variables. That is, the setup is one where accounting bias, informativeness, and explicit pay each arise endogenously. The key exogenous (latent) variable that permeates the results is that of intrinsic interest alignment, $\alpha$. That is, while one may expect interest alignment to vary in a cross-section of firms, induced changes in bias, informativeness and pay follow as optimal consequences of resulting economic relationships. By viewing these variables as endogenous (and jointly determined), one may get a clearer picture of how these variables interrelate and why, in some circumstances, empirical evidence on such a
relation is mixed. Hence, in that follows, we attempt to provide a brief synopsis of the key implications of the results herein.

*What are signs of an incentive problem?*

A first foray is into the admittedly difficult task of identifying situations rife with incentive concerns. Though intuition may lead to the conclusion that bias (e.g., earnings management) is an outgrowth of interest misalignment, such a relationship turns out to be more complex. Though increases in $\alpha$ indicate better aligned interests, less bias does not follow. From Corollaries 1(i) and 2(ii), the setting here identifies a non-monotonic relationship. The reason conventional wisdom falls short is that it implicitly holds constant the level of control the principal (firm shareholders) has over the firm’s information system. As we show here, the principal can control the quality of the information system either by discretion or by explicit incentive pay. Endogenizing these controls puts a damper on the typical intuition relating bias and interest alignment. Thus, the commonly-held view that earnings management is a sign of interest misalignment may fall short of fully capturing the nuances of the relationship.

Similarly, at first glance it seems reasonable to view the extent of incentive pay as a proxy for the extent of intrinsic interest misalignment. After all, the larger the incentive problem, the more incentive pay is required. Missing from this logic, however, is the fact that greater incentive misalignment (lower $\alpha$) may lead a firm to abandon incentive pay all together. That is, from Corollary 2(i), while $\alpha$ does map into firm performance, the connection to $A^*$ is not as straightforward. This result is consistent with the caveats regarding the link between pay and performance highlighted in Demski and Sappington (1999). The added twist here is that pay, bias, and performance are all interrelated. Thus, not only may there be a weak observable link between pay and performance, but a
similar weak link may form between bias and performance. Indeed, these weak relations are noted in recent empirical studies (e.g., Larcker, et al. (2004)).

Determinants of Bias

One stream of literature that has garnered substantial attention is that identifying the economic determinants of earnings management (see Healy and Wahlen, 1999 for an excellent synopsis). A variety of causes of incentives to manage earnings have been identified. The flavor of many such determinants is that managers are exploiting “loopholes” to their own advantage; rarely are signs of healthy bias identified (one exception is Bowen et al. 2004). The results here suggest that the distinction between harmful bias and healthy bias is likely to be hard to untangle. That is, the result highlights the strange dichotomy that bias arises as an optimal response to incentive problems, yet greater incentive problems can also reduce the extent of bias (Corollary 1(i) and Corollary 2(ii)).

Further complicating matters is the fact that other seemingly innocuous variables are caught up in the mix. Consider the result that increases in fundamental uncertainty, $\sigma_k^2$, increase the attractiveness of discretion and, thus, bias (Proposition 2 (i)). The implication is that healthy bias and uncertainty are positively related. If fundamental uncertainty is roughly proxied by cost of capital, such a positive relation is well documented (e.g., Francis et al. 2005). The result here suggests care in interpretation. Though the relationship between cost of capital and earnings management may be a sign that earnings management is harmful, it could also arise from a well-designed incentive scheme.
Consequences of Bias

An equally important stream of research investigates the economic consequences of bias. While conventional wisdom views bias as harmful, it can also be seen as a means of conveying valuable information (e.g., Demski 1999). Consistent with this view, Subramanyam (1996) finds a positive relationship between bias and informativeness in accounting reports (this sentiment also permeates Healy and Palepu, 1996). Yet, the converse view rings true in several studies as well. A case in point is the research involving managers’ use of abnormal accruals to inflate prices before equity offerings (Teoh et al. 1998a, 1998b).

