Management Science

Corporate Governance, Accounting Conservatism, and Manipulation

Judson Caskey, Volker Laux

To cite this article:
Judson Caskey, Volker Laux (2017) Corporate Governance, Accounting Conservatism, and Manipulation. Management Science 63(2):424-437. http://dx.doi.org/10.1287/mnsc.2015.2341

informs
http://pubsonline.informs.org/journal/mnsc/

MANAGEMENT SCIENCE
Vol. 63, No. 2, February 2017, pp. 424–437
ISSN 0025-1909 (print), ISSN 1526-5501 (online)

Corporate Governance, Accounting Conservatism, and Manipulation

Judson Caskey,[a] **Volker Laux**[b]

[a] UCLA Anderson School of Management, University of California, Los Angeles, Los Angeles, California 90024; [b] McCombs School of Business, University of Texas at Austin, Austin, Texas 78712

Contact: judson.caskey@anderson.ucla.edu (JC); volker.laux@mccombs.utexas.edu (VL)

Received: November 27, 2013
Accepted: August 13, 2015
Published Online in Articles in Advance: March 10, 2016

https://doi.org/10.1287/mnsc.2015.2341

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, ceteris paribus, conservative accounting is desirable because it allows the board of directors to better oversee the firm's investment decisions. 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.

History: Accepted by Mary Barth, accounting.

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 the failure to use conservative accounting can stem from weak boards that do not act in shareholders' best interests.

We develop a model on the optimal level of conservatism from shareholders' perspective and show that the optimal level varies with the board's ability to oversee financial reporting, which leads to the positive relation between conservative accounting and board monitoring depicted in the empirical literature. 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 offers 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 signals 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 it 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, the effect of conservatism on firm value is positive only when the benefit of avoiding overinvestment exceeds the cost of underinvestment. This is the case, for example, when unconditional expansions have a negative net present value (NPV) and conservatism changes the bias of the accounting system without reducing its overall informativeness by too much.

However, 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 because of private benefits of control (Stein 1997, Scharfstein and Stein 2000).[5] 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 transforms low signals from the baseline accounting system into high reports, triggering expansion. Because low signals indicate that expansion has a negative expected value, manipulation leads to overinvestment, consistent with the empirical findings in 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, reporting oversight reduces the probability that the accounting system is distorted, and thus it increases the likelihood that conservatism 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 byproduct 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 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 reporting 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. By 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. Results from Bertomeu et al. (2013) show that contracts can create, rather than eliminate, forces such that conservative accounting leads to manipulation. By 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 report, which imprecisely signals talent, or a perfect, but incrementally costly, signal. Gao and Wagenhofer (2013) show that boards with lower information acquisition costs (which represents stronger governance) optimally choose more conservative accounting. We also predict a positive relation between board governance and conservatism, but for different reasons.[7] 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 proxies for the model's constructs. Section 6 concludes. 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. On the basis of this report, the board decides whether to approve expansion of current operations. At time 2, the firm realizes and distributes its terminal payoffs.

2.1. 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 θ 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 θ. The a priori probability of high economic earnings $\theta = \theta_h$ is given by $\alpha < 1$.

2.2. 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 θ. 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 $\mathrm{P}(S_i \mid \theta_j; c)$ be the probability that the accounting system generates signal S_i, given economic earnings, θ_j, with $i, j \in \{h, l\}$, and given the level of conservatism, denoted by c. The inability to perfectly observe θ stems from both the noise inherent in estimating the future cash flows from current transactions and 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, $c \in [\underline{c}, \bar{c}]$, where a higher c reflects a higher degree of conservatism. All players observe the choice of c, and $\mathrm{P}(S_i \mid \theta_j; c)$ is twice differentiable with respect to c. We make the following assumptions.[8]

Assumption A1. *For any given c, the likelihood ratio $\mathrm{P}(S \mid \theta_h; c)/\mathrm{P}(S \mid \theta_l; c)$ is increasing in the signal S: $\mathrm{P}(S_h \mid \theta_h; c)/\mathrm{P}(S_h \mid \theta_l; c) > 1 > \mathrm{P}(S_l \mid \theta_h; c)/\mathrm{P}(S_l \mid \theta_l; c)$.*

Assumption A2. *For each state θ, the probability of a low report is increasing in c: $\mathrm{dP}(S_l \mid \theta; c)/\mathrm{d}c > 0$.*

Assumption A3. *For each signal S, the likelihood ratio $\mathrm{P}(S \mid \theta_h; c)/\mathrm{P}(S \mid \theta_l; c)$ is increasing in c.*[9]

Assumption A4. *Conservatism increases the conditional likelihood of low signals with $\mathrm{dP}(S_l \mid \theta_l; c)/\mathrm{d}c = \gamma(\mathrm{dP}(S_l \mid \theta_h; c)/\mathrm{d}c)$, $\gamma > 0$, for all S and 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 stated, $\mathrm{P}(\theta_h \mid S_h; c) \geq \alpha$ and $\mathrm{P}(\theta_l \mid S_l; c) \geq 1-\alpha$. Assumption A2 implies that conservative accounting increases the probability that the information system produces low rather than high signals. Assumption 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,

$$\frac{\mathrm{dP}(\theta_h \mid S_h; c)}{\mathrm{d}c} > 0 \quad \text{and} \quad \frac{\mathrm{dP}(\theta_l \mid S_l; c)}{\mathrm{d}c} < 0, \tag{1}$$

where

$$\begin{aligned} \mathrm{P}(\theta_h \mid S_h; c) &= \frac{\alpha}{\alpha + (1-\alpha)(\mathrm{P}(S_h \mid \theta_l; c)/\mathrm{P}(S_h \mid \theta_h; c))}, \\ \mathrm{P}(\theta_l \mid S_l; c) &= \frac{1-\alpha}{\alpha(\mathrm{P}(S_l \mid \theta_h; c)/\mathrm{P}(S_l \mid \theta_l; c)) + 1 - \alpha}. \end{aligned} \tag{2}$$

The parameter γ in Assumption A4 allows conservatism c to have different effects on the distribution of the signal depending on the underlying economic state $\theta \in \{\theta_h, \theta_l\}$. When $\gamma = 1$, $\partial \mathrm{P}(S_l \mid \theta; c)/\partial c$ is independent of θ. When $\gamma > 1$, an increase in c will increase the probability of correctly classifying the low state faster than it increases the probability of incorrectly classifying the high state ($\mathrm{dP}(S_l \mid \theta_l; c)/\mathrm{d}c > \mathrm{dP}(S_l \mid \theta_h; c)/\mathrm{d}c > 0$). Conversely, when $\gamma < 1$, an increase in c will increase the probability of incorrectly classifying the high state faster than it increases the probability of correctly classifying the low state ($\mathrm{dP}(S_l \mid \theta_h; c)/\mathrm{d}c > \mathrm{dP}(S_l \mid \theta_l; c)/\mathrm{d}c > 0$).

