Review of Accounting Studies, 6, 29–51, 2001

The Demand for Accounting Conservatism for Management Control

YOUNG K. KWON
College of Commerce and Business Administration, University of Illinois

D. PAUL NEWMAN Paul.Newman@bus.utexas.edu
McCombs School of Business, University of Texas at Austin

YOON S. SUH
School of Business Administration, Ajou University, Korea

Abstract. We show that conservative financial reporting arises naturally in principal-agent settings as a means of efficiently motivating agents when the penalties that can be imposed on agents are limited. We consider an accounting system whose reports are used for contracting and whose parameters are controlled by the principal. One advantage of our model is that the information system we describe has the accounting characteristic of mapping unbiased underlying information about the firm into a reduced message space. The principal can choose how that mapping operates, i.e., conservatively, liberally, or neutrally. When penalties are sufficiently limited (a limited liability setting), we show that the accounting system designed by the principal is always conservative. Alternatively, in an unlimited liability setting, any bias in the system depends on random circumstances, and we would not expect accounting conservatism to arise as a pervasive and enduring phenomenon.

Keywords: accounting conservatism, moral hazard, limited liability

The pervasive characteristic of conservatism in accounting has long intrigued academics.[1] As a result, numerous rationales for conservatism have been advanced.[2] In 1993, a special session of the American Accounting Association's annual meeting was devoted to the issue of conservatism, and a number of eminent scholars advocated research designed to investigate the causes and effects of conservative financial reporting.

The purpose of this paper is to introduce a new rationale for conservative accounting. In particular, we show that under plausible conditions in an agency setting, the principal designs the accounting system to be biased conservatively in order to efficiently motivate the agent. While other agency explanations of conservatism have been advanced, they rely on asymmetric information beyond the usual assumption that the principal cannot observe (or, more strictly, cannot contract on) the agent's action. In our model, no such additional asymmetry exists. More specifically, our results show that if the contracting alternatives available to the principal are sufficiently limited in terms of penalties, then the principal will design a conservative reporting mechanism to motivate and compensate the agent.

Address correspondence to: D. Paul Newman, CBA 4M.202, Department of Accounting, University of Texas at Austin, Austin, TX 78712.

Most discussions of conservatism rely on an external reporting environment in which there are no explicit contracting issues. Devine (1963) identifies three possible explanations of conservatism: (1) investors have asymmetric loss functions; (2) conservative claims of management may be more easily verified than optimistic claims; and (3) managers may optimistically bias their reports, leading auditors to compensate by being conservative.[3] Beaver (1993) identifies a variety of alternative explanations, including tax incentives, legal liability of auditors and management, compensation contracts, debt covenants, and regulatory induced behavior.

Basu (1997) provides an extensive review of various motivations for accounting conservatism and characterizes the typical principal-agent explanation of conservative reporting as follows. Managers have valuable private information and may have incentives to withhold or positively bias information that affects their compensation. This incentive problem is said to lead rational shareholders to reduce managerial compensation accordingly, and conservatism arises as managers attempt to commit, through a downwardly biased accounting system, to offset their informational advantage.[4]

In a contracting setting, Antle and Lambert (1988) develop an agency model involving a principal and an accountant that gives rise to an endogenous demand for conservative accounting. In their model, the principal hires the accountant who must incur private costs to produce information of value to the principal. In addition, the accountant privately observes the information and must be induced to reveal it honestly to the principal. Because the principal induces the accountant to report accurately, conservatism in Antle and Lambert cannot be described in terms of the reports. Instead, Antle and Lambert show that the accountant will prefer a conservative information system (that provides a signal to the accountant) that tends to identify unfavorable conditions when unfavorable conditions exist.

In a contracting setting with no moral hazard, Reichelstein (1997) examines incentive systems that achieve goal congruence between a principal and an agent with respect to investment decisions. As he shows, when incentive systems are linear in accounting performance measures and the agent's discount factor is unknown to the principal, the optimal performance measure will use a conservative depreciation schedule, in the sense that the book values of existing projects are less than their net present values, if that performance measure is to attain goal congruence. Dutta and Reichelstein (2000) extend this analysis to a moral hazard setting and show that the same type of depreciation rule is part of an optimal performance measure.

In our analysis, the principal is faced with a simple contracting problem in which the accounting system, which is not under the control of the agent, produces a signal that is informative about the agent's effort level. The principal can design the system to be unbiased (neutral), conservative, or liberal in terms of the likelihood of identifying favorable or unfavorable outcomes. We show that when the principal is limited in terms of the penalties that can be imposed on the agent (following prior literature, labeled the *limited liability scenario*), then the optimal accounting system will always be conservative. Without limited penalties, the optimal system may be conservative, liberal, or neutral, depending on circumstances.

In a setting without limited liability, Kim (1995) demonstrates that increasing the variability of performance measures improves contract efficiency by allowing the use of compensation incentives with a lower risk premium. Specifically, performance measure A is more efficient than performance measure A' if the likelihood ratio of report probabilities for A is a mean preserving spread of the likelihood ratio for A'. However, in a limited liability setting, the likelihood ratios associated with low outcome reports become irrelevant for motivating the agent. By designing a conservative accounting system, the principal increases likelihood ratios for higher outcome reports.

The remainder of this paper is organized as follows. In Section 1, we develop the model. Section 2 contains our central results, and Section 3 concludes.

1. Model

In developing our model, we attempt to capture several common characteristics of accounting systems and principal-agent relationships. First, if we are to consider accounting conservatism, we want an information system that captures the salient attributes of accounting. In particular, we wish to represent a system that transforms all available information within a firm to a smaller dimensionality, much like a real firm's system aggregates and transforms the transactions, events, and perceptions of a period to produce a set of financial statements.

Second, we wish to formally represent the idea that not all of the larger information set is available for contracting. To do so, we allow contracting only on the reduced financial report. This assumption can be justified in a number of ways. First, using the underlying data for contracting may be too costly in realistic settings. Second, contracts based on internal information may not be enforceable if the information cannot be verified in court. For example, courts likely will not enforce a contract based on the subjective probability of losing a lawsuit against the firm. However, that subjective probability is important in determining accounting income, which may be an enforceable component of a contract. Thus, the internal information used to prepare financial reports could be qualitative in nature, precluding its use as a contracting variable. As a final justification, we note that much of the financial minutiae that are ultimately coalesced into financial statements are not used in contracts in practice. While our assumption is extreme, in that we do observe some disaggregated information in contracts, it is intended to capture the idea that contractual limitations exist.[5]

Third, we want to reflect the fact that constraints are imposed on the compensation schedule that the principal can offer to the agent. For example, contracts that specify unacceptable social outcomes (e.g., slavery) are unenforceable. Following Sappington (1983), we call this contracting constraint "limited liability."[6] Finally, to avoid possible confounding explanations of the phenomena we investigate, we consider a setting in which the agent does not acquire information (beyond knowledge of effort taken) that is unavailable to the principal.

