Corporate governance, accounting conservatism, and manipulation*

Judson Caskey and Volker Laux
University of Texas at Austin

August 2014

*We would like to thank Paul Newman, Florin Sabac, James Spindler, Jack Stecher, Alfred Wagenhofer, Yong Yu, and workshop participants at the University of Alberta Accounting Conference, the Basel Accounting Research Workshop, Duke University, the Minnesota Theory Conference, Stanford University, and the University of Texas Law School for their helpful comments.
Corporate governance, accounting conservatism, and manipulation

Abstract

We develop a model to analyze how board governance affects firms’ financial reporting choices, and managers’ incentives to manipulate accounting reports. In our setting, the board of directors relies on accounting information to make project approval decisions, and will reject the project absent information supporting its profitability. We consider a setting where, ceteris paribus, conservative accounting is desirable because it allows the board to better oversee the firm’s investments. This feature of conservatism, however, causes the manager to manipulate the accounting system to mislead the board and distort its decisions. Effective reporting oversight curtails managers’ ability to manipulate, which increases the benefits of conservative accounting and simultaneously reduces its costs. Our model predicts that stronger reporting oversight leads to greater accounting conservatism, manipulation, and investment efficiency.

Keywords: Corporate governance, conservatism, manipulation, investment decisions
1 Introduction

In the wake of recent accounting scandals around the world, commentators and regulators have called for stronger governance and board oversight to curb accounting manipulation and fraud. These calls have led to boards and audit committees with a higher proportion of outside directors and greater financial expertise.\(^1\) Recent empirical studies find evidence that the strength of board governance is positively associated with accounting conservatism.\(^2\) This literature portrays conservatism as a valuable tool for monitoring management and hypothesizes that only strong boards will demand it.

We develop a model on the optimal level of conservatism and offer an alternative explanation for the positive relation between governance and conservatism. In our setting, consistent with previous arguments, conservative accounting produces information that enables boards to better oversee the firm’s investment decisions. However, the fact that conservatism facilitates board interventions causes the manager to manipulate the accounting system to mislead the board and distort its decisions. Acting in the best interest of shareholders, the board balances these benefits and costs to obtain an optimal interior level of conservatism. We show that boards that are more effective in restraining accounting manipulation can better exploit the benefits of conservatism and simultaneously curtail its costs, leading to a positive relation between the strength of reporting oversight and conservative accounting. Our model also of-

\(^{1}\)For example, the New York Stock Exchange listed company manual requires an audit committee comprised of “financially literate” independent board members and places restrictions on the number of audit committees on which those members serve. The manual also prescribes reporting oversight responsibilities beyond those required by the Securities and Exchange Commission in, for example, Rule 10-3A.

\(^{2}\)For example, see Beekes et al. (2004), Lobo and Zhou (2006), Ahmed and Duellman (2007), García Lara et al. (2009), and Ramalingegowda and Yu (2012); however, Larcker et al. (2007) find no relation between governance and conservatism.
fers various cross-sectional predictions and relates oversight strength to accounting manipulation and the efficiency of investment decisions.

Specifically, we consider a setting where the board chooses whether to approve a strategic investment such as expanding the firm into a new market or product. The accounting system generates noisy information about the firm’s economic earnings, which are informative about the value of expansion. Fama and Jensen (1983) hypothesize that boards play important roles in ratifying and monitoring key decisions, and Bushman and Smith (2001) argue that financial reports can assist directors in these roles.\(^3\)

We model accounting conservatism as in Gigler et al. (2009). Conservatism is defined as imposing stricter verifiability standards for reporting good news than for reporting bad news (Basu 1997; Watts 2003), and hence not only increases (reduces) the frequency of bad (good) reports but also reduces (increases) its information content.\(^4\) This feature of conservatism enables the board to better prevent investments that would have failed, but comes at the cost of forgoing some investments that would have succeeded. Thus, *ceteris paribus*, conservative accounting can improve the board’s monitoring of the firm’s investments, as argued in Ball (2001), Watts (2003) and Ahmed and Duellman (2011); however, this applies only to environments where the benefit of avoiding overinvestment exceeds the cost of underinvestment, which is the case when unconditional expansions have a negative net present value (NPV). This assumption seems reasonable in stable industries where only high eco-

\(^3\)See Armstrong et al. (2010) for a recent overview of research on the role of financial reporting for corporate governance.

\(^4\)See also Gigler and Hemmer (2001) and Venugopalan (2004). Many empirical studies focus on how conservatism impacts the asymmetric timeliness of good versus bad news, especially as measured by Basu (1997), which does not directly translate to static settings such as ours. See Gigler et al. (2009) for a discussion of how their notion of conservatism relates to Basu’s (1997) asymmetric timeliness measures.
onomic earnings indicate sufficient customer demand to warrant expansion, or risky industries, such as pharmaceuticals, where the typical project fails and it only pays to pursue projects after receiving some preliminary news of their profitability. In these cases, the board prefers conservative accounting because it supports their desire to avoid expansion when the economic environment does not support it.

The above arguments ignore the potential adverse effects of conservative accounting on the manager’s behavior. We introduce a conflict of interest between shareholders and the manager by assuming that the manager has a preference for expansion due to private benefits of control (Stein 1997; Scharfstein and Stein 2000). Because conservatism allows the board to make cautious expansion decisions, it encourages the manager to manipulate the accounting system to mislead the board and distort its decision. Successful manipulation is detrimental to the firm as it transforms low signals from the baseline accounting system into high reports, leading to overinvestment, consistent with empirical evidence by McNichols and Stubben (2008).

Thus, conservatism facilitates the board’s monitoring of investment decisions when the manager fails to distort the accounting system, but it also provides the manager with stronger incentives to distort the system in the first place. We show that the strength of reporting oversight, which curtails the manager’s ability to manipulate the accounting system, affects both the costs and benefits of conservative accounting. Specifically, more effective oversight mitigates the manager’s inclination to respond to conservatism with increased manipulation, and therefore weakens the negative side effects of conservatism. In addition, oversight reduces the probability that the accounting system is distorted, and thus increases the likelihood that conservatism

5This preference can also arise from stock option holdings or managerial optimism. Malmendier and Tate (2005) show that managerial optimism can lead to overinvestment even when the manager intends to maximize shareholder value.
has the desired effects on reporting and hence investment. As a result, strong boards can better exploit the positive effects of conservatism and limit its negative effects, and hence optimally choose more conservative accounting systems.

Our model also provides insights into the effects of reporting oversight on accounting manipulation and investment efficiency. All else equal, reporting oversight curbs manipulation, consistent with conventional views. However, boards that are more effective in restraining manipulation find it optimal to choose more conservative accounting, which, in turn, encourages manipulation. This indirect effect on manipulation via conservatism dominates the direct effect, and firms with stronger reporting oversight exhibit more rather than less accounting manipulation. This finding does not imply that governance diminishes the decision-usefulness of accounting information. The increased manipulation incentive is merely a by-product of the optimal choice of conservatism, and the board would not increase conservatism if it did not facilitate decision making. Thus, in our setting, effective reporting oversight results in both greater manipulation as well as more efficient investments. The analysis therefore suggests that empiricists should be careful when using the presence of manipulation as a proxy for the accounting system’s decision usefulness.

Taken together, our model predicts that stronger oversight is associated not only with greater accounting conservatism, but also with greater manipulation, and greater investment efficiency. Given these links, our model also predicts a positive association between conservatism and investment efficiency, consistent with empirical findings in Ahmed and Duellman (2011). However, this observation does not imply that boards can always improve investment efficiency by simply choosing more conservative accounting. In our model, there is an optimal (interior) level of conservatism and deviating from this level reduces investment efficiency. Our prediction of a positive
association between conservatism and investment efficiency arises because both the optimal choice of conservatism and the investment efficiency are higher in firms with more effective oversight than in firms with less effective oversight.