As a consequence, a change in c affects not only the bias of the accounting system but, if $\gamma \neq 1$, also its overall informativeness, which we denote by Π:[10]

$$\Pi \equiv \mathrm{P}(S_h \mid \theta_h; c) + \mathrm{P}(S_l \mid \theta_l; c) - 1. \qquad (3)$$

The signal perfectly reveals θ at $\Pi = 1$ ($\mathrm{P}(S_h \mid \theta_h; c) = \mathrm{P}(S_l \mid \theta_l; c) = 1$) and is uninformative at $\Pi = 0$ ($\mathrm{P}(S \mid \theta_h; c) = \mathrm{P}(S \mid \theta_l; c)$ for $S \in \{S_h, S_l\}$). An increase in conservatism increases the overall informativeness ($\mathrm{d}\Pi/\mathrm{d}c > 0$) when $\gamma > 1$, because the effect on correctly classifying θ_l dominates the effect on incorrectly classifying θ_h. Conversely, conservatism reduces overall informativeness ($\mathrm{d}\Pi/\mathrm{d}c < 0$) when $\gamma < 1$, because the misclassification effect dominates. For $\gamma = 1$, conservatism has no effect on informativeness. Clearly, given a choice, the board would prefer the highest possible value of γ because for any given level of conservatism, a larger γ implies a larger overall informativeness. However, since our focus here is on the optimal choice of c, we treat γ as exogenously given.

Several papers on conservatism use the parameterization $\mathrm{P}(S_h \mid \theta_h) = \lambda + \delta$ and $\mathrm{P}(S_l \mid \theta_l) = 1 - \delta$, where δ reflects a reduction in conservatism (e.g., Venugopalan 2004, Bagnoli and Watts 2005, Chen et al. 2007, Li 2013, Bertomeu et al. 2013, Drymiotes and Hemmer 2013, Nan and Wen 2014). Our setting can replicate this parameterization by setting $\gamma = 1$ and assuming that $\mathrm{dP}(S_l \mid \theta_l; c)/\mathrm{d}c = \mathrm{dP}(S_l \mid \theta_h; c)/\mathrm{d}c = 1$. Also note that the λ parameter in these studies reflects the overall informativeness of the accounting system and corresponds to our Π measure.

2.3. Manipulation

The manager has the ability to tamper with the accounting system such that the publicly observed report, denoted by $R \in \{R_h, R_l\}$, can deviate from the signal S. Specifically, at time 0, after observing the firm's accounting policies (i.e., conservatism c), the manager chooses an unobservable level of manipulation, denoted by $m \in [0, 1]$.[11] Since the manager never wishes to misreport good news, manipulation is only relevant when the signal is low. With probability m, manipulation is successful, and a low signal S_l is misclassified as a high report R_h; with probability $1 - m$, the manipulation attempt fails, and a low signal is correctly classified as a low report. Thus, the probability of a high report given manipulation m is

$$\begin{aligned}\mathrm{P}(R_h \mid \theta; c, m) \\ = \mathrm{P}(S_h \mid \theta; c) + m\mathrm{P}(S_l \mid \theta; c), \quad \theta \in \{\theta_h, \theta_l\}. \qquad (4)\end{aligned}$$

Interfering with the accounting system costs the manager $\frac{1}{2}\,km^2$, where $k > 0$ 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, and 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 always 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.

2.4. 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 θ 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 0. The "low" economic earnings θ_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."

We assume that the signal S is sufficiently informative such that it is useful for the expansion decision; otherwise, there would be no role for the accounting system. Assumption A1 implies that $\mathrm{P}(\theta_h \mid S_h; c) > \alpha > \mathrm{P}(\theta_h \mid S_l; c)$, and the assumption of signal usefulness implies

$$\mathrm{P}(\theta_h \mid S_l; c)X - I < 0 < \mathrm{P}(\theta_h \mid S_h; c)X - I. \qquad (5)$$

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 downward, a low report indicates that the signal is low and the board rejects expansion given (5). 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:

$$\mathrm{P}(\theta_h \mid R_h; c, m)X - I > 0, \qquad (6)$$

where

$$\begin{aligned}\mathrm{P}(\theta_h \mid R_h; c, m) \\ = \alpha \frac{\mathrm{P}(R_h \mid \theta_h; c, m)}{\alpha \mathrm{P}(R_h \mid \theta_h; c, m) + (1-\alpha)\mathrm{P}(R_h \mid \theta_l; c, m)}. \qquad (7)\end{aligned}$$

Note that $P(\theta_h \mid R_h; c, m)$ is declining in m and exceeds $P(\theta_h) = \alpha$ for any $m < 1$. Condition (6) is always satisfied if the ex ante NPV of expansion is positive, $\alpha X - I > 0$, regardless of the level of manipulation m. If the ex ante NPV is negative, $\alpha X - I < 0$, then condition (6) implies that manipulation cannot be too severe. However, as we show in Section 3.3, in equilibrium it always holds that $m^* < \frac{1}{2}$.

2.5. 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. The model's results also hold for $B_l < 0$ as long as B_l is not too low.[12] However, large negative values of B_l due to legal penalties or reputational costs would eliminate incentives for manipulation and render the analysis trivial.

3. Board's Choice of Conservatism

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

$$U(c,m) = \alpha \underbrace{(P(S_h \mid \theta_h; c) + mP(S_l \mid \theta_h; c))}_{P(R_h \mid \theta_h; c, m)}(X - I) - (1-\alpha)\underbrace{(P(S_h \mid \theta_l; c) + mP(S_l \mid \theta_l; c))}_{P(R_h \mid \theta_l; c, m)} I. \quad (8)$$

The shareholders' preference function (8) can be explained as follows. With probability α, the expansion is profitable ($\theta = \theta_h$) and, if approved, yields a payoff of $(X - I)$. Similarly, with probability $(1-\alpha)$, the expansion is unprofitable ($\theta = \theta_l$) and, if approved, yields a payoff of $-I$. The probabilities of approval, conditional on $\theta = \theta_h$ and $\theta = \theta_l$, are $P(R_h \mid \theta_h; c, m)$ and $P(R_h \mid \theta_l; c, m)$, respectively. The board approves expansion only when the report is high, which arises either if the accounting system generates a high signal S_h or if it generates a low signal S_l but the manager successfully manipulates it.

The first-order condition for maximizing (8) is

$$0 = \frac{\partial U}{\partial c} + \frac{\partial U}{\partial m}\frac{\partial m}{\partial c}, \quad (9)$$

where the first term represents the direct effect of conservatism on firm value and 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 $m \in [0,1]$ is exogenously fixed. Holding m constant, a change in conservatism has the following effect on firm value:

$$\frac{\partial U}{\partial c} = (1-m)(\gamma(1-\alpha)I - \alpha(X-I))\frac{dP(S_l \mid \theta_h; c)}{dc}. \quad (10)$$

Since Assumption A2 implies that $P(S_l \mid \theta_h; c)$ is increasing in c and $m \in [0,1]$, the sign of $\partial U/\partial c$ is determined by the sign of

$$Z \equiv \gamma(1-\alpha)I - \alpha(X-I). \quad (11)$$

The expression Z reflects the trade-off between the marginal benefit of avoiding unprofitable expansions $(\gamma(1-\alpha)I)$ versus the marginal cost of failing to pursue profitable expansions $(\alpha(X-I))$ and determines whether conservatism increases or decreases value.

Specifically, 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 $Z > 0$, the advantage of conservatism (reduced overinvestment) exceeds its disadvantage (increased underinvestment), and investment efficiency increases with conservative accounting. For $Z < 0$, the opposite argument holds, and investment efficiency declines with conservative accounting.