Consider a setting with one risk-neutral principal and one risk-averse agent. The agent's effort and a random state of nature combine to produce an outcome that is valued by the principal. We make the following assumptions about effort and the outcome:

$x \in \{H, L\}$ (binary outcome)

$a \in \{a_H, a_L\}$ (agent's binary effort)

Thus, the agent can take one of two effort levels (high or low) that generate a high or low outcome. Our assumption that effort levels and outcomes are binary is a convenience that allows us to solve for the optimal compensation schedule simply and graphically.[7]

We assume that the agent's effort has the following effect on the outcome:

$$P(x = H \mid a_H) = \beta, \quad \text{and} \quad P(x = L \mid a_H) = 1 - \beta;$$

$$P(x = H \mid a_L) = 1 - \alpha, \quad \text{and} \quad P(x = L \mid a_L) = \alpha;$$

where $\alpha + \beta > 1$. We assume that x is not publicly observed until the firm liquidates, and thus cannot be used in contracting. This restriction naturally gives rise to a demand for a reporting system, albeit not necessarily a conservative system. In addition, we assume that the principal wants the agent to select effort level a_H, which leads to an increased likelihood that the desirable outcome $x = H$ will be realized.

1.1. The Accounting System

After the agent selects his effort, a signal y, where $y = x + \varepsilon$, is generated, which is informative about x. This signal represents the "disaggregated" detailed information from which financial reports will be generated. For this reason, we assume that y cannot be used for contracting purposes.

We make the following assumptions on the density function $f(\varepsilon)$, defined on $\varepsilon \in [-d, d]$:

(a) $f(\varepsilon) = f(-\varepsilon)$ for $\varepsilon \in [-d, d]$;

(b) $f(d) = f(-d) = 0$;

(c) $f'(\varepsilon) < 0$ for $\varepsilon \in (0, d]$; and

(d) $d > \frac{1}{2}(H - L)$.

The distribution of ε is shown in Figure 1, and the corresponding distribution of y is shown in Figure 2. Assumptions (a) and (b) imply that the distribution of ε is symmetric and bounded. Assumption (c) implies that the likelihood ratio $f(y \mid x = L)/f(y \mid x = H)$ is monotonic (see Figure 2). This assumption is important in our model because the accounting system

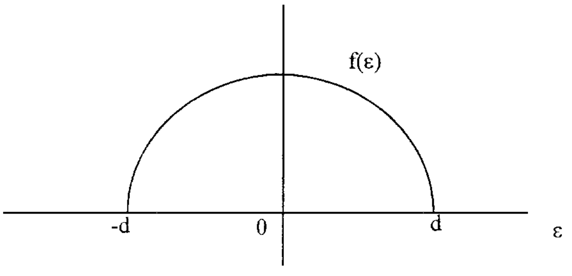

Figure 1. Distribution of ε.

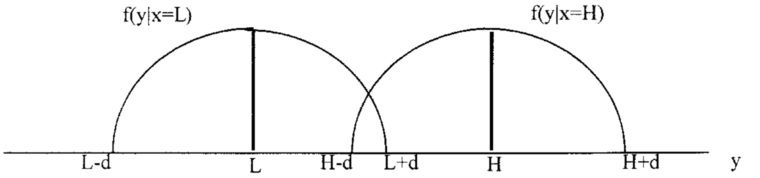

Figure 2. Distribution of y.

designed by the principal, discussed later in this section, involves a threshold level such that a high report is given if y is above the threshold, and a low report is given otherwise. The monotonicity of the likelihood ratio implies that the threshold based reporting system is efficient; given a probability of a type I error, the probability of a type II error is minimized, or, as more commonly stated, the statistical power is maximized.

Note that the two graphs representing $f(y \mid x = L)$ and $f(y \mid x = H)$ must intersect, since otherwise, observing y is equivalent to observing x. To avoid this trivial case, we assume that the graphs intersect, which occurs when $L + d > H - d$, or $d > \frac{1}{2}(H - L)$, which is assumption (d). Finally, note that y is unbiased.

Because we wish to investigate incentives for conservative reporting, we now introduce an accounting system that is designed by the principal.[8] We assume that at the end of the period, the accounting system produces a report z, $z \in \{L, H\}$, such that $z = L$ is reported when $y \leq w$ and $z = H$ is reported if $y > w$. That is, we assume that the accounting system's message dimensionality is identical to the outcome dimensionality. Thus, the system we consider reduces the dimensionality of the underlying information within the firm.[9] The parameter w is the threshold level to be chosen by the principal. In addition, we assume the following conditional probabilities for the accounting report given the outcome:

$$\text{Prob}[z = L \mid x = L] = \text{Prob}[y \leq w \mid x = L] = p, \quad \text{and}$$
$$\text{Prob}[z = H \mid x = H] = \text{Prob}[y > w \mid x = H] = q.$$

Figure 3 summarizes these relationships.

The probability p indicates the likelihood of reporting unfavorable outcomes when unfavorable outcomes occur, while q represents the likelihood of reporting favorable outcomes given that favorable outcomes occur. That is, p or q represents the probability of a "correct" report. Note that the choice of w determines both p and q simultaneously. A graphical representation is given in Figure 4.

1.2. *Preliminary Results*

We now define accounting conservatism and assess some consequences of neutral accounting. Let w_0 denote the level of y in which $f(y \mid x = L) = f(y \mid x = H)$. Since the distribution of ε is symmetric, we have $w_0 = (L + H)/2$. Based on this characteristic, we can define conservative reporting in the context of our model.