The results here provide one explanation for the seemingly schizophrenic nature of the empirical findings. Conditional on granting discretion and explicit incentives, higher $\alpha$ leads to lower bias and higher informativeness of accounting. When discretion or explicit incentives is viewed endogenously, however, the relationship is not clear. Thus, one would expect that in a cross-section of firms with different levels of interest alignment, different induced relationships among the two endogenous variables (bias and informativeness) can be observed. This “weak” relation between bias and informativeness suggests extra care in controlling for the endogenous nature of firms’ control over the quality of their information system can help better sift out the underlying relationship. In effect, such control for the degree of endogenous information system may not only sharpen econometric specifications but may also allow clearer interpretations of observed regularities.

5. Conclusion

This paper presents a simple model of the costs and benefits of reporting biases. In doing so, the paper highlights the role of explicit and implicit incentives in governing
the relationship between management and shareholders. Importantly, bias arises as a natural consequence of discretion that is employed to exploit localized information. Further, in the case of explicit incentives, such bias may be cultivated ex post solely to provide ex ante incentives for reducing environmental uncertainty.

By viewing the interplay between optimal discretion, bias, and informativeness of accounting reports in the presence of incentive concerns, the results provide some caveats to the traditional view of empirical regularities. In particular, the model points out that failing to control for the (endogenous) extent of firms’ control for the quality of their information systems may lead one to find weak evidence in even the most intuitive relationships such as the relation between interest misalignment and bias. Accordingly, controlling for such latent variables may help sift out key causes and consequences of conflicts of interest and accounting bias.

Notably missing from the stylized analysis is a valuation exercise. That is, the perspective taken here is one of accounting as a source of information for decision-making and control, without consideration of its role in valuation. Though outside the scope of the present undertaking, layering security markets into consideration may point to other key endogenous variables that govern the relationships among discretion, bias, and informativeness.
Appendix

As a preliminary, we establish the following observation.

**Observation 1.**

If the principal believes $s$ is uniformly distributed over the interval $[t_1, t_2]$, the action that maximizes the principal’s utility is $\frac{t_1 + t_2}{2}$, i.e., the mean of the distribution. The principal’s expected payoff in this case is $\frac{t_1 + t_2}{2} - \frac{t_2 - t_1}{4}$.

**Proof**

Given the principal believes $s$ is uniformly distributed over the interval $[t_1, t_2]$, her expected utility from taking action $a$ that is interior to the support is

$$
\int_{t_1}^{t_2} \frac{1}{t_2 - t_1} (s - a)^2 ds = \frac{t_1 + t_2}{2} - \frac{a^2 - a(t_1 + t_2) + (t_1^2 + t_2^2)}{2}.
$$

Setting the derivative of (1) with respect to $a$ equal to zero yields $a^* = \frac{(t_1 + t_2)}{2}$. The principal’s payoff is then obtained by substituting $a^*$ in (1). It is easy to verify that the second order condition is satisfied and any $a \not\in [t_1, t_2]$ is strictly dominated by $a^*$. Q.E.D.

**Proof of Lemma 1.**

Using Observation 1, it is easy to obtain the principal’s expected utility from setting a cutoff $m$ is:

$$
\frac{m - (k - d)}{2d} \int_{k-d}^{m} \left( s - \frac{s - (k - d + m)}{2} \right) ds + \frac{k + d - m}{2d} \int_{m}^{k + d} \left( s - \frac{s - (k + d + m)}{2} \right) ds.
$$

Equation (2) directly follows from applying Observation 1 to the two intervals: $[k - d, m]$ and $[m, k + d]$. Setting the derivative of (2) equal to zero, the principal’s payoff is maximized at $m = m^{FB} = k$. Q.E.D.
Proof of Proposition 1.