To provide further intuition, suppose that $\gamma = 1$, such that an increase in c does not change the overall informativeness of the accounting system, Π. In this case, $Z = I - \alpha X$, and conservatism improves the efficiency of the board's expansion decision if the project's ex ante NPV is negative ($\alpha X - I < 0$). This result is intuitive because a negative ex ante NPV implies that the board is more concerned about the cost of investing in a failing project than about the loss of forgoing a successful one. Thus, the board's desire to make conservative expansion decisions creates a natural demand for a conservative accounting bias.[13] The opposite argument holds for a positive ex ante NPV. Then, aggressive accounting rules are optimal because they facilitate the board's desire to make aggressive expansion decisions. If the ex ante NPV is 0, the accounting bias plays no role because the cost of overinvestment equals the cost of underinvestment; thus, $Z = 0$.

When $\gamma > 1$ ($\gamma < 1$), conservatism not only affects the bias in the accounting system but also increases (reduces) the overall informativeness of the system. Clearly, as γ declines, conservative accounting becomes less desirable. Observe that for $\gamma > 1$ ($\gamma < 1$) conservatism increases (reduces) firm value even when the project's ex ante NPV is 0 as a result of its effect on overall informativeness. The following lemma summarizes these results.

Lemma 1. *When the level of manipulation is exogenously fixed, an increase in conservatism increases firm value if $Z > 0$ and reduces firm value if $Z < 0$.*

As will become clear below, for $Z < 0$, conservatism continues to be unambiguously detrimental when we allow for endogenous manipulation choices (see also Endnote 14). We therefore focus on the case in which $Z > 0$ for the remainder of our analysis. As mentioned earlier, we obtain $Z > 0$, for example, if the ex ante NPV of expansion is negative, $\alpha X < I$, and γ is not too small (for small γ, conservatism severely reduces overall informativeness). A negative ex ante NPV implies that the board will only approve expansions when it receives additional information indicating that expansion is profitable. By contrast, with a positive ex ante NPV, the board would approve expansion even when it could not obtain additional information. The assumption of a negative ex ante NPV seems reasonable in stable industries where only high economic earnings indicate sufficient customer demand to warrant expansion or risky industries (e.g., pharmaceuticals) where 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 observation that there are circumstances under which conservative accounting can help boards to better oversee the firm's investment strategies is consistent with arguments in Ball (2001), Watts (2003), and Ahmed and Duellman (2011). Ceteris paribus, conservative accounting improves investment oversight when directors are more concerned about potential overinvestment than they are about potential underinvestment. 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.*

Not surprisingly, manipulation reduces investment efficiency and hence firm value. Taking the first derivative of (8), we obtain

$$\begin{aligned}\frac{\partial U}{\partial m} &= \alpha \mathrm{P}(S_l \mid \theta_h; c)(X - I) - (1-\alpha)\mathrm{P}(S_l \mid \theta_l; c) I \\ &= \mathrm{P}(S_l; c)(\mathrm{P}(\theta_h \mid S_l; c)X - I) < 0, \end{aligned} \tag{12}$$

where the inequality follows from (5). Successful manipulation transforms a low signal into a high report, triggering investment. Since a low signal indicates that expansion has a negative value, manipulation leads to overinvestment, consistent with the empirical findings in McNichols and Stubben (2008).

When the manager chooses the level of manipulation, he maximizes his expected payoff:

$$\begin{aligned}&\alpha \underbrace{(\mathrm{P}(S_h \mid \theta_h; c) + m\mathrm{P}(S_l \mid \theta_h; c))}_{\mathrm{P}(R_h \mid \theta_h; c, m)} B_h \\ &\quad + (1-\alpha)\underbrace{(\mathrm{P}(S_h \mid \theta_l; c) + m\mathrm{P}(S_l \mid \theta_l; c))}_{\mathrm{P}(R_h \mid \theta_l; c, m)} B_l - \tfrac{1}{2}km^2. \end{aligned} \tag{13}$$

The manager's preference function (13) can be explained in a similar fashion as the shareholders' preference function (8). The key difference is that the manager—in contrast to shareholders—is not concerned about potential overinvestment and always prefers to expand. This conflict of interest causes the manager to manipulate the accounting system to convince the board to approve expansion. The first-order condition from (13) gives the manager's optimal manipulation choice:

$$m = \frac{\alpha \mathrm{P}(S_l \mid \theta_h; c)B_h + (1-\alpha)\mathrm{P}(S_l \mid \theta_l; c)B_l}{k}, \tag{14}$$

with the second-order condition satisfied for $k > 0$. The following comparative statics results follow from (14).

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), and*

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

Part (i) of Proposition 2 shows that conservatism increases the manager's incentive to manipulate the accounting system. The manager prefers to move forward with the expansion, but 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. When the manager benefits only from successful projects ($B_h > 0, B_l = 0$), he maintains a concern that the board may block expansions that would have been successful and hence continues to engage in manipulation; however, incentives for manipulation are weaker than for the case with $B_l > 0$.

Parts (ii) and (iii) of Proposition 2 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 (8). Taking the first derivative of (8), we obtain

$$\frac{\mathrm{d}U}{\mathrm{d}c} = \underbrace{(1-m)Z\frac{\mathrm{d}P(S_l \mid \theta_h; c)}{\mathrm{d}c}}_{\text{positive direct effect}} + \underbrace{\frac{\partial U}{\partial m}\frac{\mathrm{d}m}{\mathrm{d}c}}_{\substack{\text{negative}\\ \text{indirect effect}}}. \tag{15}$$

The first term in (15) represents the direct effect of conservatism on firm value. From Lemma 1, we know that conservatism yields a direct benefit when $Z > 0$, because ceteris paribus, it allows the board to make more prudent expansion decisions. The second term in (15) 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, $\partial m/\partial c > 0$ (Proposition 2).[14]

When the board chooses the accounting system, it balances the positive direct effect of conservatism with the negative indirect effect of conservatism via its impact on the manager's manipulation incentive. In the appendix, we show that this trade-off leads to a unique interior level of conservatism $c^* \in (\underline{c}, \bar{c})$, unless the oversight strength, k, takes very high or very low values. 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 finding that k has to lie in an intermediate range to ensure an interior solution for c is intuitive. For example, an extremely high k virtually eliminates manipulation incentives and only the positive direct effect of conservatism remains. In this case, the board prefers maximally conservative accounting, $c = \bar{c}$. If k is extremely low, the board is so concerned about manipulation that it chooses maximally aggressive accounting ($c = \underline{c}$). We define the values of $\underline{k}$ and $\bar{k}$ in the proof of Proposition 3 in the appendix.

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 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 ($\partial m/\partial k < 0$). 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 ($\partial^2 m/\partial c\partial k < 0$). Thus, effective oversight reduces the adverse side effects of conservative accounting (from $\partial U/\partial m < 0$). 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.[15]

Part (ii) of Proposition 4 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 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 ($\partial^2 m/\partial c\partial k < 0$), 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.

The result in part (iii) of Proposition 4 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.

Consistent with empirical findings in Ahmed and Duellman (2011), our model predicts a positive association between conservatism and investment efficiency.[16] 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; 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. That is, our analysis suggests that reporting oversight drives the relation between conservative accounting and investment efficiency.