Prior studies develop settings in which conservatism reduces incentives for manipulation, consistent with the arguments in Watts (2003). In Chen et al. (2007), conservatism weakens the sensitivity of share prices to earnings reports and hence renders manipulation less attractive. In Gao (2013), conservatism is portrayed as increasing the scrutiny applied to favorable reports and thereby reduces manipulation incentives. In contrast, we study a setting in which accounting conservatism enables boards to better oversee firm investments and this feature of conservatism increases the manager’s incentive to distort the accounting system.\(^6\)

Bertomeu et al. (2013) show that conservative accounting can encourage manipulation in a setting in which the manager receives accounting-based compensation. There, the board designs an accounting system to induce productive effort at the lowest possible compensation cost. Bertomeu et al.’s (2013) results show that contracts can create, rather than eliminate, forces such that conservative accounting leads to manipulation. In contrast, we abstract from optimal contracting, and consider the usefulness of accounting reports for the board’s oversight of the firm’s investment decisions, when the board and the manager have conflicting investment interests, and the manager can manipulate accounting information to mislead the board.

Gao and Wagenhofer (2013) also offer a novel explanation for the positive link between governance and conservatism. In their model, the board’s task is to replace untalented executives. The board can base its decision on either an accounting re-

---

\(^6\)Several studies examine accounting conservatism in a debt contracting context in which there is no conflict between managers and shareholders, and there is no earnings manipulation (e.g., Gigler et al. 2009; Caskey and Hughes 2012; Li 2013).
port, which imprecisely signals talent, or a perfect, but incrementally costly, signal. Gao and Wagenhofer (2013) show that well-governed firms optimally choose more conservative accounting, where they represent strong governance by low information acquisition costs. We also predict a positive relation between board governance and conservatism, but for different reasons.\footnote{In contrast, Göx and Wagenhofer (2009) predict that the ability to manipulate reports leads to more conservative accounting, in the sense of stricter thresholds for impairment.} In addition, our model sheds light on the impact of reporting oversight on accounting manipulation and firm value.

The next section develops our model. Section 3 derives the manager’s reporting choice and the board’s accounting choice. Section 4 analyzes how equilibrium choices vary with the model’s exogenous parameters. Section 5 discusses empirical predictions and Section 6 concludes. Unless otherwise stated, all proofs are in the Appendix.

2 Model

A risk-neutral manager runs a firm owned by risk-neutral shareholders who are represented by a benevolent board of directors. The model has times 0, 1, and 2.

At Time 0, the board determines the firm’s accounting policies (i.e., the level of conservatism) and the manager can engage in personally costly activities that distort the reporting system. At Time 1, the accounting system produces a report that is informative about the firm’s economic environment. Based on this report, the board decides whether to approve expansion of current operations. At Time 2, the firm realizes and distributes its terminal payoffs.

Preexisting operations: The firm has preexisting operations that generate economic earnings $\theta \in \{\theta_h, \theta_l\}$ over the course of Times 1 and 2, where $\theta_h > \theta_l$. We assume that $\theta$ is determined as of Time 1, but is not fully realized until Time 2 so
that it is impossible to obtain a noiseless signal of \( \theta \). The *a priori* probability of high economic earnings \( \theta = \theta_h \) is given by \( \alpha < 1 \).

**Accounting signal:** The firm’s baseline information system produces an imperfect accounting signal \( S \in \{S_h, S_l\} \) that is informative about economic earnings \( \theta \). The manager, however, can engage in manipulative activities such that the public report \( R \) issued at Time 1 can differ from the signal \( S \). In what follows, we first discuss the properties of the baseline accounting signal \( S \) and then turn to the manager’s manipulation activity.

Let \( P(S_i|\theta_j) \) be the probability that the accounting system generates signal \( S_i \), given economic earnings, \( \theta_j \), with \( i, j \in \{h, l\} \). The inability to perfectly observe \( \theta \) stems from both the noise inherent in estimating the future cash flows from current transactions, and from the noise inherent in estimating the cash flow implications of future transactions that result from current activities. For example, firms that offer credit sales may not perfectly predict collections, or the firm may generate economic earnings in the form of customer loyalty, which does not yield a cash payoff until Time 2. At Time 0, the board chooses the level of accounting conservatism, denoted \( c \in [c, \overline{c}] \), where a higher \( c \) denotes a higher degree of conservatism. All players observe the choice of \( c \), and \( P(S_i|\theta_j) \) is twice differentiable with respect to \( c \). Following Gigler et al. (2009), we make the following assumptions:

(A1) For any given \( c \), the likelihood ratio \( \frac{P(S_h|\theta_h)}{P(S_l|\theta_l)} \) is increasing in the signal \( S \):

\[
1 > \frac{P(S_h|\theta_h)}{P(S_l|\theta_l)}.
\]

(A2) For each state \( \theta \), the probability of a low report is increasing in \( c \):

\[
\frac{d P(S_l|\theta_l)}{dc} > 0 \quad \text{and} \quad \frac{d P(S_h|\theta_h)}{dc} > 0.
\]

\^Gigler et al. (2009) describe these conditions in terms of a parameter \( \delta \) that indexes the accounting signal’s aggressiveness (anti-conservativeness). We state the conditions here in terms of \( c \) so that a higher level of the parameter reflects greater conservatism.
(A3) For each signal $S$, the likelihood ratio $\frac{P(S|\theta_h)}{P(S|\theta_l)}$ is increasing in $c$.

(A4) The effect of $c$ does not depend on the state $\theta$: $\frac{d P(S_l|\theta)}{d c} = \frac{d P(S_l|\theta_h)}{d c}$.

Assumption (A1) guarantees that the signal is informative about economic earnings, where $S_h$ represents good news and $S_l$ represents bad news. Formally, $P(\theta_h|S_h) \geq \alpha$ and $P(\theta_l|S_l) \geq 1 - \alpha$. Condition (A2) implies that conservative accounting increases the probability that the information system produces low rather than high signals. Condition (A3) implies that an increase in conservatism increases the information content of the high signal but reduces the information content of the low signal; that is,

$$
\frac{d P(\theta_h|S_h)}{d c} > 0 \quad \text{and} \quad \frac{d P(\theta_l|S_l)}{d c} < 0,
$$

(1)

where

$$
P(\theta_h|S_h) = \frac{\alpha}{\alpha + (1 - \alpha)\frac{P(S_h|\theta_l)}{P(S_h|\theta_h)}}, \quad P(\theta_l|S_l) = \frac{1 - \alpha}{\alpha \frac{P(S_l|\theta_h)}{P(S_l|\theta_l)} + 1 - \alpha}.
$$

(2)

Note that conservatism has an ambiguous effect on the signal’s overall informativeness such that two information systems with different levels of conservatism cannot be ranked in a Blackwell (1953) sense. Gigler et al. (2009) define Assumption (A4) as reflecting unconditional conservatism because it ensures that the effects of changes in $c$ do not depend on the state $\theta$.

Several papers on conservatism use the parameterization $P(S_h|\theta_h) = \lambda + \delta$ and $P(S_l|\theta_l) = 1 - \delta$, where $\delta$ reflects a reduction in conservatism (e.g., Venugopalan 2004; Li 2013; Bertomeu et al. 2013; Drymiotes and Hemmer 2013; Nan and Wen 2014).

---

9Our results continue to hold if we weaken (A4) and use the condition $\frac{d P(S_l|\theta)}{d c} = \gamma \frac{d P(S_l|\theta_h)}{d c}$, with $\gamma > 0$, which allows conservatism to have differing effects on reports for good and bad states. We later show that a negative ex ante NPV, $\alpha X - I < 0$, is a necessary condition for conservatism to have value. When $\gamma \neq 1$, the condition changes to $\alpha X - I < (1 - \alpha)(\gamma - 1)I$. A proof is available upon request.
This formulation assumes that conservatism has a linear effect on the probabilities and is a special case of the general conditions (A1) - (A4).