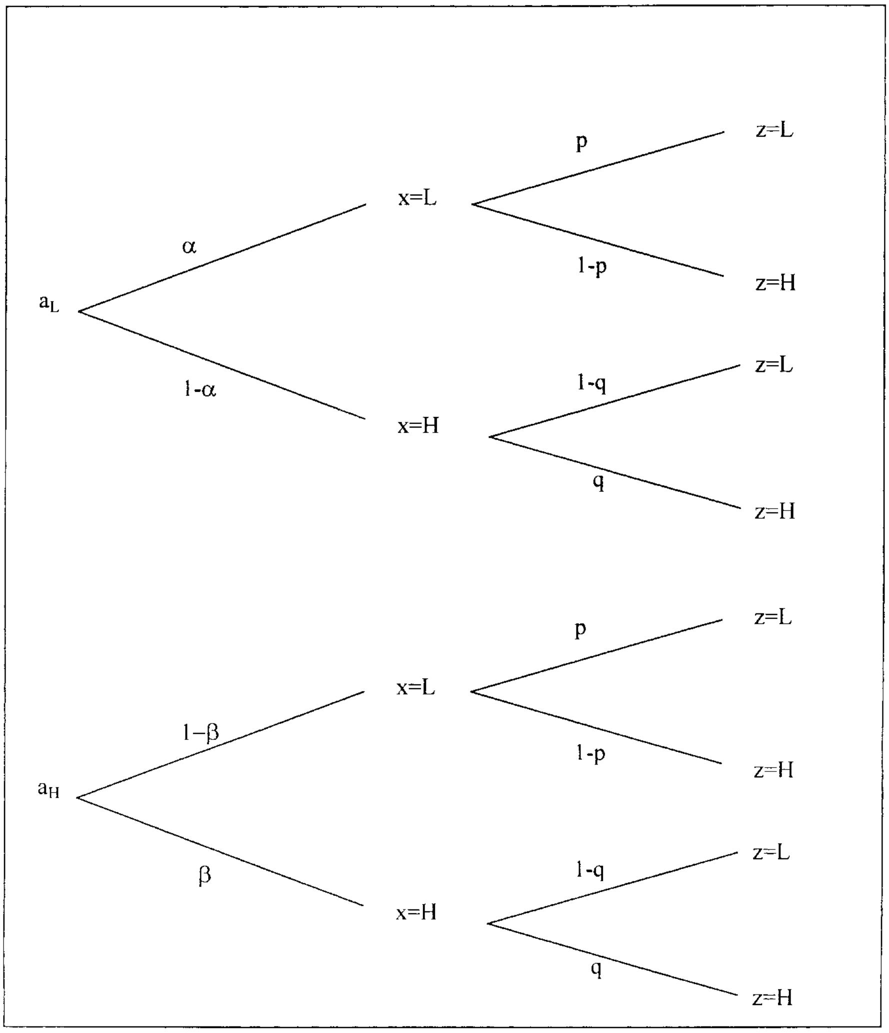

Figure 3. Conditional probabilities for outcome x and report z.

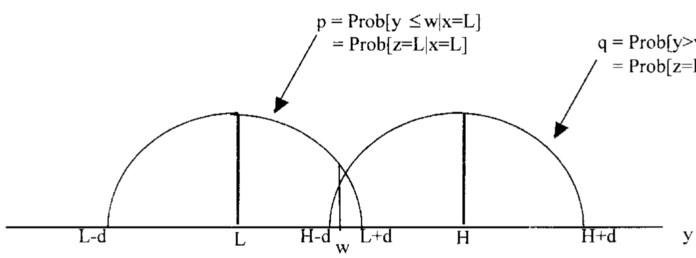

Figure 4. Determination of p and q.

Definition: *Accounting reporting is conservative if $w > w_0$, neutral if $w = w_0$, and liberal if $w < w_0$.*

This definition of conservative reporting implies that the accounting system is more likely to report "low" when the outcome is low than to report "high" when the outcome is high. The converse is true when the accounting system is liberal. Lemma 1 and Figure 4 formalize this intuition.

Lemma 1 *Let $p_0 \equiv p(w = w_0)$ and $q_0 \equiv q(w = w_0)$. Then,*

(a) $p_0 = q_0 > \frac{1}{2}$;

(b) $p_0' > 0, q_0' < 0$; *and*

(c) $p_0' + q_0' = 0$,

where $p_0' \equiv \frac{\partial p}{\partial w}|_{w=w_0}$ *and* $q_0 \equiv \frac{\partial q}{\partial w}|_{w=w_0}$, *respectively.*

Proof: See Appendix. ∎

According to Lemma 1, the probability of obtaining a correct report z is the same for each outcome, H or L, if the principal chooses w_0 as the threshold level of reporting, i.e., if the principal chooses "neutral" reporting. If the principal chooses a higher threshold level, $w > w_0$, then $p > q$. That is, the reporting system is more likely to be correct given the unfavorable outcome ($x = L$), but only at the cost of being more likely to be incorrect given the favorable outcome ($x = H$). Figure 4 shows that as w increases, p increases and q decreases.

Our definition of conservatism is consistent with that of Antle and Lambert (1982), who defined conservatism as a higher likelihood of identifying unfavorable conditions given that unfavorable conditions exist.[10] Our definition is also consistent with Devine (1963), who characterized conservatism as reporting favorable indications with some reluctance and reporting unfavorable indications promptly and with "unmistaken" emphasis. Finally, our definition is consistent with underreporting outcomes in early periods with subsequent overreporting in later periods (in our model, when x is observed).

2. Results

In this section we focus primarily on a limited liability setting, in which the penalties that can be imposed on the agent are restricted, and we show that conservatism arises naturally in such a setting. However, to illustrate the effects of the limited liability assumption, we also briefly consider the principal's design of an accounting system when compensation arrangements are unconstrained.

2.1. Limited Liability Setting

In practice, some limits are imposed on the maximum loss that agents can be forced to bear as a consequence of contracting with the principal. We operationalize this assumption in the following fashion. Let s_i denote the agent's compensation when $z = i, i \in \{L, H\}$ is reported. We assume that $s_i \geq b, i = L, H$ (i.e., the agent must receive at least amount b in any event).

Denoting the agent's utility function as $K(s, a)$, we assume an additively separable function $K(s, a) = U(s) - V(a)$, where

$$U'(s) > 0, \quad U''(s) < 0,$$

$$V(a_H) = v > 0, \quad V(a_L) = 0, \quad \text{and}$$

$$\bar{K} \equiv \text{minimum utility required to employ the agent.}$$

Thus, the agent is risk averse (we consider the special case of risk neutrality later) and incurs more effort disutility for action a_H than for a_L. For convenience, we introduce the inverse function $\phi(\cdot)$ of $U(\cdot)$:

$$s = \phi(u) \quad \text{if and only if} \quad u = U(s).$$

Recalling that the principal is risk neutral and wishes to motivate a_H, the principal's problem is:

$$\max_{s_L, s_H, w} (1-\beta)L + \beta H - [(1-\beta)p + \beta(1-q)]s_L - [(1-\beta)(1-p) + \beta q]s_H$$

subject to:

$$[(1-\beta)p + \beta(1-q)]U(s_L) + [(1-\beta)(1-p) + \beta q]U(s_H) - v \geq \bar{K} \tag{1}$$

$$[(1-\beta)p + \beta(1-q)]U(s_L) + [(1-\beta)(1-p) + \beta q]U(s_H) - v$$
$$\geq [\alpha p + (1-\alpha)(1-q)]U(s_L) + [\alpha(1-p) + (1-\alpha)q]U(s_H) \tag{2}$$

$$s_i \geq b, \qquad i = L, H. \tag{3}$$

Constraint (1) is the individuality rationality constraint, (2) is the incentive compatibility constraint, and (3) is the limited liability constraint.