4.2. Management Preferences

The effect of the manager's private benefits B_h and B_l 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_l, 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 (see also Guay and Verrecchia 2006). They interpret this relation as being driven by stronger legal systems increasing investor demands for conservative accounting 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 ex ante profitability of expansion affects the optimal design of the accounting system.

Proposition 6. *If the value of investment opportunities declines (I increases or X decreases), then*
(i) *the board chooses a higher level of conservatism, c;*
(ii) *the manager engages in more manipulation, m; and*
(iii) *firm value, U, declines.*

A decrease in the ex ante profitability of expansion (increase in I or reduction in X) increases the direct benefit from conservative accounting ($\partial^2 U/\partial c \partial I > 0$) but also increases the indirect cost of conservatism, via manipulation ($\partial^2 U/\partial m \partial I > 0$). 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 evidence from Bushman et al. (2011) 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 Proposition 6. Finally, an increase in I or a reduction in X decreases firm value because it directly reduces the value of the expansion opportunity.

5. Empirical Proxies

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, $P(R_l; c, m) = (1-m)P(S_l; c)$, 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 1999). Because the board's choice of conservatism c increases both the probability that the baseline system produces a low signal $P(S_l; c)$ and the level of manipulation m, it does not immediately follow that the model's parameters have the same directional impact on $P(R_l; c, m)$ 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* $\mathrm{P}(R_l; c, m)$ *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 θ as an unrealized gain (θ_h) or loss (θ_l), then a reduced likelihood of recognizing unrealized gains would be reflected by a reduction in $\mathrm{P}(R_h \mid \theta_h; c, m)$, and an increased likelihood of recognizing unrealized losses would be reflected by an increase in $\mathrm{P}(R_l \mid \theta_l)$. We can therefore view $\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m)$ as a gauge of asymmetric loss recognition.[17] 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 θ to the time 1 report R, where $\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m)$ 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 $\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m)$ and $\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m)$ as they have on c.

Proposition 8. *Asymmetric loss recognition* ($\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m)$) *and the differential persistence of gains versus losses* ($\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m)$) *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 $\mathrm{P}(\theta_l, R_h, S_l; c, m) = (1-\alpha) m \mathrm{P}(S_l \mid \theta_l; c)$—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 $\mathrm{P}(\theta_l, R_h, S_l; c, m)$ as they do on the manager's choice of m.

Proposition 9. *Detected manipulations* $\mathrm{P}(\theta_l, R_h, S_l; c, m)$ *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*).*

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. Ceteris paribus, accounting conservatism is desirable when directors are more concerned about the risk of approving expansions that fail than about the risk of rejecting expansions 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 the manager's incentive to manipulate the system.

The optimal (interior) level of conservatism balances the benefit of better expansion 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 reporting oversight use more conservative accounting.

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

Acknowledgments

The authors thank Mary Barth (department editor), an anonymous associate editor, two anonymous referees, Paul Newman, Florin Sabac, James Spindler, Jack Stecher, Alfred Wagenhofer, and Yong Yu, as well as workshop participants at the University of Alberta Accounting Conference, the Basel Accounting Research Workshop, Columbia University, Duke University, the Minnesota Theory Conference, Stanford University, University of California at Los Angeles, and the University of Texas Law School for helpful comments.

Appendix. Proofs

Preliminaries. In this appendix, we show that Assumption A3 imposes a lower and an upper bound on γ. Since Assumption A3 requires that $(\mathrm{d}/\mathrm{d}c)(\mathrm{P}(S\mid\theta_h;c)/\mathrm{P}(S\mid\theta_l;c)) > 0$ for $S\in\{S_l,S_h\}$ and all $c\in[\underline{c},\bar{c}]$, we obtain

$$\begin{aligned}0 &< \frac{\mathrm{d}}{\mathrm{d}c}\left(\frac{\mathrm{P}(S_l\mid\theta_h;c)}{\mathrm{P}(S_l\mid\theta_l;c)}\right)\\ &= \frac{\mathrm{P}(S_l\mid\theta_l;c)-\gamma\mathrm{P}(S_l\mid\theta_h;c)}{\mathrm{P}(S_l\mid\theta_l;c)^2}\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c},\end{aligned}\qquad\text{(P1)}$$

which implies that $\gamma < \mathrm{P}(S_l\mid\theta_l;c)/\mathrm{P}(S_l\mid\theta_h;c)$ for all c. Because $(\mathrm{d}/\mathrm{d}c)(\mathrm{P}(S\mid\theta_h;c)/\mathrm{P}(S\mid\theta_l;c)) > 0$ implies that $\mathrm{P}(S_l\mid\theta_l;c)/\mathrm{P}(S_l\mid\theta_h;c)$ is decreasing in c, $\gamma < \mathrm{P}(S_l\mid\theta_l;c)/\mathrm{P}(S_l\mid\theta_h;c)$ is satisfied for all c if $\gamma < \mathrm{P}(S_l\mid\theta_l;\bar{c})/\mathrm{P}(S_l\mid\theta_h;\bar{c})$. Assumption A3 also gives

$$\begin{aligned}0 &< \frac{\mathrm{d}}{\mathrm{d}c}\left(\frac{\mathrm{P}(S_h\mid\theta_h;c)}{\mathrm{P}(S_h\mid\theta_l;c)}\right)\\ &= \frac{\gamma\mathrm{P}(S_h\mid\theta_h;c)-\mathrm{P}(S_h\mid\theta_l;c)}{\mathrm{P}(S_h\mid\theta_l;c)^2}\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c},\end{aligned}\qquad\text{(P2)}$$

which implies that $\gamma > \mathrm{P}(S_h\mid\theta_l;c)/\mathrm{P}(S_h\mid\theta_h;c)$ for all c. Because $\mathrm{P}(S_h\mid\theta_l;c)/\mathrm{P}(S_h\mid\theta_h;c)$ is decreasing in c, $\gamma > \mathrm{P}(S_h\mid\theta_l;c)/\mathrm{P}(S_h\mid\theta_h;c)$ is satisfied for all c if $\gamma > \mathrm{P}(S_h\mid\theta_l;\underline{c})/\mathrm{P}(S_h\mid\theta_h;\underline{c})$. Combining (P1) and (P2) gives the following restriction on γ:

$$\frac{\mathrm{P}(S_h\mid\theta_l;\underline{c})}{\mathrm{P}(S_h\mid\theta_h;\underline{c})} < \gamma < \frac{\mathrm{P}(S_l\mid\theta_l;\bar{c})}{\mathrm{P}(S_l\mid\theta_h;\bar{c})}.\qquad\text{(P3)}$$

Note that Assumption A1 implies that $\gamma=1$ lies within the range given by (P3).