**Manipulation:** The manager has the ability to tamper with the accounting system such that the publicly observed report, denoted \( R \in \{ R_h, R_l \} \), can deviate from the signal \( S \). Specifically, at Time 0, after observing the firm’s accounting policies (i.e., conservatism \( c \)), the manager choose an unobservable level of manipulation, denoted \( m \in [0, 1] \).\(^{10}\) With probability \( m \), accounting manipulation is successful, and the report is favorable \((R = R_h)\), regardless of the signal \( S \), and with probability \( 1 - m \) manipulation fails, and the report is truthful \((R = S)\). As will become clear later, the manager never wishes to distort the report downwards. Thus, the probability of a high report given manipulation \( m \) is:

\[
P(R_h|\theta) = m + (1 - m)P(S_h|\theta), \quad \theta \in \{\theta_h, \theta_l\}.
\]

Interfering with the accounting system costs the manager \( km^2/2 \), where \( k \geq 0 \) is an indicator of the strength of reporting oversight. More effective oversight (higher \( k \)) makes it harder for the manager to create deficiencies in the financial reporting system and restricts manipulation. Our model takes the oversight quality \( k \) as given. In practice boards have some control over the strength of oversight but are nevertheless restricted by factors such as the quality of the auditor, the financial expertise and independence of the audit committee, the tightness of accounting standards and their legal enforcement, as well as firm characteristics that determine the difficulty with which outsiders can oversee reporting, such as firm size and the complexity of operations. Since manipulation destroys valuable information, a higher level of \( k \) al-

\(^{10}\)Other papers that consider ex ante manipulation include, for example, Bar-Gill and Bebchuk (2003), Gao (2013), Gao and Wagenhofer (2013), and Bertomeu et al. (2013). Our model could also be interpreted as the manager incurring costs *ex ante* to lay the groundwork for manipulation, but making the manipulation, itself, after observing signal \( S \).
ways increases firm value. Thus, in a model with an explicit choice of $k$, the board would choose the highest possible level of $k$ subject to implementation costs and the above exogenous restrictions.

The manager’s manipulation distorts the accounting system, but not so much to cause the observed accounting report $R$ to behave substantially different from the unmanipulated signal $S$. In particular, in equilibrium, the report $R$ continues to satisfy assumptions (A1) to (A3). However, rather than satisfying condition (A4), the report $R$ satisfies Gigler et al.’s (2009) condition (A5) for conditional conservatism.\textsuperscript{11}

**Expansion:** At Time 1, the firm has the option to invest $I$ to expand its operations. We assume that the expansion is sufficiently material to require approval by the board. Economic earnings $\theta$ are informative about the expected profitability of expansion, but the board can only observe the manager’s report $R$. Specifically, if economic earnings are high ($\theta = \theta_h$), expansion succeeds and yields an expected gross payoff $X$, and if economic earnings are low ($\theta = \theta_l$), expansion fails and yields an expected gross payoff that we normalize to zero. The ‘low’ economic earnings $\theta_l$ need not be low, *per se*, but should be interpreted as “not high enough to signal that it would be profitable to expand operations.”

The board acts in the best interests of the shareholders and approves expansion only when it perceives expansion to be a positive NPV investment. In the absence of additional information, the project has a negative NPV, $\alpha X - I < 0$. This assumption implies that the board will not ‘blindly’ approve expansions without further information. Instead, board approval requires information indicating that expansion is profitable. Grinstein and Tolkowsky (2004) provide evidence that board committees dedicated to overseeing investment decisions are more common for large, mature

\textsuperscript{11}Proofs are available upon request.
firms and firms with risky expansion opportunities, consistent with the monitoring occurring more for firms where expansions have negative \textit{ex ante} NPV. As will become clear below, making the alternative assumption that ‘blind’ expansions have a positive NPV, \( \alpha X - I > 0 \), renders conservatism unambiguously detrimental such that the board always chooses the maximum level of aggressive accounting \( c = c \).

We assume that the signal \( S \) provides information that is useful for the expansion decision. If the board could directly observe the signal, it would approve expansion if and only if the signal is favorable; that is:

\[
P(\theta_h|S_l)X - I < \alpha X - I < 0 < P(\theta_h|S_h)X - I.
\]  

The board, however, can only observe the report \( R \) when making its expansion choice. Because the manager does not take any actions to manipulate the report downwards, a low report indicates that the signal is low and the board rejects expansion given (4). If the report is high, the board understands that it might have been distorted. Nevertheless, to ensure that the report is useful for the decision, we assume that, in equilibrium, the NPV of the project is positive given a high report:

\[
P(\theta_h|R_h)X - I > 0,
\]  

where:

\[
P(\theta_h|R_h) = \alpha \frac{m + (1 - m)P(S_h|\theta_h)}{m + (1 - m)P(S_h)} = \frac{P(\theta_h, S_h) + mP(\theta_h, S_l)}{P(S_h) + mP(S_l)}.
\]  

Note that \( P(\theta_h|R_h) \) is declining in \( m \), exceeds \( P(\theta_h) = \alpha \) for any \( m < 1 \), and is less than \( P(\theta_h|S_h) \) for any \( m > 0 \).

**Manager preferences:** We assume that the manager is eager to expand because he enjoys private benefits of control as in Stein (1997) and Scharfstein and Stein (2000). The manager expects no private benefits if the board rejects expansion,
private benefits $B_h > 0$ in the event of successful expansion, and private benefits $B_l \geq 0$ in the event of unsuccessful expansion. We assume that $B_h \geq B_l$, so that the manager benefits weakly more from a successful expansion than from a failed expansion.

3 Board’s choice of conservatism

Ignoring the expected value $E[\theta]$ generated by ongoing operations, which does not depend on the accounting system, the ex ante value of the option to expand is:

$$U = m (\alpha X - I) + (1 - m)Q(c),$$

where

$$Q(c) = P(S_h) (P(\theta_h|S_h)X - I).$$

The shareholders’ preference function (7) can be explained as follows. If the manager successfully overrides the accounting system, which occurs with probability $m$, the report is high and the firm expands regardless of the underlying signal $S$. Because the manipulated report is uninformative, expansion yields the unconditional expected value of $(\alpha X - I)$. With probability $(1 - m)$, the manager fails to distort the accounting system and the report represents the true signal, $R = S$. When the report is undistorted, the expected firm value is $Q(c)$ as given in (8). In this case, the accounting system produces a high report with probability $P(S_h) = \alpha P(S_h|\theta_h) + (1 - \alpha)P(S_h|\theta_l)$. The firm then incurs the expansion cost $I$, and succeeds with probability $P(\theta_h|S_h)$, yielding $X$, and fails otherwise.
The first-order condition for maximizing (7) is:

\[ 0 = (1 - m) \frac{\partial Q}{\partial c} + (\alpha X - I - Q(c)) \frac{\partial m}{\partial c}, \]  

(9)

The first term represents the direct effect of conservatism on firm value. The second term represents the indirect effect of conservatism via its influence on manipulation \( m \). The next subsections analyze these two effects and then characterize the board’s choice of conservatism.