By rearranging the principal's constraints, the principal's problem can be easily solved graphically for s_H and s_L. In Figure 5, these constraints are plotted such that constraint (3), the limited liability or minimum wage constraint, is binding. Such an outcome will occur if $\bar{K}$ is sufficiently small (we specify the exact requirement on $\bar{K}$ later).

Note that point Q in Figure 5 is the intersection of constraints (1) and (2). If the lower bound b of the agent's fee is large relative to $\bar{K}$, point Q is infeasible, and constraint (3) becomes binding for s_L. If b is small relative to $\bar{K}$, however, point Q is feasible, and constraint (3) is non-binding at the optimum. The coordinates of point Q are

$$\left(\bar{K} - \frac{(1-p) + (1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v, \bar{K} + \frac{p\alpha + (1-\alpha)(1-q)}{(\alpha+\beta-1)(p+q-1)}v\right).$$

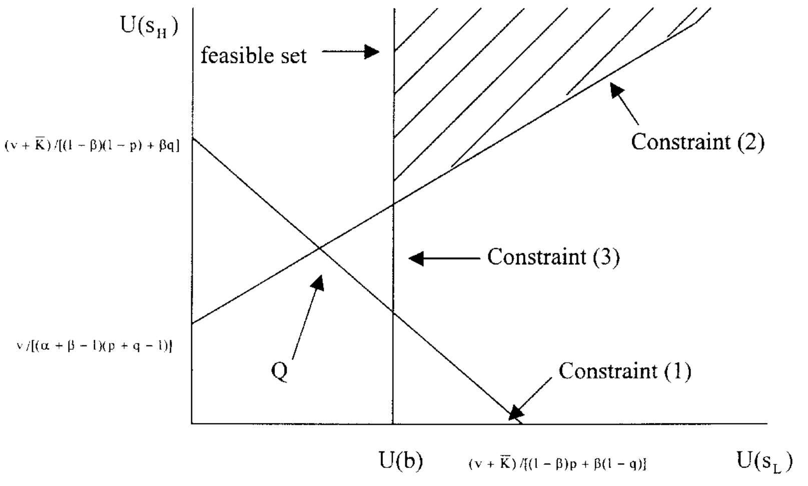

Figure 5. The feasible set of wage solutions.

Assume that b is sufficiently large that constraint (3) is binding at the optimum. Given the coordinates of Q, this assumption is equivalent to

$$b > \phi\left(\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right).$$

In other words, the agent gets more than his minimum utility due to the limited liability constraint imposed on the contract. Thus, denoting the principal's utility as $G(\cdot)$, the solution to the program is:

$$s_L^* = b$$

$$s_H^* = \phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right]$$

$$\begin{aligned} EK &= [(1-\beta)p + \beta(1-q)]U(b) + [(1-\beta)(1-p) + \beta q] \\ &\quad \times \left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - v \end{aligned}$$

$$\begin{aligned} EG &= (1-\beta)L + \beta H - [(1-\beta)p + \beta(1-q)]b - [(1-\beta)(1-p) + \beta q] \\ &\quad \times \phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right]. \end{aligned}$$

Having solved for the optimal wage schedule, we next turn to the principal's accounting system choice, embodied in the selection of the threshold w.

Proposition 1 *The optimal threshold w^* in the principal's problem is such that $w^* \in (w_0, L+d)$, which implies that accounting reporting is conservative with $q < p < 1$.*

Proof: See Appendix. ■

Thus, in our setting, it is in the best interest of the principal to have a reporting system which provides a higher likelihood of detecting an unfavorable outcome (p) than the likelihood of detecting a favorable outcome (q). To understand why this happens, consider the graph in Figure 6.

The principal's expected compensation cost, EC, is:

$$\begin{aligned} EC &= \text{Prob}(z = L)s_L^* + \text{Prob}(z = H)s_H^* \\ &= s_L^* + \text{Prob}(z = H)[s_H^* - s_L^*] \\ &= b + [1 - p + \beta(p + q - 1)]\left\{\phi\left[U(b) + \frac{\nu}{(\alpha + \beta - 1)(p + q - 1)}\right] - b\right\}. \end{aligned}$$

A change in w not only affects $\text{Prob}(z = H)$ but also changes s_H^* through $p(w)$ and $q(w)$. In general, as p or q increases, the principal will be better off, since the signal z becomes more informative. However, in our setting, p and q are chosen by the choice of w, and, as we see in Figure 6, they generally move in opposite directions as w changes. Therefore, in choosing w, the principal faces a tradeoff between p and q.

An increase of w, up to $H - d$, generates a more informative signal z, since it increases p without decreasing q. However, for any increase in w beyond $w = H - d$, the principal knows that q decreases. Up to $w = w_0$, the increase in p more than offsets the decrease in q (i.e., $p' + q' \geq 0$), thus decreasing s_H^*. Because $s_L^* = b$ is a constant, the question becomes whether $\text{Prob}(z = H)$ can be reduced even further by the choice of $w > w_0$, i.e., by adopting a conservative reporting system. To add economic insight, we differentiate $\text{Prob}(z = H)$ with respect to w:

$$\begin{aligned} \frac{d}{dw}\text{Prob}(z = H) &= -(1 - \beta)p' + \beta q' \\ &= -p' + \beta(p' + q') \end{aligned}$$

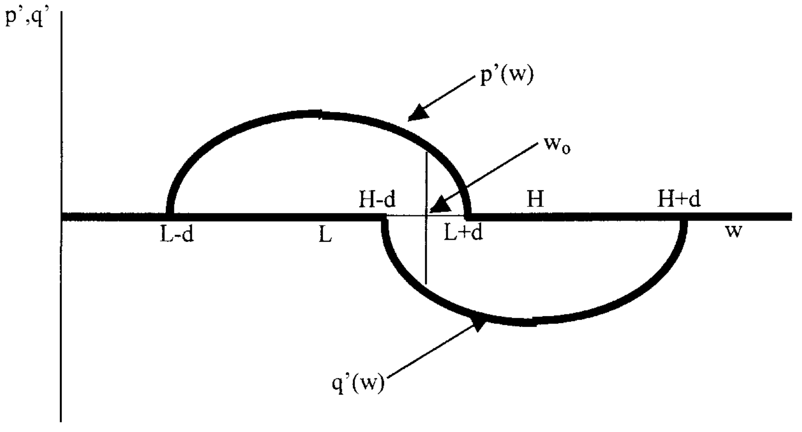

Figure 6. Marginal effects on $p(w)$ and $q(w)$ of changing the report threshold w.