Proof of Proposition 2. The results follow from direct computations using (14), where the sign of the effect of c follows from Assumption A2. □

Proof of Proposition 3. Expression (14) gives

$$\frac{\mathrm{d}m}{\mathrm{d}c} = \frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}\frac{\alpha B_h+\gamma(1-\alpha)B_l}{k} > 0.\qquad\text{(P4)}$$

Substituting (P4) into (15) yields the first-order condition:

$$\frac{\mathrm{d}U(c,m)}{\mathrm{d}c} = g(c,k)\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c} = 0,\qquad\text{(P5)}$$

where the optimal level of c (if it is an interior solution) is determined by

$$g(c,k) = (1-m^*)Z + \frac{\alpha B_h+\gamma(1-\alpha)B_l}{k}\frac{\partial U}{\partial m} = 0,\qquad\text{(P6)}$$

where m^* is determined by (14). Expression (P6) is decreasing in c because m^* is increasing in c and

$$\begin{aligned}\frac{\partial^2 U}{\partial c\,\partial m} &= \frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}\alpha X - \frac{\mathrm{dP}(S_l;c)}{\mathrm{d}c}I\\ &= -Z\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c} < 0.\end{aligned}\qquad\text{(P7)}$$

The second-order condition is satisfied at any interior optimum, since

$$\begin{aligned}\frac{\mathrm{d}^2U(c,m)}{\mathrm{d}c^2} &= \frac{\partial g(c,k)}{\partial c}\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c} + g(c,k)\frac{\mathrm{d}^2\mathrm{P}(S_l\mid\theta_h;c)}{\mathrm{d}c^2}\\ &= -2\frac{\partial m}{\partial c}Z\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c},\end{aligned}\qquad\text{(P8)}$$

which is negative at $g(c,k)=0$ because g is decreasing in c.

We now establish the conditions for a unique interior solution $c^*\in[\underline{c},\bar{c}]$. Because g is strictly decreasing in c, we obtain a unique interior solution c^* that solves $g(c,k)=0$ if $g(\underline{c},k) > 0 > g(\bar{c},k)$. For any fixed c, $g(c,k)$ is increasing in k because m^* is decreasing in k, the term that multiplies $\partial U/\partial m < 0$ is decreasing in k, and $\partial U/\partial m$ does not depend on k. Also, for any fixed c, $g(c,k)$ approaches negative infinity as k approaches 0, and $g(c,k)$ approaches $Z>0$ as $k\to\infty$. Thus, there are unique bounds $\underline{k}$ and $\bar{k}$ that solve $g(\underline{c},\underline{k})=0$ and $g(\bar{c},\bar{k})=0$, respectively, such that $g(\underline{c},k)>0$ for all $k>\underline{k}$ and $g(\bar{c},k)<0$, for all $k<\bar{k}$. We then have $g(\bar{c},k)<0<g(\underline{c},k)$ for all $k\in(\underline{k},\bar{k})$, and, therefore, an interior solution. The implicit function theorem gives $\mathrm{d}c/\mathrm{d}k = -(\partial g/\partial k)/(\partial g/\partial c) > 0$, which implies $\bar{k}>\underline{k}$.

Setting $g(\underline{c},\underline{k})=0$ and solving for $\underline{k}$ yields

$$\begin{aligned}\underline{k} = \mathrm{P}(S_l;\underline{c})\Big(&\mathrm{P}(\theta_h\mid S_l;\underline{c})B_h + \mathrm{P}(\theta_l\mid S_l;\underline{c})B_l\\ &+(\alpha B_h+\gamma(1-\alpha)B_l)\frac{I-\mathrm{P}(\theta_h\mid S_l;\underline{c})X}{Z}\Big),\end{aligned}\qquad\text{(P9)}$$

where Z, B_h, $B_l\ge 0$, and $\mathrm{P}(\theta_h\mid S_l;\underline{c})X - I < 0$ imply $\underline{k}>0$. This implies that the constraint $k\in(\underline{k},\bar{k})$ binds in the sense that we do not obtain an interior solution for arbitrarily low oversight k. The upper bound $\bar{k}>\underline{k}$ can be defined similarly where the probabilities depend on $\bar{c}$.

To show that $m^*<\frac{1}{2}$, we assume $m\ge\frac{1}{2}$ and derive a contradiction. If $m\ge\frac{1}{2}$, then $m\ge 1-m$, and the first-order condition (P6) implies

$$m^*Z \ge -\frac{\alpha B_h+\gamma(1-\alpha)B_l}{k}\frac{\partial U}{\partial m}.\qquad\text{(P10)}$$

Substituting m^* from (14), $\partial U/\partial m$ from (12), and Z from (10) into (P10), cancelling out the $k>0$ term, and rearranging yields the inequality

$$0\le\left(\gamma-\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}\right)\mathrm{P}(S_l\mid\theta_h;c)\alpha(1-\alpha)(IB_h+(X-I)B_l).\qquad\text{(P11)}$$

The inequality (P11) contradicts (P3). Thus, it cannot be the case that $m\ge\frac{1}{2}$. □

Proof of Proposition 4. *Part* (i). Because the second-order condition is satisfied, the implicit function theorem implies that the sign of $\mathrm{d}c/\mathrm{d}k$ is the same as the sign of differentiating the first-order condition with respect to k:

$$\begin{aligned}&\frac{\partial}{\partial k}\left((1-m)Z\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}+\frac{\partial U}{\partial m}\frac{\mathrm{d}m}{\mathrm{d}c}\right)\\ &\quad= Z\underbrace{\frac{1}{k}m}_{\partial m/\partial k}\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c} - \frac{\partial U}{\partial m}\underbrace{\frac{1}{k}\frac{\partial m}{\partial c}}_{\partial^2 m/\partial c\,\partial k} < 0,\end{aligned}\qquad\text{(P12)}$$

where the inequality follows because $\mathrm{dP}(S_l\mid\theta_h;c)/\mathrm{d}c>0$ and $\partial U/\partial m<0$.

Part (ii). Expression (14) gives

$$\frac{\mathrm{d}m}{\mathrm{d}k}=\frac{\partial m}{\partial k}+\frac{\partial m}{\partial c}\frac{\mathrm{d}c}{\mathrm{d}k}. \tag{P13}$$

We first determine $\mathrm{d}c/\mathrm{d}k$. Using (P12) and (P8) yields

$$\begin{aligned}\frac{\mathrm{d}c}{\mathrm{d}k}&=-\frac{Z(1/k)m(\mathrm{dP}(S_l\mid\theta_h;c)/\mathrm{d}c)-(\partial U/\partial m)(1/k)(\partial m/\partial c)}{-2(\partial m/\partial c)Z(\mathrm{dP}(S_l\mid\theta_h;c)/\mathrm{d}c)}\\&=\frac{1}{2k}\frac{1}{\partial m/\partial c},\end{aligned} \tag{P14}$$

where the second equality follows after substituting from (P6) in the numerator.

Substituting (P14) and $\partial m/\partial k=-(1/k)m$ into (P13) gives

$$\frac{\mathrm{d}m}{\mathrm{d}k}=\frac{\partial m}{\partial k}+\frac{\partial m}{\partial c}\frac{\mathrm{d}c}{\mathrm{d}k}=\frac{1}{k}\left(\frac{1}{2}-m\right)>0, \tag{P15}$$

where the inequality follows because Proposition 3 shows that $m^*<\frac{1}{2}$.