### 3.1 Direct effect of conservatism

To study the direct effect of conservatism on firm value suppose that the level of manipulation \( m \geq 0 \) is exogenously fixed. Holding \( m \) constant, a change in conservatism has the following effects on firm value

\[ \frac{\partial U}{\partial c} = (1 - m) \frac{\partial Q}{\partial c} = (1 - m) (I - \alpha X) \frac{dP(S_t)}{dc}, \]  

(10)

which follows from a substitution from Assumption (A4). Since \( P(S_t) \) is increasing in \( c \) (Assumption A2), the sign of \( \frac{\partial Q}{\partial c} \) depends on the sign of the ex ante NPV, \( \alpha X - I \). This result can be explained as follows. From Assumption (A3), an increase in conservatism \( c \) increases the information content of good signals but reduces the information content of bad signals. As a consequence, conservative accounting allows the board to better screen out expansions that would have failed but comes at the cost of blocking some investments that would have succeeded. When the ex ante NPV of expansion is negative, the advantage of conservatism (reduced overinvestment) exceeds its disadvantage (increased underinvestment) and investment efficiency increases with conservative accounting. In short, the assumption of a negative ex ante
NPV introduces a natural demand for conservative accounting rules.\textsuperscript{12} The characteristics of the accounting system affect decision making only if the manager fails to override the system, which occurs with probability $1 - m$. Thus, a higher level of manipulation weakens the positive effects of conservatism on decision making. In the extreme, when $m = 1$, the report is always favorable and $c$ no longer matters. However, as we show below, in equilibrium, the manager chooses $m \leq 1/2$. The following lemma summarizes the direct effect of conservatism:

**Lemma 1**  *When the level of manipulation is exogenously fixed, an increase in conservatism increases firm value.*

The finding that conservative accounting can produce information that allows boards to better oversee the firm’s investment strategies is consistent with arguments in Ball (2001), Watts (2003), and Ahmed and Duellman (2011). However, this viewpoint ignores the potential adverse effects of conservatism on the manager’s behavior, which we study next.

### 3.2 Indirect effect of conservatism

We now turn to the indirect effect of conservatism via its impact on the manager’s manipulation strategy. In what follows, we first study the effect of manipulation on firm value and then examine the manager’s incentive to engage in manipulation.

**Proposition 1** *Ceteris paribus, manipulation $m$ leads to overinvestment and lower firm value.*

\textsuperscript{12}This finding is related to Gigler et al. (2009), who analyze conservative accounting in a setting with debt contracts and an interim abandonment decision. They predict that conservative accounting has value only when the *ex ante* belief is that the project should be abandoned at the interim stage. Similarly, Lu and Sapra (2009) show that clients prefer conservative auditors when they have relatively poor *ex ante* payoffs from investment.
Not surprisingly, manipulation reduces investment efficiency and hence firm value:

$$\frac{\partial U}{\partial m} = P(S_l) (P(\theta_h|S_l)X - I) < 0.$$  \hspace{1cm} (11)

Successful manipulation transforms a low signal into a high report, triggering investment. Since a low signal indicates that expansion has a negative value (from assumption (4)), manipulation leads to overinvestment, consistent with the empirical findings in McNichols and Stubben (2008).

When the manager chooses the level of manipulation, he wishes to maximize his expected payoff:

$$m (\alpha B_h + (1 - \alpha)B_l) + (1 - m) [P(S_h) (P(\theta_h|S_h)B_h + P(\theta_l|S_h)B_l)] - \frac{1}{2}km^2.$$  \hspace{1cm} (12)

With probability $m$, the manager successfully distorts the accounting system and the board approves expansion, yielding the manager an expected benefit of $\alpha B_h + (1 - \alpha)B_l$. With probability $1 - m$, the manipulation attempt is unsuccessful and the manager’s expected benefits are given by the term in square brackets in (12). In this case, the unmanipulated report is high with probability $P(S_h)$, causing the board to expand. Conditional on the high report, the expansion succeeds with probability $P(\theta_h|S_h)$ and fails with probability $P(\theta_l|S_h)$, and, depending on the outcome, the manager enjoys benefits of $B_h$ or $B_l$.

In contrast to shareholders, the manager is not concerned about potential overinvestment and always prefers to expand. The preference for expansion creates a conflict of interest between the manager and the board, and induces the manager to manipulate the accounting system. The first-order condition from (12) gives the manager’s optimal manipulation choice:
\[ m = \frac{1}{k} (P(S_l|\theta_h)\alpha B_h + P(S_l|\theta_l)(1 - \alpha)B_l), \]  
with the second-order condition satisfied for \( k > 0 \). The following comparative statics result follow from (13):

**Proposition 2** The manager’s choice of manipulation, \( m \), increases if:

(i) the accounting system is more conservative (\( c \) is higher),

(ii) the strength of reporting oversight is lower (\( k \) is lower),

(iii) the manager enjoys greater private benefits (\( B_h \) and/or \( B_l \) is larger).

Part (i) of the proposition shows that conservatism increases the manager’s incentive to manipulate the accounting system. To provide the intuition for this result, it is useful to distinguish between two cases. Suppose first that the manager benefits equally from investment regardless of whether expansion succeeds (\( B_h = B_l > 0 \)). For example, the manager knows that he will likely leave the firm before the long-term outcome of expansion is realized. Conservatism increases the probability of a low signal (Assumption A2) and hence the probability that the board blocks expansion. The manager is therefore more eager to distort the accounting system to increase the chances of approval. Suppose now that the manager benefits only from successful expansions (\( B_h > 0, B_l = 0 \)). The link between conservatism and manipulation is again positive, but for slightly different reasons. In this case, the manager’s concern is not that the board rejects expansions *per se*, but that it blocks expansions that would have been successful. Thus, what matters is the information content of low signals. For example, if the accounting system is highly aggressive such that low signals are perfectly informative about economic earnings, the manager would have no incentive to override the accounting system. Conservatism, however, increases the
chances that good economic earnings are presented as low signals, leading to underinvestment. The manager responds to the increased probability of underinvestment by choosing a higher level of manipulation.

Parts (ii) and (iii) of the Proposition are intuitive and show that the manager chooses a higher level of manipulation to increase the chances of expansion, if he has a stronger preference for expansion ($B_l$ and/or $B_h$ is larger) and if reporting oversight is weaker ($k$ is smaller).

### 3.3 Optimal accounting system

We are now ready to study the optimal design of the accounting system. Acting in the best interests of the shareholders, the board chooses the level of conservatism $c$ to maximize firm value (7). Taking the first derivative of (7), we obtain

$$
\frac{dU}{dc} = (1 - m)(I - \alpha X) \frac{dP(S_i|\theta_h)}{dc} + \frac{\partial U}{\partial m} \frac{\partial m}{dc}.
$$

(14)

The first term in (14) represents the direct effect of conservatism on firm value. From Lemma 1, we know that conservatism yields a direct benefit when the project has a negative *ex ante* NPV, $\alpha X < I$, because *ceteris paribus*, it allows the board to make more prudent expansion decisions. The second term reflects the negative indirect effect of conservatism on firm value via its impact on the manager’s manipulation choice. As conservatism increases, the manager becomes more concerned about board interventions and hence has a stronger incentive to manipulate the accounting system, $\frac{\partial m}{dc} > 0$ (Proposition 2).\(^{13}\)

\(^{13}\)This discussion also shows why we expect that conservatism is germane to a setting where expansion has a negative *ex ante* value. If the ex ante NPV of expansion is positive, both the direct and indirect effects of conservatism are negative and the board will choose maximally aggressive accounting ($c = c$).
When the board chooses the accounting system, it balances the positive direct effect of conservatism on shareholder value with the negative indirect effect of conservatism via its impact on the manager’s manipulation incentive. Assuming an interior solution, the optimal level of $c$ is determined by setting condition (14) equal to zero. The following proposition summarizes these results.

**Proposition 3** There exist values $0 < \underline{k} < \bar{k} < \infty$ of oversight strength $k$ such that the board chooses an interior level of conservatism, $c \in (\underline{c}, \bar{c})$ when $k \in (\underline{k}, \bar{k})$. The resulting optimal level of conservatism yields an interior manipulation $m^* \in (0, \frac{1}{2})$.

The qualification on the strength of oversight, $k$, reflects that the costs of misreporting provide the counter-balance to maximally conservative accounting. When oversight is extremely strong ($k > \bar{k}$), manipulation is low even when the board selects maximally conservative accounting ($c = \bar{c}$). When oversight is extremely weak ($k < \underline{k}$), conservatism invites so much misreporting that the board prefers maximally aggressive accounting ($c = \underline{c}$).