At $w = w_0$, $p' + q' = 0$ from Lemma 1. Thus, the increase in w around $w = w_0$ has no impact on s_H^* at the margin, but it will decrease the probability of paying s_H^*, i.e., Prob$(z = H)$. By using a conservative accounting rule, the principal can effectively reduce the chance of paying the agent a high salary s_H^* without affecting his action incentives.

Corollary 1 *If the agent is risk-neutral, then* $w^* = L + d$, *or equivalently,* $p = 1$, *at the optimum.*

Proof: See Appendix. ■

The important element of Corollary 1 is that risk-neutrality does not eliminate conservatism. In fact, the principal rationally can be no more conservative than by setting $w^* = L + d$. This result emphasizes the fact that contract restrictions in the form of limited agent liability, and not agent risk aversion, create the incentives for conservatism in this model.

2.2. Conservatism and the Efficiency of Accounting Performance Measures[11]

Kim (1995) derives a sufficient condition based on likelihood ratios for a performance measurement system to be more efficient than another system. Briefly, Kim (1995) documents that an increase in the variability of the likelihood ratios improves the efficiency of contracts because it permits the use of incentives with a lower risk premium.[12] In this subsection, we show how Kim's (1995) ranking of performance measurement systems is related to our results regarding the benefits of conservatism.

To describe Kim's (1995) main result in the framework of the present model, consider the principal's contract design problem in Section 2.1. Assuming an interior solution, Kim's (1995) characterization of the agent's optimal fee schedule, $s^w(z)$, can be written as follows:

$$\frac{1}{u'[s^w(z)]} = \begin{cases} \lambda^w + \mu^w L(z \mid a_H, a_L, w) & \text{if (RHS)} \geq \dfrac{1}{u'(b)} \quad \text{(4a)} \\[2ex] \dfrac{1}{u'(b)} & \text{otherwise} \quad \text{(4b)} \end{cases}$$

where λ^w and μ^w are Lagrange multipliers associated with constraints (1) and (2), w refers to the optimal threshold that the principal chooses, $L(z \mid a_H, a_L, w) = \frac{p(z \mid a_H, w) - p(z \mid a_L, w)}{p(z \mid a_H, w)}$ is the report likelihood ratio, and b is the lower bound of the agent's fee as constraint (3) requires. Because $s^w(H) > s^w(L) \geq b$ must hold by constraints (2) and (3), the agent's fee $s^w(H)$ must satisfy condition (4a). On the other hand, the agent's fee $s^w(L)$ is determined by condition (4a) if the limited liability constraint (3) is not binding, and by condition (4b) if (3) is binding. To state Kim's (1995) result in terms of our model, denote the solution to (4a) for $z = L$ as s_L^w.

Kim's (1995) main result states that the threshold w is more efficient than the threshold w_0 (i.e., $E[s^w(z)] < E[s^{w_0}(z)]$) if the likelihood ratio of report probabilities with the threshold

w is a mean preserving spread of the likelihood ratio with the threshold w_0, i.e.,

$$\frac{p(z_L \mid a_H, w) - p(z_L \mid a_L, w)}{p(z_L \mid a_H, w)} \leq \frac{p(z_L \mid a_H, w_0) - p(z_L \mid a_L, w_0)}{p(z_L \mid a_H, w_0)} \tag{5a}$$

$$\frac{p(z_H \mid a_H, w) - p(z_H \mid a_L, w)}{p(z_H \mid a_H, w)} \geq \frac{p(z_H \mid a_H, w_0) - p(z_H \mid a_L, w_0)}{p(z_H \mid a_H, w_0)} \tag{5b}$$

(at least one inequality must be strict) if the limited liability constraint (3) is not binding for $z = L$.

Using Figure 3, conditions (5a) and (5b) can be restated in a more convenient form as follows:

$$-\frac{p(w) + q(w) - 1}{p(w) - \beta(p(w) + q(w) - 1)} \leq -\frac{2p_0 - 1}{p_0 - \beta(2p_0 - 1)} \tag{6a}$$

$$\frac{p(w) + q(w) - 1}{1 - p(w) + \beta(p(w) + q(w) - 1)} \geq \frac{2p_0 - 1}{1 - p_0 + \beta(2p_0 - 1)} \tag{6b}$$

As mentioned above, condition (6a) applies only when $s_L^w \geq b$.[13] Note that the (LHS) is increasing in w near w_0 for both (6a) and (6b). As a result, a conservative accounting system $w(>w_0)$ does not satisfy Kim's (1995) likelihood ratio conditions (6a) and (6b) whenever the limited liability constraint (3) is not binding, and thus the agent's fee is characterized by condition (4a) for both $z = L$ and $z = H$.[14]

Turning to the limited liability setting, consider the case where $s_L^w < b$, i.e.,

$$\lambda^{w_0} + \mu^{w_0}\left[-\frac{(2p_0 - 1)(\alpha + \beta - 1)}{p_0 - \beta(2p_0 - 1)}\right] < \frac{1}{u'(b)}, \tag{7}$$

where

$$-\frac{(2p_0 - 1)(\alpha + \beta - 1)}{p_0 - \beta(2p_0 - 1)} = \frac{p(z_L \mid a_H, w_0) - p(z_L \mid a_L, w_0)}{p(z_L \mid a_H, w_0)}.$$

As a result, constraint (3) is binding for $z = L$ with the threshold w_0. Of course, condition (4a) continues to determine $s^w(H)$, since (3) is never binding when $z = H$.[15] If (3) is binding for $z = L$, then $s^w(L) = b$ by this constraint, and conditions (5a) and (5b) are reduced to:

$$\frac{p(z_H \mid a_H, w) - p(z_H \mid a_L, w)}{p(z_H \mid a_H, w)} \geq \frac{p(z_H \mid a_H, w_0) - p(z_H \mid a_L, w_0)}{p(z_H \mid a_H, w_0)}, \tag{8}$$

and condition (5a) is not needed. Observe that the following inequality must hold for all w sufficiently close to w_0 by continuity:

$$\lambda^w + \mu^w\left[-\frac{(p(w) + q(w) - 1)(\alpha + \beta - 1)}{p(w) - \beta(p(w) + q(w) - 1)}\right] < \frac{1}{u'(b)}. \tag{9}$$

Thus, $s_L^w < b$ and constraint (3) is binding for $z = L$ whenever the threshold w is sufficiently close to w_0 so that (9) holds. Of course, the agent's fee $s^w(H)$ is determined by condition (4a), barring the uninteresting case noted in footnote 15.