(i) Under ND, the principal’s problem is to solve:
\[
\begin{align*}
\text{Max } & \quad E_k \left[ \frac{m - (k - d)}{2d} \int_{k-d}^{m} \frac{s - |s - (k - d + m)/2|}{m - (k - d)} \, ds \right] \\
\end{align*}
\]
\[
\begin{align*}
\Rightarrow \quad \text{Max } & \quad E_k \left[ k - \frac{(m - k)^2 + d^2}{4d} \right] \\
\end{align*}
\]
(3)

The first-order condition of (3) is
\[
E_k [2(m - k)] = 0. \tag{4}
\]
Solving (4) yields \( m^{ND} = 0 \).

(ii) Under D, the agent’s problem is to solve:
\[
\begin{align*}
\text{Max } & \quad m - (k - d) \alpha \int_{k-d}^{m} \left[ \frac{s - |s - (k - d + m)/2|}{m - (k - d)} \right] \, ds \\
& + \frac{k + d - m}{2d} \int_{m}^{k+d} \left[ \frac{s - |s - (k + d + m)/2|}{k + d - m} \right] \, ds + (1 - \alpha)b \\
\end{align*}
\]
\[
\begin{align*}
\Rightarrow \quad \text{Max } & \quad m^{D} = k - \frac{1 - \alpha}{\alpha} \, b \tag{5} \\
\end{align*}
\]
Setting the derivative of (5) equal to zero yields \( m = m^{D} = k - \frac{1 - \alpha}{\alpha} \, b \). Q.E.D.

Proof of Proposition 2.

Given Proposition 1(i), the principal’s expected payoff under ND is
\[
U_{ND}^P = -\left( \sigma_k^2 + d^2 \right) / 4d.
\]
Given Proposition 1(ii), the principal’s expected payoff under D is
\[
U_{D}^P = -\left( \frac{(1 - \alpha)b}{\alpha} \right)^2 + d^2 \right) / (4d). \tag{6}
\]
Comparing \( U_{ND}^P \) and \( U_{D}^P \) yields the conditions in the proposition. Q.E.D.
Proof of Corollary 1.

From Proposition 2, for \( \alpha < \hat{\alpha} \), the principal optimally withholds discretion from the agent, i.e., \( m = 0 \), which gives bias \( |E_s(0 - s)| = 0 \), and informativeness \( U^{P}_{ND} \). Conversely for \( \alpha \geq \hat{\alpha} \), the principal optimally grants discretion from the agent, yielding
\[
m = k - \frac{1 - \alpha}{\alpha} b.
\]
In this case, bias is \( |E_k \left[ E_{j,k} \left( k - \frac{1 - \alpha}{\alpha} b - s \right) \right]| = \frac{1 - \alpha}{\alpha} b \) and informativeness is \( U^{P}_{D} \). Corollary 1 follows. Q.E.D.

Proof of Lemma 2.

Consider two adjacent partition elements \( \{[p_{i-1}, p_i), [p_i, p_{i+1}]\} \). In equilibrium, the principal takes action \( a = \frac{p_{i-1} + p_i}{2} \) when \( k \in [p_{i-1}, p_i) \) and \( a = \frac{p_i + p_{i+1}}{2} \) when \( k \in [p_i, p_{i+1}) \). Thus, a manager who observes \( k = p_i \) must be indifferent between reporting \( k \in [p_{i-1}, p_i) \) and reporting \( k \in [p_i, p_{i+1}) \), which generates the expressions in the lemma. Q.E.D.

Proof of Proposition 3.