## 4 Comparative statics

### 4.1 Oversight over financial reporting

One of this study’s main goals is to analyze how the manager’s ability to distort the accounting system affects the optimal degree of accounting conservatism, the equilibrium level of manipulation, and investment efficiency. We obtain the following results.

**Proposition 4** As the strength of reporting oversight, $k$, increases:

(i) the board chooses a higher level of conservatism, $c$,
(ii) the manager engages in more manipulation, \( m \), and
(iii) firm value, \( U \), increases.

Part (i) of the Proposition 4 states that the optimal level of conservatism is higher in environments in which manipulating the reporting system is more costly to the manager (\( k \) is larger). This result follows because stronger reporting oversight affects both conservatism’s direct positive effect and its negative indirect effect via manipulation. Consider first the direct effect. Ceteris paribus, more effective reporting oversight weakens the manager’s incentive to manipulate the accounting system (\( \frac{\partial m}{\partial k} < 0 \)). Since conservatism improves the decision usefulness of the report only when the manager fails to override the system, the direct beneficial effect of conservatism on firm value increases as \( m \) declines. Consider now the indirect effect. Strong reporting oversight weakens the manager’s temptation to increase manipulation in response to an increase in conservatism (\( \frac{\partial^2 m}{\partial k \partial c} < 0 \)). Thus, effective oversight reduces the adverse side effects of conservative accounting (from \( \frac{\partial U}{\partial m} < 0 \)). Both effects — the increase in the benefits of accounting conservatism and the reduction in its costs — encourage the board to choose a more conservative reporting system. This result is consistent with several empirical studies that find a positive relation between the strength of board governance and accounting conservatism in organizations.\(^{14}\)

Part (ii) of the proposition shows that the equilibrium level of manipulation increases with stricter reporting oversight (higher \( k \)). Although oversight directly curbs manipulation incentives, the board optimally reacts to this change by choosing a higher degree of conservatism, which, in turn, strengthens the manager’s desire to

\(^{14}\) See, for example, Beekes et al. (2004), Lobo and Zhou (2006), Ahmed and Duellman (2007), Krishnan and Visvanathan (2008), García Lara et al. (2009), Goh and Li (2011), and Ramalingegowda and Yu (2012).
manipulate. These two forces have opposite effects on manipulation, but the indirect effect via the higher conservatism dominates, resulting in an overall increase in manipulation. To see why the indirect effect dominates, note that the board can always react to an increase in $k$ by mildly increasing $c$ such that the manager’s manipulation incentive remains unchanged. However, a higher $k$ reduces the marginal effect of conservatism on manipulation ($\frac{\partial^2 m}{\partial c \partial k} < 0$) which provides an additional inducement to increase $c$ beyond the level required to hold $m$ constant. The increase in $c$ therefore pushes the level of manipulation above the initial level, implying that stricter reporting oversight results in more manipulation, not less.

Although stronger reporting oversight is associated with greater manipulation, this does not imply that oversight reduces investment efficiency. Rather, Proposition 4 demonstrates that effective reporting oversight (high $k$) leads to both greater manipulation and more useful accounting reports. The higher manipulation in firms with stronger oversight is merely a by-product of the board’s optimal choice of conservatism. The manipulation dampens, but does not overwhelm, the effect of higher conservatism. This finding suggests that the presence of accounting manipulation does not always indicate that accounting reports lack decision usefulness.

Formally, the result in part (iii) of the proposition follows from applying the envelope theorem to the board’s objective function. Keeping $c$ constant, an increase in reporting oversight, $k$, directly curbs manipulation, and hence increases the information content of the report and the investment efficiency. The board responds to the change in $k$ by increasing the level of accounting conservatism, which ultimately leads to more manipulation. But, by the envelope theorem, this indirect effect on $U$ via $c$ can be ignored and the shareholders’ payoff is increasing in $k$. 
Our model also predicts a positive association between conservatism and investment efficiency, consistent with empirical findings in Ahmed and Duellman (2011). However, one needs to be careful in interpreting this result. A positive correlation in the data does not imply that increases in conservatism unambiguously improve the firm’s investment decisions. In the context of our model, there is an optimal (interior) level of conservatism and deviating from this level reduces investment efficiency. Our prediction of a positive association arises because both the optimal choice of conservatism and the investment efficiency are greater in firms with more effective oversight than in firms with weaker oversight.

4.2 Management preferences

The effect of the manager’s private benefits $B_h$ and $B_t$ on conservatism are the mirror image of the effect of oversight $k$. Manipulation depends on the trade-off between the manager’s private benefits and the costs imposed by oversight.

**Proposition 5** If either of the manager’s private benefits, $B_h$ or $B_t$, increase, then:

(i) the board chooses a lower level of conservatism, $c$,
(ii) the manager engages in less manipulation, $m$, and
(iii) firm value, $U$, decreases.

Bushman and Piotroski (2006) find empirical evidence suggesting that accounting conservatism is greater in countries with stronger legal protection. They interpret this relation as being driven by stronger legal systems increasing investor demands for conservative accounting in order to curtail managers’ attempts at rent extraction. This finding is also consistent with part (i) of Proposition 5, if we assume that strong legal systems curtail private benefits from manipulation by, for example, reducing
managers’ ability to hide assets subject to clawback provisions. In this case, a stronger legal system renders accounting conservatism more desirable by directly reducing the payoffs from manipulation.

4.3 Investment opportunities

Finally, we consider how the \textit{ex ante} profitability of expansion affects the optimal design of the accounting system.

**Proposition 6** If the value of investment opportunities declines ($I$ increases), then:

(i) the board chooses a higher level of conservatism, $c$, and
(ii) the manager engages in more manipulation, $m$,
(iii) firm value, $U$, declines.

A decrease in the \textit{ex ante} profitability of expansion (increase in $I$) increases the direct benefit from conservative accounting ($\frac{\partial^2 U}{\partial c \partial I} > 0$) but also increases the indirect cost of conservatism, via manipulation ($\frac{\partial^2 U}{\partial m \partial I} > 0$). The former effect dominates the latter so that firms with less valuable growth opportunities optimally rely on more conservative accounting systems. This is consistent with Bushman et al.’s (2011) evidence that conservative accounting helps firms to curtail unprofitable investments. The increase in conservatism, in turn, strengthens the manager’s incentive to manipulate, which explains part (ii) of the proposition. Finally, an increase in $I$ decreases firm value because it directly reduces the value of the expansion opportunity.

5 Discussion

Empiricists cannot directly observe the board’s choice of conservatism $c$. They instead observe the accounting system’s output, which also reflects manipulation. An
observable measure that captures the magnitude of conservative accounting in our study is the frequency of low reports, \( P(R_l) = (1 - m)P(S_l) \), which is analogous to empirical measures such as large negative income (Barth et al. 2008), large negative accruals (Givoly and Hayn 2000), or low book values that lead to low book-to-market ratios (Stober 1996). Because the board’s choice of conservatism \( c \) increases both the probability that the baseline system produces a low signal \( P(S_l) \) and the level of manipulation \( m \), it does not immediately follow that the model’s parameters have the same directional impact on \( P(R_l) \) as they do on \( c \). The next proposition, however, shows that this is indeed the case. This finding implies that the manager’s manipulation dampens the effect of, for example, oversight \( k \) on the observed reports, but manipulation is not so high as to reverse the direction of the impact.

**Proposition 7** The probability \( P(R_l) \) of observing low reports increases with the board’s choice of conservatism \( c \) and is greater in firms in which reporting oversight is more effective (higher \( k \)); growth opportunities are less valuable (higher \( I \)); and managers enjoy smaller benefits from expansion (lower \( B_h \) and \( B_l \)).