Consider a setting with the following three properties: (i) inequality (7) holds; (ii) w is sufficiently close to w_0 so that (9) holds; and (iii) $w > w_0$. Since $s_L^w < b$ for all such w by (ii), Kim's (1995) likelihood ratio condition is reduced to (8). Thus, given conditions (i)–(iii), the threshold w is more efficient than the threshold w_0 if

$$\frac{p(w)+q(w)-1}{1-p(w)+\beta(p(w)+q(w)-1)} \geq \frac{2p_0-1}{1-p_0+\beta(2p_0-1)}. \tag{10}$$

The (LHS) of (10) is strictly increasing in w near w_0 since

$$\left[\frac{\partial}{\partial w}\left(\frac{p(w)+q(w)-1}{1-p(w)+\beta(p(w)+q(w)-1)}\right)\right]_{w=w_0} = \frac{p_0'(2p_0-1)}{[1-p_0+\beta(2p_0-1)]^2} > 0.$$

Because the limited liability constraint (3) is binding for $z = L$, Kim's (1995) likelihood ratio condition (10) is satisfied for all w with properties (i)–(iii). Consequently, the optimal threshold exhibits conservatism: $w^* \in (w_0, L+d)$, as shown in Proposition 1.

Intuitively, the limited liability constraint (3) reduces the effect of significantly negative likelihood ratios on the agent's fee schedule and makes accounting conservatism beneficial because conservatism implies that performance measurement system parameters increase likelihood ratios for higher outcomes, where the agent's compensation exceeds the lower bound b.

This analysis may be useful in extending our results beyond the binary outcome setting. Note that Kim's (1995) performance measurement system ranking is formulated in terms of the probability likelihood ratios of such measures. Because likelihood ratios are not restricted to binary outcomes, Kim's (1995) ranking may be useful in extending the present analysis of conservatism to cases of three or more outcomes.

2.3. Unlimited Liability Setting

To understand the role of limited liability in the results of Section 2.1, we consider a setting in this section in which the limited liability constraint is not binding. We assume that b is "small" in the sense that

$$b \leq \phi\left(\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right).$$

The solution to the principal's problem when the limited liability constraint is not binding is easily obtained graphically, as shown in Figure 7.

As we discussed in Section 2.1, the coordinates of point Q are

$$\left(\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v,\ \bar{K} + \frac{p\alpha+(1-\alpha)(1-q)}{(\alpha+\beta-1)(p+q-1)}v\right).$$

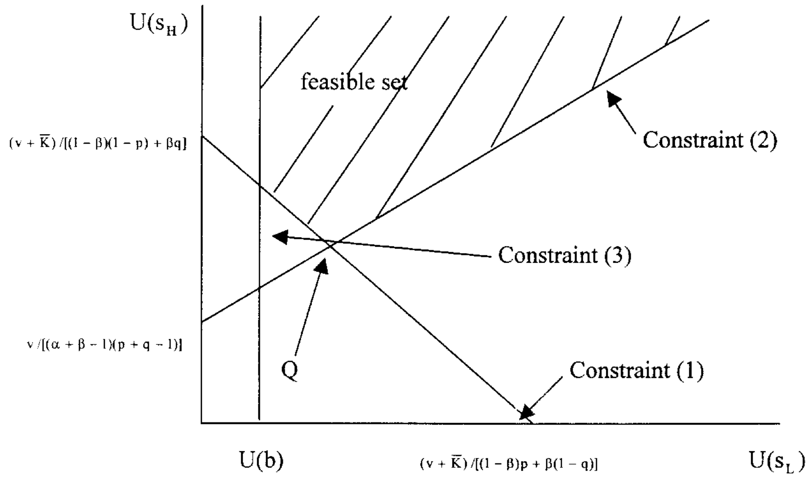

Figure 7. The feasible set of wage solutions with unlimited liability.

Thus, the solution to the principal's problem, without considering the limited liability constraint, constraint (3), is:

$$s_L^* = \phi\left[\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right]$$

$$s_H^* = \phi\left[\bar{K} + \frac{p\alpha+(1-\alpha)(1-q)}{(\alpha+\beta-1)(p+q-1)}v\right].$$

Given these optimal wages, we can consider the principal's accounting system design.

Proposition 2 *With unlimited liability,* $H - d < w^* < L + d$.

Proof: See Appendix. ■

Note that the result in Proposition 2 does not indicate whether w^* is larger or smaller than w_0. To investigate circumstances under which the principal will design a conservative or liberal accounting system, we consider a special case of the agent's utility function. Specifically, we solve the principal's problem in a setting in which the agent is risk averse, with a square-root utility function over compensation.

Corollary 2 *Assume that* $U(s) = \sqrt{s}$ *(the agent is risk averse), the agent's liability is unlimited, and EG is concave in* w.[16] *Then*

(i) $w^* > w_0$ *if* $\beta < \frac{1}{2}$,

(ii) $w^* = w_0$ *if* $\beta = \frac{1}{2}$, *and*

(iii) $w^* < w_0$ *if* $\beta > \frac{1}{2}$.

Proof: See Appendix. ■

Briefly, Corollary 2 demonstrates that when limited liability does not exist, conservative or liberal accounting systems may arise depending on the situation. In our case, the choice of w depends on the likelihood that the agent's action will yield the principal's desired outcome. In such a setting, we should not observe a consistent and persistent conservative bias in accounting reports.

Finally, we consider a setting in which the agent is risk neutral.

Corollary 3 *Assume that* $U(s) = s$ *and the agent's liability is unlimited. Then,* $w_0 = \frac{1}{2}(L + H)$ *is an optimal threshold. That is, the principal has no incentive to create a conservative accounting system.*

Proof: See Appendix. ■

If the agent is risk neutral, the principal's expected utility is independent of w. Thus, the principal has no incentive to select a conservative or liberal accounting system. More generally, if the principal has other uses for the information that induce a strict preference for unbiased information (e.g., the principal wishes to make allocation or investment decisions on the basis of the information), then the principal would strictly prefer an unbiased system in all circumstances.

3. Conclusion

To the extent that available penalties are sufficiently limited in a contractual setting, we have shown that conservative financial reporting arises naturally as a means of efficiently motivating agents. We consider an accounting system whose reports are used for contracting and whose parameters are controlled by the principal. One advantage of our model is that the information system we describe has the accounting characteristic of mapping unbiased underlying information about the firm into a reduced message space. The principal can choose how that mapping operates, i.e., conservatively, liberally, or neutrally. In a limited liability setting, we show that the accounting system designed by the principal is always conservative. Alternatively, in an unlimited liability setting, any bias in the system depends on random circumstances, and we would not expect conservatism to arise as a pervasive phenomenon.