Part (iii). The envelope theorem implies that the effect of k on the board's utility function (8) is the partial effect of k evaluated at the equilibrium c and m, giving

$$\frac{\mathrm{d}U^*}{\mathrm{d}k}=\frac{\partial U}{\partial m}\frac{\partial m}{\partial k}\bigg|_{c=c^*,\,m=m^*}>0, \tag{P16}$$

where the inequality follows from $\partial m/\partial k$, $\partial U/\partial m<0$. □

Proof of Proposition 5. First, we have $\partial m/\partial B_h=(1/k)\cdot \mathrm{P}(S_l\mid\theta_h;c)\alpha$ and $\partial m/\partial B_l=(1/k)\mathrm{P}(S_l\mid\theta_l;c)(1-\alpha)$. Using (P6) and (P8) yields the following for B_h and B_l:

$$\begin{aligned}\frac{\mathrm{d}c}{\mathrm{d}B_h}&=-\frac{-(\partial m/\partial B_h)Z+(\alpha/k)(\partial U/\partial m)}{-2(\partial m/\partial c)Z}\\&=-\frac{Z+(\mathrm{P}(S_l;c)/\mathrm{P}(S_l\mid\theta_h;c))(I-\mathrm{P}(\theta_h\mid S_l;c)X)}{2(\partial m/\partial c)Z}\\&\quad\cdot\frac{\partial m}{\partial B_h}<0,\end{aligned} \tag{P17}$$

$$\begin{aligned}\frac{\mathrm{d}c}{\mathrm{d}B_l}&=-\frac{-(\partial m/\partial B_l)Z+(\gamma(1-\alpha)/k)(\partial U/\partial m)}{-2(\partial m/\partial c)Z}\\&=-\frac{Z+\gamma(\mathrm{P}(S_l;c)/\mathrm{P}(S_l\mid\theta_l;c))(I-\mathrm{P}(\theta_h\mid S_l;c)X)}{2(\partial m/\partial c)Z}\\&\quad\cdot\frac{\partial m}{\partial B_l}<0.\end{aligned} \tag{P18}$$

The effects on m are then

$$\begin{aligned}\frac{\mathrm{d}m}{\mathrm{d}B_h}&=\frac{\partial m}{\partial B_h}+\frac{\partial m}{\partial c}\frac{\mathrm{d}c}{\mathrm{d}B_h}\\&=\frac{1}{2Z}\left(\gamma-\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}\right)(1-\alpha)I\frac{\partial m}{\partial B_h}<0,\end{aligned} \tag{P19}$$

$$\begin{aligned}\frac{\mathrm{d}m}{\mathrm{d}B_l}&=\frac{\partial m}{\partial B_l}+\frac{\partial m}{\partial c}\frac{\mathrm{d}c}{\mathrm{d}B_l}\\&=\frac{1}{2Z}\left(\gamma-\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}\right)\frac{\mathrm{P}(S_l\mid\theta_h;c)}{\mathrm{P}(S_l\mid\theta_l;c)}\\&\quad\cdot\alpha(X-I)\frac{\partial m}{\partial B_l}<0,\end{aligned} \tag{P20}$$

where the inequalities follow from (P3).

The effect on U follows from the envelope theorem, since $\partial U/\partial m<0$ and $\partial m/\partial B_h$, $\partial m/\partial B_l>0$. □

Proof of Proposition 6. Because the second-order condition is satisfied, the implicit function theorem implies that the signs of $\mathrm{d}c/\mathrm{d}I$ and $\mathrm{d}c/\mathrm{d}X$ are the same as the signs of differentiating the first-order condition with respect to I and X, respectively,

$$\begin{aligned}&\frac{\partial}{\partial I}\left((1-m)Z\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}+\frac{\partial U}{\partial m}\frac{\mathrm{d}m}{\mathrm{d}c}\right)\\&\quad=(1-m)\frac{\mathrm{P}(\theta_h\mid S_l;c)(1-\alpha)X}{I-\mathrm{P}(\theta_h\mid S_l;c)X}\left(\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}-\gamma\right)\\&\quad\cdot\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}>0,\end{aligned} \tag{P21}$$

$$\begin{aligned}&\frac{\partial}{\partial X}\left((1-m)Z\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}+\frac{\partial U}{\partial m}\frac{\mathrm{d}m}{\mathrm{d}c}\right)\\&\quad=-(1-m)\frac{\mathrm{P}(\theta_h\mid S_l;c)(1-\alpha)I}{I-\mathrm{P}(\theta_h\mid S_l;c)X}\left(\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}-\gamma\right)\\&\quad\cdot\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}<0,\end{aligned} \tag{P22}$$

where both expressions follows after a substitution from (P6) for $\mathrm{P}(S_l;c)((\alpha B_h+\gamma(1-\alpha)B_l)/k)$, and the inequalities follow from (P3).

Because neither I nor X has a direct effect on m and $\partial m/\partial c>0$, $\mathrm{d}c/\mathrm{d}I>0$ implies $\mathrm{d}m/\mathrm{d}I>0$ and $\mathrm{d}c/\mathrm{d}X<0$ implies $\mathrm{d}m/\mathrm{d}I<0$. The envelope theorem implies that U is decreasing in I and increasing in X since $\partial U/\partial I<0$ and $\partial U/\partial X>0$. □

Proof of Proposition 7. We first note that low reports increase with the board's choice of c:

$$\begin{aligned}\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}c}&=(1-m)\frac{\mathrm{dP}(S_l;c)}{\mathrm{d}c}-\mathrm{P}(S_l;c)\frac{\mathrm{d}m}{\mathrm{d}c}\\&=(1-m)\frac{\mathrm{P}(\theta_h\mid S_l;c)(1-\alpha)X}{I-\mathrm{P}(\theta_h\mid S_l;c)X}\left(\frac{\mathrm{P}(S_l\mid\theta_l;c)}{\mathrm{P}(S_l\mid\theta_h;c)}-\gamma\right)\\&\quad\cdot\frac{\mathrm{dP}(S_l\mid\theta_h;c)}{\mathrm{d}c}>0,\end{aligned} \tag{P23}$$

where the second equality follows after a substitution from (P6) for $\mathrm{P}(S_l;c)(\alpha B_h+\gamma(1-\alpha)B_l)/k$ and simplification. The inequality follows from (P3).

Given (P23), Propositions 2 and 4–6 imply

$$\begin{aligned}\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}k}&=\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}c}\\&\quad\cdot\frac{\mathrm{d}c}{\mathrm{d}k}+\underbrace{\frac{\partial\mathrm{P}(R_l;c,m)}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial k}}_{<0}>0,\end{aligned} \tag{P24}$$

$$\begin{aligned}\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}I}&=\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}c}\\&\quad\cdot\frac{\mathrm{d}c}{\mathrm{d}I}+\underbrace{\frac{\partial\mathrm{P}(R_l)}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial I}}_{=0}>0,\end{aligned} \tag{P25}$$

$$\begin{aligned}\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}B_i}&=\frac{\mathrm{dP}(R_l;c,m)}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}B_i}\\&\quad+\underbrace{\frac{\partial\mathrm{P}(R_l)}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial B_i}}_{>0}<0.\quad\square\end{aligned} \tag{P26}$$