Define the minimal average length of the partition elements, denoted by \( \bar{P} \), as a function of divergent interest \( \frac{1 - \alpha}{\alpha} b \): \( \bar{P} \left( \frac{1 - \alpha}{\alpha} b \right) = \frac{2L}{N \left( \frac{1 - \alpha}{\alpha} b \right)} \), where \( N \left( \frac{1 - \alpha}{\alpha} b \right) \) is the maximum number of partition elements in equilibrium given \( \frac{1 - \alpha}{\alpha} b \). Note that the necessary and sufficient condition for granting discretion to be strictly preferred over no discretion is \( E_s \left( |a^* - s| \right) \geq \left( \frac{1 - \alpha}{\alpha} b \right)^2 + d^2 \right) / 4d \), where \( a^* \) is the action taken by the principal under communication. Since \( k \) is uniform and \( s \) is conditionally uniform, we also have \( E_s \left( |a^* - s| \right) \geq \left( \bar{P} \left( \frac{1 - \alpha}{\alpha} b \right) \right)^2 / 12 + d^2 \right) / 4d \), where the inequality is strict if and
only if partition elements are unequal in length. Thus, a sufficient condition for granting
discretion is
\[
\left( \frac{P\left(\frac{1-\alpha}{b}b\right)}{1-\alpha} \right)^2 \geq 12.
\]

\[
\frac{1-\alpha}{b} = p_{N(\frac{1-\alpha}{b})} - p_{N(\frac{1-\alpha}{b}-1)} + \frac{1}{N(\frac{1-\alpha}{b})} \sum_{i=1}^{N(\frac{1-\alpha}{b})-1} 4i \frac{1-\alpha}{b}
\]

From Lemma 2,
\[
2[N(\frac{1-\alpha}{b}) - 1] \frac{1-\alpha}{b} \Rightarrow \left[ \frac{1-\alpha}{b} \right]^2 \geq 4[N(\frac{1-\alpha}{b}) - 1]^2
\]
 Clearly, \(4[N(\frac{1-\alpha}{b}) - 1]^2 \geq 12\) is satisfied for all \(N(\frac{1-\alpha}{b}) > 2\).

Finally, we show that for \(N(\frac{1-\alpha}{b}) > 2\), the principal still prefers to grant discretion rather than to communicate. Denote \(P_1 = p_1 - p_0\) and \(P_2 = p_2 - p_1\). From Lemma 2, then \(P_1 = P_2 + 4 \frac{1-\alpha}{b}\) so that if the principal doesn’t grant discretion to the manager, she implements \(a = p_0 + \frac{P_1}{2}\) if \(k \in [p_0, p_1]\) and \(a = p_1 + \frac{P_1}{2} - 2 \frac{1-\alpha}{b}\) if \(k \in (p_1, p_2]\).

Given that \(k\) is uniform and \(s\) is conditionally uniform, it is easy to verify that
\[
E_s\left[\left(\frac{1-\alpha}{b}\right)^2 + d^2\right] / 4d \quad \text{Q.E.D.}
\]

**Proof of Lemma 3.**

Consider the no discretion case when \(A = A_h - A_j > 0\). Since by the time the principal gets to decide \(m\), the manager has already taken action \(e\), the principal’s problem can be formulated as
\[
\max_m \quad E_k\left[ k - \frac{(m-k)^2 + d^2}{4d} - \frac{k + d_e - m}{2d_e} - A | d_e \right]
\]
which gives the optimal \(m^* = A\). Next, let’s consider the agent’s effort choice decision. The agent’s problem is to compare his payoff from exerting high effort \(E_k[\frac{k + d_e - m^*}{2d_e} - A - C]\) with that from shirking \(E_k[\frac{k + d_e - m^*}{2d_e} - A]\). Clearly, the former is smaller than the latter for all \(A > 0\),
i.e., the agent strictly prefers to shirk. Hence, the principal’s payoff can be improved by granting discretion and forgoing incentive pay to the agent. The no discretion case when $A \equiv A_{k} - A_{l} < 0$ can be ruled out as an optimum in a similar fashion.