Starting with Basu (1997), many empirical studies focus on measures that proxy for the asymmetric timeliness of accounting reports such as the correlation between accounting earnings and stock returns. The concept of timeliness inherently relates to multiperiod settings and hence does not directly translate to our static model. However, if we take the state \( \theta \) as an unrealized gain (\( \theta_h \)) or loss (\( \theta_l \)), then a reduced likelihood of recognizing unrealized gains would be reflected by a reduction in \( P(R_h|\theta_h) \) and an increased likelihood of recognizing unrealized losses would be reflected by an increase in \( P(R_l|\theta_l) \). We can therefore view \( P(R_l|\theta_l) - P(R_h|\theta_h) \) as a
gauge of asymmetric loss recognition. Many studies also utilize Basu’s (1997) prediction that conservative accounting causes gains to be more persistent than losses. The analogous measure from our model compares the Time 2 realization $\theta$ to the Time 1 report $R$, where $P(\theta_h|R_h) - P(\theta_l|R_l)$ reflects the extent to which gains are more persistent than losses. The next proposition shows that changes in the model’s parameters have the same directional effects on $P(R_l|\theta_l) - P(R_h|\theta_h)$ and $P(\theta_h|R_h) - P(\theta_l|R_l)$ as they have on $c$.

**Proposition 8** Asymmetric loss recognition $(P(R_l|\theta_l) - P(R_h|\theta_h))$ and the differential persistence of gains versus losses $(P(\theta_h|R_h) - P(\theta_l|R_l))$ increase with the board’s choice of conservatism $c$ and are greater in firms in which reporting oversight is more effective (higher $k$); growth opportunities are less valuable (higher $I$); and managers enjoy lower private benefits from expansion (lower $B_h$ and $B_l$).

Just as empiricists cannot directly observe the board’s choice of conservatism $c$, they also cannot directly observe the manager’s manipulation choice $m$. An observable measure that captures $m$ in our model is detected manipulations such as restatements or legal settlements for misreporting. Assuming that a project failure triggers an investigation, the frequency of detected manipulations should be proportional to $P(\theta_l, R_h, S_l) = (1 - \alpha)mP(S_l|\theta_l)$ — a failed expansion that later investigation reveals to have been based on a low underlying signal $S_l$. The following prediction shows that the model’s parameters have the same directional impact on detected manipulations $P(\theta_l, R_h, S_l)$ as they do on the manager’s choice of $m$.

**Proposition 9** Detected manipulations $P(\theta_l, R_h, S_l)$ are greater in firms in which reporting oversight is more effective (higher $k$); growth opportunities are less valuable

---

15Alternatively, if we view $\theta$ as the information that could potentially be reflected in stock prices, then $P(R_l|\theta_l) > P(R_h|\theta_h)$ indicates that accounting reports reflect more good news than bad news.

24
(higher $I$); and managers enjoy lower private benefits from expansion (lower $B_h$ and $B_l$).

Lastly, we note the effect of conservatism on rational conjectures about whether the manager has manipulated earnings. In the context of our model, any financial statement user knows that a low report has not been manipulated ($P(S_h|R_l) = 0$), so that the perceived likelihood of manipulation is $P(S_l|R_h) = \frac{mP(S_l)}{P(R_h)}$. Conservatism increases both manipulation $m$ and the likelihood $P(S_l)$ that the baseline system produces a low signal, whereas it decreases the likelihood $P(R_h)$ of a high report. These factors all cause conservatism to increase the perceived likelihood that a high report has been manipulated. Intuitively, if the accounting system is conservative, it should not produce many high reports, which should increase the belief that a high report has been manipulated. Overall, conservatism increases the informativeness of high reports despite the manipulation. The following proposition summarizes this observation and states that the model’s parameters have the same impact on the perceived likelihood of manipulation as they do on the manager’s choice of manipulation $m$.

**Proposition 10** The perceived likelihood of manipulation $P(S_l|R_h)$ increases with the board’s choice of conservatism $c$ and is greater in firms in which reporting oversight is more effective (higher $k$); growth opportunities are less valuable (higher $I$); and managers enjoy lower private benefits from expansion (lower $B_h$ and $B_l$).

### 6 Conclusion

We develop a model to analyze how the board’s ability to restrain accounting manipulation affects the optimal choice of conservatism, the magnitude of accounting manipulation, and investment efficiency. The accounting report provides imperfect
information about economic earnings, and guides the board’s decision of whether
to approve or reject new investment opportunities such as expanding the firm. *Ce-
teris paribus*, accounting conservatism is desirable when directors are more concerned
about the risk of approving expansions that fail than about the risk of rejecting ex-
pansions that would have been successful. However, the very fact that conservatism
enables the board to more aggressively intervene in the firm’s investment decisions
encourages the manager to distort the accounting system. The greater the level of
conservatism, the greater is the manager’s incentive to manipulate the system.

The optimal (interior) level of conservatism balances the benefit of better expan-
sion decisions when the manager fails to distort the accounting system against the
detriment of providing an incentive to engage in manipulation. We show that boards
that are more effective in restricting manipulation can better exploit the benefits of
conservatism while curtailing its costs. As a result, within the set of firms for which
overinvestment is a bigger concern than underinvestment, boards with stronger re-
porting oversight use more conservative accounting.

Paradoxically, our model suggests that more effective reporting oversight is asso-
ciated with more, rather than less, accounting manipulation. This follows because
stronger boards not only directly deter manipulation, but also choose more conserv-
ptive accounting systems. A higher level of conservatism, in turn, encourages ma-
nipulation, and this latter effect dominates the former. Although firms with stronger
board oversight exhibit greater manipulation, oversight unambiguously leads to more
efficient investment decisions.
References


Gao, Y. and Wagenhofer, A. 2013. Accounting conservatism and board efficiency. Working paper, City University of Hong Kong and University of Graz.


A Appendix

Proof of Proposition 2

The results follow from applying the implicit function theorem to (13), where the sign of the effect of $c$ follows from Assumption (A2).

Proof of Proposition 3

Using (13) to obtain $\frac{\partial m}{\partial c}$ and substituting into (14) yields:

$$0 = \left( (1 - m)(I - \alpha X) + P(S_i) (P(\theta_h|S_i)X - I) \frac{\alpha B_h + (1 - \alpha)B_l}{k} \right) \frac{dP(S_i|\theta_h)}{dc}, \quad (A.1)$$

The second-order condition is:

$$0 > \left( (1 - m)(I - \alpha X) + P(S_i) (P(\theta_h|S_i)X - I) \frac{\alpha B_h + (1 - \alpha)B_l}{k} \right) \frac{d^2P(S_i|\theta_h)}{dc^2}$$

$$- 2(I - \alpha X) \frac{\alpha B_h + (1 - \alpha)B_l}{k} \left( \frac{dP(S_i|\theta_h)}{dc} \right)^2, \quad (A.2)$$

which holds under the assumption that $\alpha X < I$. Expression (A.2) implies that the first-order condition identifies a local maximum. The term in parentheses that multiplies $\frac{dP(S_i|\theta_h)}{dc}$ in the first-order condition (A.1) is strictly decreasing in $c$, as can be seen in the second line of (A.2). This implies that $U$ has only one critical point ($c^*$ such that $\frac{dU}{dc} = 0$), which implies that the first-order condition identifies the global maximum.