We provide one explanation for how limited liability induces a demand for conservatism by relating our analysis to Kim's (1995) results regarding the ranking of performance measurement systems based on report likelihood ratios. Because a limited liability constraint makes the variability of lower reports irrelevant, the principal increases the likelihood ratio of higher reports, thereby improving contract efficiency, by designing a conservative reporting system. However, because Kim's (1995) conditions are sufficient, but not necessary, conservatism may arise in settings with or without limited liability for other reasons as well.

Thus, we add to the list of explanations for conservative accounting practices, practices that predate regulatory intervention by centuries. Of course, there may be countervailing forces that offset these effects. For example, the Financial Accounting Standards Board (SFAS No. 2), focusing on investors' use of accounting information in predicting future cash flows, argues that financial statements should be unbiased.[17] To the extent that the informational role of financial reporting dominates the contracting role, we might expect conservatism to be less important.

Appendix

Preliminaries

Based on the assumptions in Section 1.1, we first state some preliminary facts about $p(w)$ and $q(w)$:

$$p(w) = \begin{cases} 0 & \text{for } w < L - d \\ \int_{-d}^{w-L} f(\varepsilon)\, d\varepsilon & \text{for } L - d < w < L \\ 1 - \int_{w-L}^{d} f(\varepsilon)\, d\varepsilon & \text{for } L < w < L + d \\ 1 & \text{for } w > L + d \end{cases}$$

and

$$p'(w) = \begin{cases} 0 & \text{for } w < L - d \\ f(w - L) & \text{for } L - d < w < L \\ f(w - L) & \text{for } L < w < L + d \\ 0 & \text{for } w > L + d \end{cases}.$$

Similarly, we have:

$$q(w) = \begin{cases} 1 & \text{for } w < H - d \\ 1 - \int_{-d}^{w-H} f(\varepsilon)\, d\varepsilon & \text{for } H - d < w < H \\ \int_{w-H}^{d} f(\varepsilon)\, d\varepsilon & \text{for } H < w < H + d \\ 0 & \text{for } w > H + d \end{cases}$$

and

$$q'(w) = \begin{cases} 0 & \text{for } w < H - d \\ -f(w - H) & \text{for } H - d < w < H \\ -f(w - H) & \text{for } H < w < H + d \\ 0 & \text{for } w > H + d \end{cases}$$

Proof of Lemma 1:

(a)

$$p_0 = 1 - \int_{w_0 - L}^{d} f(\varepsilon)\, d\varepsilon = 1 - \int_{\frac{H-L}{2}}^{d} f(\varepsilon)\, d\varepsilon > 1 - \int_{0}^{d} f(\varepsilon)\, d\varepsilon = \frac{1}{2}$$

$$q_0 = 1 - \int_{-d}^{w_0 - H} f(\varepsilon)\, d\varepsilon = 1 - \int_{\frac{H-L}{2}}^{d} f(\varepsilon)\, d\varepsilon = p_0$$

(b)

$$p_0' = f(w_0 - L) = f\left(\frac{H-L}{2}\right) > 0 \quad \text{because } d > \frac{H-L}{2}.$$
$$q_0' = -f(w_0 - H) = -f\left(\frac{L-H}{2}\right) < 0 \quad \text{because } d > \frac{H-L}{2}.$$

(c)

$$p_0' + q_0' = f\left(\frac{H-L}{2}\right) - f\left(\frac{L-H}{2}\right) = f\left(\frac{H-L}{2}\right) - f\left(\frac{H-L}{2}\right) = 0$$

because $f(\varepsilon) = f(-\varepsilon)$. ■

Proof of Proposition 1: The proof is by contradicting other possibilities.

(1) Suppose $w \leq H - d$. Then $q(w) = 1$ and $p(w) < 1$. In addition, the principal's expected cost to compensate the agent for his effort has the form:

$$EC = (1-\beta)bp(w) + [(1-\beta)(1-p(w)) + \beta]\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)p(w)}\right]$$
$$= b + [1-(1-\beta)p(w)]\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)p(w)}\right] - b\right\}.$$

As w increases, $p(w)$ increases. Also, as $p(w)$ increases, both $[1-(1-\beta)p(w)]$ and $\{\phi[U(b) + \frac{v}{(\alpha+\beta-1)p(w)}] - b\}$ decrease. Therefore $\frac{\partial EC}{\partial w} < 0$ for $w \leq H - d$, and the optimal w must be greater than $H - d$, contradicting the original supposition.

(2) Suppose $w \geq L + d$. Then $p(w) = 1$, $q(w) < 1$, and

$$EC = [1-\beta q(w)]b + \beta q(w)\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)q(w)}\right]$$
$$= b + \beta q(w)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)q(w)}\right] - b\right\}$$
$$= b + \frac{\beta v}{\alpha+\beta-1} \bullet \frac{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)q(w)}\right] - \phi[U(b)]}{\frac{v}{(\alpha+\beta-1)q(w)}}.$$

As w increases, $q(w)$ decreases. Since the function $s = \phi(u)$ is strictly convex in u, it follows from the above expression that EC increases, i.e., $\frac{\partial EC}{\partial w} > 0$ for $w \geq L + d$. Therefore the optimal w must be less than $L + d$, contradicting the original supposition.

(3) Suppose $H - d < w \leq w_0$. In this region,

$$p'(w) = f(w-L) > 0, \quad \text{and} \quad q'(w) = -f(w-H) < 0.$$

If $w - L < 0$, then $f(w - L) > f(w - H)$.
If $w - L > 0$, then $|w - H| \geq w - L$ for $w \leq w_0 = (H + L)/2$, which implies

$$f(w - L) \geq f(w - H) > 0 \quad \text{for } H - d < w \leq w_0.$$

Thus, $p'(w) + q'(w) = f(w - L) - f(w - H) \geq 0$ for $H - d < w \leq w_0$.
Note that

$$\begin{aligned}
EC &= [(1-\beta)p + \beta(1-q)]b + [(1-\beta)(1-p) + \beta q] \\
&\quad \times \phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] \\
&= pb + (1-p)\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] \\
&\quad + \beta(p+q-1)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\} \\
&= b + (1-p)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\} \\
&\quad + \beta(p+q-1)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\} \\
&= b + Y(w) + Z(w)
\end{aligned}$$

where

$$Y(w) = (1-p)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\}$$

and

$$Z(w) = \beta(p+q-1)\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\}.$$

Differentiating $Y(w)$ with respect to w yields:

$$\begin{aligned}
Y'(w) &= -p'\left\{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - b\right\} \\
&\quad + (1-p)\phi'\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] \\
&\quad \bullet \frac{-v}{(\alpha+\beta-1)(p+q-1)^2}(p'+q') < 0.
\end{aligned}$$

Rewrite $Z(w)$ in the form:

$$Z(w) = \frac{\beta v}{\alpha+\beta-1} \bullet \frac{\phi\left[U(b) + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] - \phi\left[U(b)\right]}{\frac{v}{(\alpha+\beta-1)(p+q-1)}}.$$

Note that $p(w)+q(w)$ weakly increases in w. Since $\phi(u)$ is convex in u, it then follows from the above expression that $Z(w)$ weakly decreases.