**Proof of Proposition 4.**

In this case, denote the agent’s expected utility given $e$ and $m$ by $U^{A}(e,m)$, where

$$U^{A}(e,m) \equiv \frac{m - (k - d_{e})}{2d_{e}} \left[ \int_{k-d_{e}}^{m} \left( s - \frac{s - (k - d_{e} + m)/2}{m - (k - d_{e})} \right) ds + \left( 1 - \alpha \right)(A_{L} - C_{e}) \right] + \frac{k + d_{e} - m}{2d_{e}} \left[ \int_{m}^{k+d_{e}} \left( s - \frac{s - (k + d_{e} + m)/2}{k + d_{e} - m} \right) ds + \left( 1 - \alpha \right)(A_{H} - C_{e}) \right]$$

(6)

Setting the derivative of $U^{A}(e,m)$ with respect to $m$ equal to zero yields

$$m = m^{D} = k - \frac{1 - \alpha}{\alpha} A .$$

Q.E.D.

**Proof of Proposition 5.**

First, note that to motivate the agent to undertake $e = 1$ after observing a given $k$, requires $U^{A}(1,m^{D}) \geq U^{A}(0,m^{D})$, or

$$(A_{H} - A_{L})^{2} \geq \left( \frac{4d_{0}d_{1}C}{d_{0} - d_{1}} \right) \left( \frac{\alpha}{1 - \alpha} \right) - d_{0}d_{1} \left( \frac{\alpha}{1 - \alpha} \right)^{2}$$

(7)

From (7), it follows that if the principal wishes to motivate $e = 1$ for any $k$, it must do so for all $k$. With the limited liability assumption, the optimal contract that motivates $e = 1$ must have either $A_{H}$ or $A_{L}$ equal to 0. Without loss of generality, we will set $A_{L} = 0$.

Since (7) will be binding, $A_{H} = A_{H}^{*} = \sqrt{\left( \frac{4d_{0}d_{1}C}{d_{0} - d_{1}} \right) \left( \frac{\alpha}{1 - \alpha} \right) - d_{0}d_{1} \left( \frac{\alpha}{1 - \alpha} \right)^{2}}$. Thus, the principal’s expected utility for when motivating $e = 1$, denoted $U_{1}^{P}$, is:

$$U_{1}^{P} \equiv E_{k} \left[ \frac{m^{D} - (k - d_{1})}{2d_{1}} \left[ \int_{k-d_{1}}^{m^{D}} \left( s - \frac{s - (k - d_{1} + m^{D})/2}{m^{D} - (k - d_{1})} \right) ds \right] + \frac{k + d_{1} - m^{D}}{2d_{1}} \left[ \int_{m^{D}}^{k+d_{1}} \left( s - \frac{s - (k + d_{1} + m^{D})/2}{k + d_{1} - m^{D}} \right) ds - A_{H}^{*} \right] \right]$$

(8)
Clearly, the cost-minimizing contract to motivate $e = 0$ entails $A_H = A_L = 0$, yielding expected utility for the principal of $-d_0/4$. Using (8), $\frac{dU_1^P}{d\alpha}$ is:

$$\frac{dU_1^P}{d\alpha} \equiv \frac{A_H^* \alpha^2 - \alpha^3 d_1^2}{2\alpha^3 d_1} \alpha (1 - \alpha^2) A_H^* \left( \frac{dA_H^*}{d\alpha} \right)$$

(9)

Given the expression for $A_H^*$ and (A1), it is readily confirmed that $\frac{dA_H^*}{d\alpha} < 0$. Thus, $\frac{dU_1^P}{d\alpha} > 0$. Since $U_0^P$ is unaffected by $\alpha$ and $U_1^P$ is increasing in $\alpha$, the cutoff representation follows. Q.E.D.

Proof of Corollary 2.

From Proposition 5, for $\alpha < \alpha$, the principal optimally sets $A = 0$, thereby inducing no bias and yielding informativeness $U_0^P$. Conversely for $\alpha \geq \alpha$, the principal sets $A = A_H^*$, yielding $m = m^D = k - \frac{1 - \alpha}{\alpha} A_H^*$. In this case, bias is $\frac{1 - \alpha}{\alpha} A_H^*$ and informativeness is $U_1^P$. Corollary 2 follows. Q.E.D.
References