Rearranging the first-order condition gives:

$$1 - m^* = \frac{P(S_i; c^*)(I - P(\theta_h|S_i; c^*)X)}{I - \alpha X} \frac{1}{k} \frac{\alpha B_h + (1 - \alpha)B_l}{\alpha B_h + (1 - \alpha)B_l}. \quad (A.3)$$

In order to show that $m^* < \frac{1}{2}$, we assume that $m^* > \frac{1}{2}$ and derive a contradiction. If
\( m^* > \frac{1}{2} \), then \( m^* > 1 - m^* \) and (A.3) implies that:

\[
\frac{P(S_l; c*) I - P(S_l|\theta_h) \alpha X}{I - \alpha X} \frac{\alpha B_h + (1 - \alpha) B_l}{k} < \frac{P(S_l|\theta_h; c^*) \alpha B_h + P(S_l|\theta_l; c^*)(1 - \alpha) B_l}{m^*}.
\]  

(A.4)

However, some rearrangements show that the above inequality is equivalent to:

\[
(P(S_l|\theta_l; c^*) - P(S_l|\theta_h; c^*)) ((1 - \alpha) \alpha B_h I + \alpha (1 - \alpha) B_l (X - I)) < 0,
\]  

(A.5)

which violates Assumption (A1)’s requirement that \( P(S_l|\theta_l) > P(S_l|\theta_h) \). Thus it must be the case that \( m^* < \frac{1}{2} \).

If an interior \( c \) is optimal, then the term in parentheses in (A.1) must be positive at \( c = \underline{c} \) and negative at \( c = \bar{c} \). In order to identify the conditions for an interior optimum, we first show that the term in parentheses in (A.1) that determines the sign of \( \frac{du}{dc} \) is increasing in \( k \):

\[
-(I - \alpha X) \frac{\partial m}{\partial k} - P(S_l) (P(\theta_h|S_l) X - I) \frac{1}{k^2} (\alpha B_h + (1 - \alpha) B_l) > 0,
\]  

(A.6)

where the inequality follows from \( \frac{\partial m}{\partial k} < 0 \) (See Proposition 2) and \( P(\theta_h|S_l) X - I < \alpha X - I < 0 \). If \( k \to \infty \), then \( m \) and \( \frac{\partial m}{\partial c} \) equal zero and (A.1) is positive. If \( k \to 0 \), then \( m \) jumps from zero to one for any strictly positive \( c \), and (A.1) is unbounded negative. For any \( c \), there is a unique value of \( k \) below which (A.1) is positive and above which it is negative, which can be obtained by solving (A.1) for \( k \). The second-order condition implies that the term in parentheses is decreasing in \( c \), so the \( k \) that sets it to zero for \( \bar{c} \) is greater than the \( k \) that sets it to zero for \( \underline{c} \), which we denote by \( \bar{k} \) and \( \underline{k} \), respectively.
Proof of Proposition 4

Denote the right-hand-side of the first-order condition (A.1) by $U_c$. Because the second-order condition is satisfied, the sign of $\frac{dc}{dk}$ is the same as that of $\frac{\partial U_c}{\partial k}$, which is:

$$\frac{\partial U_c}{\partial k} = -(I - \alpha X) \frac{dP(S_t|\theta_h)}{dc} \left(\frac{1}{km}\right) \frac{\partial^2 U/\partial c \partial m}{\partial m/\partial k} + P(S_t)(P(\theta_h|S_t)X - I) \left(\frac{1}{k^2} (\alpha B_h + (1 - \alpha)B_I) \right) \frac{dP(S_t|\theta_h)}{dc}. \quad (A.7)$$

Proposition 2 shows that $\frac{dm}{dk} < 0$ which, combined with $\frac{\partial^2 U}{\partial c \partial m} < 0$, implies that the direct effect of $k$ on $m$ contributes to an increase in $c$. Because $P(\theta_h|S_t) < \alpha$ and $\alpha X < I$ imply that $\frac{\partial m}{\partial c} < 0$, and $\frac{\partial^2 m}{\partial c \partial k} < 0$, an increase in $k$ also contributes to an increase in $c$ by reducing the manager’s response to increases in conservatism.

For use in computing $\frac{dm}{dk}$, we can write $\frac{dc}{dk}$ as:

$$\frac{dc}{dk} = \frac{-\partial U_c/\partial k}{\partial U_c/\partial c} = \frac{1}{2k} \frac{1}{\partial m/\partial c},$$

where the second equality follows from substituting from the first-order condition (A.1) in the numerator and using $\frac{\partial U_c}{\partial c} = -2(I - \alpha X) \frac{dP(S_t|\theta_h)}{dc} \frac{\partial m}{\partial c}$. This gives:

$$\frac{dm}{dk} = \frac{\partial m}{\partial k} + \frac{\partial m}{\partial c} \frac{dc}{dk} = \frac{1}{k} \frac{m - 1}{2k} = \frac{1 - 2m}{2k}, \quad (A.8)$$

which is positive because Proposition 3 shows that $m^* < \frac{1}{2}$.

From the envelope theorem, the sign of $\frac{dU}{dk}$ is the same as the sign of $\frac{\partial U}{\partial m} \frac{dm}{dk}$, which is positive because $\frac{\partial U}{\partial m}$ and $\frac{dm}{dk}$ are both negative.
Proof of Proposition 5

First, we have \( \frac{\partial m}{\partial B_h} = \frac{1}{k} P(S_l|\theta_h)\alpha \) and \( \frac{\partial m}{\partial B_l} = \frac{1}{k} P(S_l|\theta_l)(1 - \alpha) \). For the effects on \( c \), we have the following for \( B_i, i \in \{h,l\} \):

\[
\frac{dc}{dB_i} = -\frac{\partial U_c}{\partial B_i} = -\frac{I - \alpha X + \frac{P(S_l)}{P(S_l|\theta_h)} (I - P(\theta_h|S_l)X) \frac{\partial m}{\partial B_i}}{2(I - \alpha X) \frac{\partial m}{\partial c}} < 0, \quad (A.9)
\]

The effects on \( m \) are then:

\[
\frac{dm}{dB_h} = \frac{\partial m}{\partial B_h} + \frac{\partial m}{\partial c} \frac{dc}{dB_h} = \frac{I - \alpha X - \frac{P(S_l)}{P(S_l|\theta_h)} (I - P(\theta_h|S_l)X) \frac{\partial m}{\partial B_h}}{2(I - \alpha X) \frac{\partial m}{\partial B_h}} < 0.
\]

where the inequality follows from \( \frac{P(S_l)}{P(S_l|\theta_h)} > 1 \) and \( P(\theta_h|S_l) < \alpha \).

\[
\frac{dm}{dB_l} = \frac{\partial m}{\partial B_l} + \frac{\partial m}{\partial c} \frac{dc}{dB_l} = \frac{I - \alpha X - \frac{P(S_l)}{P(S_l|\theta_h)} (I - P(\theta_h|S_l)X) \frac{\partial m}{\partial B_l}}{2(I - \alpha X) \frac{\partial m}{\partial B_l}} = -\frac{(P(S_l|\theta_h) - P(S_l|\theta_h)) \alpha (X - I) \frac{\partial m}{\partial B_l}}{2(I - \alpha X) P(S_l|\theta_i)} < 0. \quad (A.11)
\]

The effect on \( U \) follows from the envelope theorem since \( \frac{\partial U}{\partial m} < 0 \) and \( \frac{\partial m}{\partial B_h}, \frac{\partial m}{\partial B_l} > 0 \).

Proof of Proposition 6

Denote the right-hand-side of the first-order condition (A.1) by \( U_c \). Because the second-order condition is satisfied, the sign of \( \frac{dc}{dT} \) is the same as that of \( \frac{\partial U_c}{\partial T} \), which is:

\[
\frac{\partial U_c}{dT} = \left( (1 - m) - P(S_l) \frac{1}{k} (\alpha B_h + (1 - \alpha) B_l) \right) \frac{dP(S_l|\theta_h)}{dT} = 0,
\]

where the second line follows from a substitution for \( P(S_l) \frac{1}{k} (\alpha B_h + (1 - \alpha) B_l) \) from the board’s first-order condition (A.1) and the inequality follows from \( P(\theta_h|S_l) < \alpha \).