Proof of Proposition 8. We first show that the report R satisfies condition A2:

$$\frac{\mathrm{dP}(R_l \mid \theta_h; c, m)}{\mathrm{d}c} = (1-m)\frac{\mathrm{P}(S_l \mid \theta_h; c)(1-\alpha)I}{\mathrm{P}(S_l; c)(I - \mathrm{P}(\theta_h \mid S_l; c)X)}\left(\frac{\mathrm{P}(S_l \mid \theta_l; c)}{\mathrm{P}(S_l \mid \theta_h; c)} - \gamma\right) \cdot \frac{\mathrm{dP}(S_l \mid \theta_h; c)}{\mathrm{d}c} > 0, \tag{P27}$$

$$\frac{\mathrm{dP}(R_l \mid \theta_l; c, m)}{\mathrm{d}c} = (1-m)\frac{\mathrm{P}(S_l \mid \theta_h; c)\alpha(X-I)}{\mathrm{P}(S_l; c)(I - \mathrm{P}(\theta_h \mid S_l; c)X)}\left(\frac{\mathrm{P}(S_l \mid \theta_l; c)}{\mathrm{P}(S_l \mid \theta_h; c)} - \gamma\right) \cdot \frac{\mathrm{dP}(S_l \mid \theta_h; c)}{\mathrm{d}c} > 0, \tag{P28}$$

where the expressions use a substitution from (P6) for $\mathrm{P}(S_l; c)(\alpha B_h + \gamma(1-\alpha)B_l)/k$ and the inequalities follows from (P3). This implies that the difference $\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m)$ increases in c. We also have

$$\begin{aligned}\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m) &= (1-m)\mathrm{P}(S_l \mid \theta_l; c) - (1 - m\mathrm{P}(S_l \mid \theta_h; c)) \\ &= (1-m)(\mathrm{P}(S_l \mid \theta_l; c) - \mathrm{P}(S_l \mid \theta_h; c)) - \mathrm{P}(S_h \mid \theta_h; c),\end{aligned} \tag{P29}$$

which implies that $\partial(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))/\partial m < 0$. Propositions 2 and 4–6 then imply

$$\frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}k} = \frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}k} + \underbrace{\frac{\partial(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial k}}_{<0} > 0, \tag{P30}$$

$$\frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}I} = \frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}I} + \underbrace{\frac{\partial(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial I}}_{=0} > 0, \tag{P31}$$

$$\frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}B_i} = \frac{\mathrm{d}(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}B_i} + \underbrace{\frac{\partial(\mathrm{P}(R_l \mid \theta_l; c, m) - \mathrm{P}(R_h \mid \theta_h; c, m))}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial B_i}}_{>0} < 0. \tag{P32}$$

We now show that the report R satisfies condition A3:

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}c}\left(\frac{\mathrm{P}(R_h \mid \theta_h; c, m)}{\mathrm{P}(R_h \mid \theta_l; c, m)}\right) &= \frac{1}{\mathrm{P}(R_h \mid \theta_l; c, m)}\frac{\mathrm{dP}(R_h \mid \theta_h; c, m)}{\mathrm{d}c} - \frac{\mathrm{P}(R_h \mid \theta_h; c, m)}{\mathrm{P}(R_h \mid \theta_l; c, m)^2}\frac{\mathrm{dP}(R_h \mid \theta_l; c, m)}{\mathrm{d}c} \\ &= (1-m)\frac{\mathrm{P}(S_l \mid \theta_h; c)\mathrm{P}(R_h; c, m)}{\mathrm{P}(R_h \mid \theta_l; c, m)^2} \cdot \frac{\mathrm{P}(\theta_h \mid R_h; c, m)X - I}{\mathrm{P}(S_l; c)(I - \mathrm{P}(\theta_h \mid S_l; c)X)} \cdot \left(\frac{\mathrm{P}(S_l \mid \theta_l; c)}{\mathrm{P}(S_l \mid \theta_h; c)} - \gamma\right)\frac{\mathrm{dP}(S_l \mid \theta_h; c)}{\mathrm{d}c} > 0,\end{aligned} \tag{P33}$$

where the inequality follows from (P3) and (6). This implies that $\mathrm{P}(\theta_h \mid R_h; c, m)$ is increasing in c and $\mathrm{P}(\theta_l \mid R_l; c, m)$ is decreasing in c, which implies that the difference $\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m)$ is increasing in c. We also have that $\mathrm{P}(\theta_l \mid R_l; c, m) = \mathrm{P}(\theta_l \mid S_l; c)$, which does not depend on m, and $\mathrm{P}(\theta_h \mid R_h; c, m)$ is decreasing in m so that the difference $\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m)$ is decreasing in m.[18] Propositions 2 and 4–6 then imply

$$\frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}k} = \frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}k} + \underbrace{\frac{\partial(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial k}}_{<0} > 0, \tag{P34}$$

$$\frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}I} = \frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}I} + \underbrace{\frac{\partial(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\partial m}}_{<0}\underbrace{\frac{\partial m}{\partial I}}_{=0} > 0, \tag{P35}$$

$$\frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}B_i} = \frac{\mathrm{d}(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\mathrm{d}c}\frac{\mathrm{d}c}{\mathrm{d}B_i} + \underbrace{\frac{\partial(\mathrm{P}(\theta_h \mid R_h; c, m) - \mathrm{P}(\theta_l \mid R_l; c, m))}{\partial m}}_{<0} \cdot \underbrace{\frac{\partial m}{\partial B_i}}_{>0} < 0. \quad \square \tag{P36}$$

Proof of Proposition 9. Denote the variable of interest by $z \in \{k, I, B_h, B_l\}$. We have

$$\frac{\mathrm{dP}(\theta_l, R_h, S_l; c, m)}{\mathrm{d}z} = \mathrm{P}(S_l \mid \theta_l; c, m)(1-\alpha)\frac{\mathrm{d}m}{\mathrm{d}z} + m\frac{\mathrm{dP}(S_l; c)}{\mathrm{d}c}(1-\alpha)\frac{\mathrm{d}c}{\mathrm{d}z}. \tag{P37}$$

For the effects of oversight and growth opportunities ($z \in \{k, I\}$), we have $\mathrm{dP}(\theta_l, R_h, S_l; c, m)/\mathrm{d}z > 0$ since $\mathrm{d}m/\mathrm{d}k$, $\mathrm{d}c/\mathrm{d}k$, $\mathrm{d}m/\mathrm{d}I$, $\mathrm{d}c/\mathrm{d}I > 0$ from Propositions 4 and 6. For the effects of private benefits ($z \in \{B_h, B_l\}$), we have $\mathrm{dP}(\theta_l, R_h, S_l; c, m)/\mathrm{d}z < 0$ since $\mathrm{d}m/\mathrm{d}B_h$, $\mathrm{d}c/\mathrm{d}B_h$, $\mathrm{d}m/\mathrm{d}B_l$, $\mathrm{d}c/\mathrm{d}B_l < 0$ from Proposition 5. □

Endnotes

[1] For example, the New York Stock Exchange listed company manual requires an audit committee comprising "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.

[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 the analytical studies on conservatism cited in Section 2.

[5] This 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.

[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).

[7] By 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.

[8] Assumptions A1–A3 follow Gigler et al. (2009). For $\gamma = 1$, Assumption A4 resembles condition (A4) in Gigler et al. (2009).

[9] Assumption A3 imposes a lower bound and an upper bound on γ, which we determine in the appendix.

[10] Nan and Wen (2014), Li (2013), and Gao and Wagenhofer (2013) use a similar measure to represent the overall informativeness of the signal. For example, Π corresponds to the λ parameter in Nan and Wen (2014) and Li (2013)—see also the discussion later in this section of the Venugopalan (2004) structure. Assumption A1 implies $\Pi \geq 0$, and the definition of probabilities implies $\Pi \leq 1$.

[11] 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.

[12] We do not include negative B_l in our analysis because many of the results would require stating bounds on B_l without adding additional insights to the model.

[13] 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.

[14] 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, and γ is not too large such that $Z < 0$, both the direct and indirect effects of conservatism are negative, and the board will choose maximally aggressive accounting ($c = \underline{c}$).

[15] 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).

[16] See also Biddle and Hilary (2006), Bushman et al. (2011), and García Lara et al. (2016).

[17] Alternatively, if we view θ as the information that could potentially be reflected in stock prices, then $P(R_l \mid \theta_l; c, m) > P(R_h \mid \theta_h; c, m)$ indicates that accounting reports reflect more bad news than good news.

[18] Formally stated, $P(\theta_l \mid R_l) = P(\theta_l \mid S_l)$ because the manager never manipulates the signal S_h downward so that $P(S_l \mid R_l) = 1$. Direct computations show that $P(S_l \mid \theta_h) < P(S_l)$ and $P(S_h \mid \theta_h) > P(S_h)$, which holds because the signal is informative by Assumption A1, imply that $P(\theta_h \mid R_h)$ is decreasing in m.

References

Ahmed A, Duellman S (2007) Accounting conservatism and board of director characteristics: An empirical analysis. *J. Accounting Econom.* 43(2–3):411–437.

Ahmed A, Duellman S (2011) Evidence on the role of accounting conservatism in monitoring managers' investment decisions. *Accounting Finance* 51(3):609–633.

Armstrong C, Guay W, Weber J (2010) The role of information and financial reporting in corporate governance and debt contracting. *J. Accounting Econom.* 50(2–3):179–234.

Bagnoli M, Watts S (2005) Conservative accounting choices. *Management Sci.* 51(5):786–801.

Ball R (2001) Infrastructure requirements for an economically efficient system of public financial reporting and disclosure. *Brookings-Wharton Papers Financial Services* 2001(1):127–169.

Bar-Gill O, Bebchuk L (2003) Misreporting corporate performance. Working paper, Harvard Law School, Boston.

Barth M, Landsman W, Lang M (2008) International accounting standards and accounting quality. *J. Accounting Res.* 46(3): 467–498.

Basu S (1997) The conservatism principle and the asymmetric timeliness of earnings. *J. Accounting Econom.* 24(1):3–37.

Beekes W, Pope P, Young S (2004) The link between earnings timeliness, earnings conservatism and board composition: Evidence from the UK. *Corporate Governance: Internat. Rev.* 12(1): 47–59.

Bertomeu J, Darrough M, Xue W (2013) Agency conflicts, earnings management, and conservatism. Working paper, Baruch College, New York.

Biddle G, Hilary G (2006) Accounting quality and firm-level capital investment. *Accounting Rev.* 81(5):963–982.

Bushman R, Piotroski J (2006) Financial reporting incentives for conservative accounting: The influence of legal and political institutions. *J. Accounting Econom.* 42(1–2):107–148. [Also see discussion in Guay and Verrecchia (2006).]

Bushman R, Smith A (2001) Financial accounting information and corporate governance. *J. Accounting Econom.* 32(1–3):237–333.

Bushman R, Piotroski J, Smith A (2011) Capital allocation and timely accounting recognition of economic losses. *J. Bus. Finance Accounting* 38(1–2):1–33.

Caskey J, Hughes J (2012) Assessing the impact of alternative fair value measures on the efficiency of project selection and continuation. *Accounting Rev.* 87(2):483–512.

Chen Q, Hemmer T, Zhang Y (2007) On the relation between conservatism in accounting standards and incentives for earnings management. *J. Accounting Res.* 45(3):541–565.

Drymiotes G, Hemmer T (2013) On the stewardship and valuation implications of accrual accounting systems. *J. Accounting Res.* 51(2):281–334.

Fama E, Jensen M (1983) Separation of ownership and control. *J. Law Econom.* 26(2):301–325.

Gao P (2013) A measurement approach to conservatism and earnings management. *J. Accounting Econom.* 55(2–3):251–268.

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

García Lara J, García Osma B, Penalva F (2009) Accounting conservatism and corporate governance. *Rev. Accounting Stud.* 14(1):161–201.

García Lara JM, García Osma B, Penalva F (2016) Accounting conservatism and firm investment efficiency. *J. Accounting Econom.* 61(1):221–238.

Gigler F, Hemmer T (2001) Conservatism, optimal disclosure policy, and the timeliness of financial reports. *Accounting Rev.* 76(4):471–493.

Gigler F, Kanodia C, Sapra H, Venugopalan R (2009) Accounting conservatism and the efficiency of debt contracts. *J. Accounting Res.* 47(3):767–797.

Givoly D, Hayn C (2000) The changing time-series properties of earnings, cash flows and accruals: Has financial reporting become more conservative? *J. Accounting Econom.* 29(3):287–320.

Goh B, Li D (2011) Internal controls and conditional conservatism. *Accounting Rev.* 86(3):975–1005.

Göx R, Wagenhofer A (2009) Optimal impairment rules. *J. Accounting Econom.* 48(1):2–16.

Guay W, Verrecchia R (2006) Discussion of an economic framework for conservative accounting and Bushman and Piotroski (2006). *J. Accounting Econom.* 42(1–2):149–165.

Krishnan G, Visvanathan G (2008) Does the SOX definition of an accounting expert matter? The association between audit committee directors' accounting expertise and accounting conservatism. *Contemporary Accounting Res.* 25(3):827–857.

Larcker D, Richardson S, Tuna I (2007) Corporate governance, accounting outcomes, and organizational performance. *Accounting Rev.* 82(4):963–1008.

Li J (2013) Accounting conservatism and debt contracts: Efficient liquidation and covenant renegotiation. *Contemporary Accounting Res.* 30(3):1082–1098.

Lobo G, Zhou J (2006) Did conservatism in financial reporting increase after the Sarbanes-Oxley Act? Initial evidence. *Accounting Horizons* 20(1):57–73.

Lu T, Sapra H (2009) Auditor conservatism and investment efficiency. *Accounting Rev.* 84(6):1933–1958.

Malmendier U, Tate G (2005) CEO overconfidence and corporate investment. *J. Finance* 60(6):2661–2700.

McNichols M, Stubben S (2008) Does earnings management affect firms' investment decisions? *Accounting Rev.* 83(6):1571–1603.

Nan L, Wen X (2014) Financing and investment efficiency, information quality, and accounting biases. *Management Sci.* 60(9):2308–2323.

Ramalingegowda S, Yu Y (2012) Institutional ownership and conservatism. *J. Accounting Econom.* 53(1–2):98–114.

Scharfstein D, Stein J (2000) The dark side of internal capital markets: Divisional rent-seeking and inefficient investment. *J. Finance* 55(6):2537–2564.

Stein J (1997) Internal capital markets and the competition for corporate resources. *J. Finance* 52(1):111–133.

Stober T (1999) Empirical applications of the Ohlson [1995] and Feltham and Ohlson [1995, 1996] valuation models. *Managerial Finance* 25(12):3–16.

Venugopalan R (2004) Conservatism in accounting: Good or bad? Working paper, University of Chicago, Chicago.

Watts R (2003) Conservatism in accounting part I: Explanations and implications. *Accounting Horizons* 17(3):207–221.