Because \( I \) has no direct effect on \( m \) and \( \frac{\partial m}{\partial c} > 0 \), \( \frac{dc}{dT} > 0 \) implies \( \frac{dm}{dT} > 0 \). The envelope theorem implies that \( \frac{dU}{dT} < 0 \) since \( \frac{\partial U}{\partial T} < 0 \). 

\[\square\]
Proof of Proposition 7

We first note that low reports increase with the board’s choice of \(c\):

\[
\frac{dP(R_l)}{dc} = (1 - m) \frac{dP(S_l)}{dc} - P(S_l) \frac{\partial m}{\partial c} = \left( (1 - m) - P(S_l) \frac{\alpha B_h + (1-\alpha) B_l}{k} \right) \frac{dP(S_l)}{dc}
\]

\[
= \frac{\alpha - m \frac{S_l}{I - \alpha X}}{1 - m \frac{S_l}{I - \alpha X}} \cdot X \cdot P(S_l) \frac{\alpha B_h + (1-\alpha) B_l \frac{dP(S_l)}{dc}}{k} > 0, \tag{A.13}
\]

where the second line substitutes from (A.1) for \(1 - m\) and simplifies. Given (A.13), Propositions 2 and 4 through 6 imply:

\[
\frac{dP(R_l)}{dk} = \frac{dP(R_l)}{dc} \frac{dc}{dk} + \frac{\partial P(R_l)}{\partial m} \frac{\partial m}{\partial k} > 0, \tag{A.14}
\]

\[
\frac{dP(R_l)}{dT} = \frac{dP(R_l)}{dc} \frac{dc}{dT} + \frac{\partial P(R_l)}{\partial m} \frac{\partial m}{\partial T} > 0, \tag{A.15}
\]

\[
\frac{dP(R_l)}{dB_l} = \frac{dP(R_l)}{dc} \frac{dc}{dB_l} + \frac{\partial P(R_l)}{\partial m} \frac{\partial m}{\partial B_l} < 0. \tag{A.16}
\]

Proof of Proposition 8

As we note in Section 2, the report \(R\) satisfies (A2): \(\frac{dP(R_l|\theta)}{dc} > 0\) and \(\frac{dP(R_h|\theta)}{dc} < 0\).

This implies that the difference \(P(R_l|\theta_l) - P(R_h|\theta_h)\) increases in \(c\). We also have:

\[
P(R_l|\theta_l) - P(R_h|\theta_h) = (1 - m)P(S_l|\theta_l) - (1 - mP(S_l|\theta_h))
\]

\[
= (1 - m) (P(S_l|\theta_l) - P(S_l|\theta_h)) - P(S_h|\theta_h), \tag{A.17}
\]
which implies that \( \frac{\partial(P(R_l|\theta_m)-P(R_h|\theta_m))}{\partial m} < 0 \). Propositions 2 and 4 through 6 then imply:

\[
\frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dk} = \frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dc} \frac{dc}{dk} + \frac{\partial(P(R_l|\theta_m)-P(R_h|\theta_m))}{\partial m} \frac{\partial m}{dk} > 0, \quad (A.18)
\]

\[
\frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dI} = \frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dc} \frac{dc}{dI} + \frac{\partial(P(R_l|\theta_m)-P(R_h|\theta_m))}{\partial m} \frac{\partial m}{dI} > 0, \quad (A.19)
\]

\[
\frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dB_i} = \frac{d(P(R_l|\theta_m)-P(R_h|\theta_m))}{dc} \frac{dc}{dB_i} + \frac{\partial(P(R_l|\theta_m)-P(R_h|\theta_m))}{\partial m} \frac{\partial m}{dB_i} < 0. \quad (A.20)
\]

As we note in Section 2, the report \( R \) satisfies (A3): \( \frac{d}{dc} \left( \frac{P(R|\theta)}{P(R|\theta)} \right) > 0 \). This implies that \( P(\theta_h|R_h) \) is increasing in \( c \) and \( P(\theta_l|R_l) \) is decreasing in \( c \), which implies that the difference \( P(\theta_h|R_h)-P(\theta_l|R_l) \) is increasing in \( c \). We also have that \( P(\theta_l|R_l) = P(\theta_l|S_l) \), which does not depend on \( m \), and \( P(\theta_h|R_h) \) is decreasing in \( m \) so that the difference \( P(\theta_h|R_h)-P(\theta_l|R_l) \) is decreasing in \( m \). \(^{16}\) Propositions 2 and 4 through 6 then imply:

\[
\frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dk} = \frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dc} \frac{dc}{dk} + \frac{\partial(P(\theta_h|R_h)-P(\theta_l|R_l))}{\partial m} \frac{\partial m}{dk} > 0, \quad (A.21)
\]

\[
\frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dI} = \frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dc} \frac{dc}{dI} + \frac{\partial(P(\theta_h|R_h)-P(\theta_l|R_l))}{\partial m} \frac{\partial m}{dI} > 0 \quad (A.22)
\]

\[
\frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dB_i} = \frac{d(P(\theta_h|R_h)-P(\theta_l|R_l))}{dc} \frac{dc}{dB_i} + \frac{\partial(P(\theta_h|R_h)-P(\theta_l|R_l))}{\partial m} \frac{\partial m}{dB_i} < 0. \quad (A.23)
\]

\[\blacksquare\]

**Proof of Proposition 9**

Denote the variable of interest by \( z \in \{k, I, B_h, B_l\} \). We have:

\[
\frac{dP(\theta_l|R_h,S_l)}{dz} = P(S_l|\theta_l)(1-\alpha)\frac{dm}{dz} + m\frac{dP(S_l)}{dc}(1-\alpha)\frac{dc}{dz}. \quad (A.24)
\]

\(^{16}\)Formally, \( P(\theta_l|R_l) = P(\theta_l|S_l) \) because the manager never manipulates the signal \( S_h \) downward so that \( P(S_l|R_l) = 1 \). Direct computations show that \( P(S_l|\theta_h) < P(S_l) \) and \( P(S_h|\theta_h) > P(S_h) \), which holds because the signal is informative by assumption (A1), imply that \( P(\theta_h|R_h) \) is decreasing in \( m \).
For the effects of oversight and growth opportunities \((z \in \{k, I\})\), we have \(\frac{dP(\theta, R_h, S_l)}{dz} > 0\) since \(\frac{dm}{dk}, \frac{dc}{dk}, \frac{dm}{dI}, \frac{dc}{dI} > 0\) from Propositions 4 and 6. For the effects of private benefits \((z \in \{B_h, B_l\})\), we have \(\frac{dP(\theta, R_h, S_l)}{dz} < 0\) since \(\frac{dm}{dB_h}, \frac{dc}{dB_h}, \frac{dm}{dB_l}, \frac{dc}{dB_l} < 0\) from Proposition 5. \(\Box\

**Proof of Proposition 10**

Because manipulation \(m\), the probability \(P(S_l)\) of low signals, and the probability \(P(R_l)\) of low reports increase with \(c\), we have \(\frac{dP(S_l|R_h)}{dc} > 0\). For any parameter \(z\), we have:

\[
\frac{dP(S_l|R_h)}{dz} = \frac{P(S_l)}{P(R_h)} \frac{dm}{dz} + \frac{m}{P(R_h)} \frac{dP(S_l)}{dc} \frac{dm}{dz} - \frac{mP(S_l)}{P(R_h)^2} \frac{dP(R_h)}{dz} = \frac{P(S_l)}{P(R_h)} \frac{dm}{dz} + \frac{m}{P(R_h)} \frac{dP(S_l)}{dc} \frac{dm}{dz} + \frac{mP(S_l)}{P(R_h)^2} \frac{dP(R_l)}{dz}.
\]

(A.25)

Prediction 7 and Propositions 7 through 6 then imply Prediction 10 because \(k, I, B_h,\) and \(B_l\) have the same directional impact on \(m, c,\) and \(P(R_l)\). \(\Box\)