Therefore, we have:

$$\frac{\partial EC}{\partial w} = Y'(w) + Z'(w) < 0 \quad \text{for all } H - d < w \le w_0,$$

which implies that EC strictly decreases throughout the region $H - d < w \le w_0$ and thus the optimal $w > w_0$, contradicting the original supposition.

Thus, we have proved that, at the optimum, $w_0 < w^* < L + d$. ■

Proof of Corollary 1: When $U(s) = s$,

$$\begin{aligned} EC &= [(1-\beta)p + \beta(1-q)]b + [(1-\beta)(1-p) + \beta q] \\ &\quad \times \left[b + \frac{v}{(\alpha+\beta-1)(p+q-1)}\right] \\ &= b + \left(\frac{v}{\alpha+\beta-1}\right)\left(\beta + \frac{1-p}{p+q-1}\right). \end{aligned}$$

Thus, the principal will choose w to minimize EC, or, equivalently, minimize $\frac{1-p}{p+q-1}$. Since $\frac{1-p}{p+q-1} \ge 0$, it follows that $p = 1$ is the optimum. ■

Proof of Proposition 2: Given the solution to the principal's problem,

$$s_L = \phi\left[\bar{K} - \frac{(1-p) + (1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right],$$

$$s_H = \phi\left[\bar{K} + \frac{\alpha p + (1-\alpha)(1-q)}{(\alpha+\beta-1)(p+q-1)}v\right],$$

we have:

$$\begin{aligned} EC &= [p - \beta(p+q-1)]\phi\left[\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right] \\ &\quad + [(1-p) + \beta(p+q-1)]\phi\left[\bar{K} + \frac{(1-q)+\alpha(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right]. \end{aligned}$$

(a) Suppose $w \ge L + d$. Then $p(w) = 1$ and $q(w) < 1$. Also, as w increases, $q(w)$ decreases. Note that:

$$\begin{aligned} EC &= (1-\beta q)\phi\left[\bar{K} - \frac{(1-\alpha)q}{(\alpha+\beta-1)q}v\right] + \beta q\phi\left[\bar{K} + \frac{1-(1-\alpha)q}{(\alpha+\beta-1)q}v\right] \\ &= (1-\beta q)\phi(M) + \beta q\phi\left[M + \frac{v}{(\alpha+\beta-1)q}\right] \end{aligned}$$

where $M = \bar{K} - \frac{1-\alpha}{\alpha+\beta-1}v$ is independent of w.

Thus, the principal's expected compensation cost, EC, can be written as:

$$EC = \phi(M) + \frac{\beta v}{\alpha+\beta-1} \bullet \frac{\phi\left[M + \frac{v}{(\alpha+\beta-1)q}\right] - \phi(M)}{\frac{v}{(\alpha+\beta-1)q}}.$$

As w increases, $q(w)$ decreases. Since $\phi(u)$ is convex in u, EC is increasing in w in the region $w \geq L + d$, and therefore $w^* < L + d$.

(b) Suppose $w \leq H - d$. Then $p(w) < 1$ and $q(w) = 1$. Also, as w increases, $p(w)$ increases. The principal's expected compensation cost is given by:

$$EC = (1-\beta)p\phi\left[\bar{K} - \frac{(1-\alpha p)}{(\alpha+\beta-1)p}v\right] + [1-(1-\beta)p]\phi\left[\bar{K} + \frac{\alpha}{(\alpha+\beta-1)}v\right].$$

Setting $A = \bar{K} + \frac{\alpha}{(\alpha+\beta-1)}v$, EC can be written as:

$$EC = (1-\beta)p\phi\left[A - \frac{v}{(\alpha+\beta-1)p}\right] + [1-(1-\beta)p]\phi(A)$$
$$= \phi(A) - \frac{(1-\beta)v}{\alpha+\beta-1} \bullet \frac{\phi(A) - \phi\left[A - \frac{v}{(\alpha+\beta-1)p}\right]}{\frac{v}{(\alpha+\beta-1)p}}.$$

As w increases, so does $p(w)$. The convexity of $\phi(u)$ then implies that EC decreases throughout the region $w \leq H - d$. Thus, we have shown that the optimal w is larger than $H - d$. ■

Proof of Corollary 2: For $U(s) = \sqrt{s}$, the principal's expected compensation cost is:

$$EC = [(1-\beta)p + \beta(1-q)]\left[\bar{K} - \frac{(1-p)+(1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right]^2 + [(1-\beta)(1-p)+\beta q]\left[\bar{K} + \frac{(1-q)+\alpha(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right]^2.$$

Opening the two square terms, EC can be simplified to the form:

$$EC = \bar{K}^2 + 2v\bar{K} - \frac{v^2}{(\alpha+\beta-1)^2}(1-\alpha)(\alpha+2\beta-1) + \frac{v^2}{(\alpha+\beta-1)^2}\left[\frac{p(1-p)}{(p+q-1)^2} + \beta\frac{2p-1}{(p+q-1)}\right].$$

Differentiating EC with respect to w yields:

$$\frac{\partial EC}{\partial w} = \frac{v^2}{(\alpha+\beta-1)^2}\left\{\frac{1-2p}{(p+q-1)^2}p' - \frac{2p(1-p)}{(p+q-1)^3}(p'+q') + \beta\left[\frac{2}{p+q-1}p' - \frac{2p-1}{(p+q-1)^2}(p'+q')\right]\right\}.$$

At $w = w_0$, $p_0' > 0$, $p_0' + q_0' = 0$, and $p_0 = q_0 > \frac{1}{2}$. Thus, we have

$$\left.\frac{\partial EC}{\partial w}\right|_{w=w_0} = \frac{v^2}{(\alpha+\beta-1)^2}\left\{-\frac{1}{2p_0-1}p_0' + \beta\left(\frac{2}{2p_0-1}\right)p_0'\right\}$$
$$= \frac{v^2}{(\alpha+\beta-1)^2}\frac{p_0'}{2p_0-1}(2\beta-1).$$

Since $\frac{v^2}{(\alpha+\beta-1)^2}\frac{p_0'}{2p_0-1}$ is positive, the sign of $\left.\frac{\partial EC}{\partial w}\right|_{w=w_0}$ is identical to the sign of $2\beta - 1$ and the results follow. ■

Proof of Corollary 3: For $U(s) = s$, the principal's expected utility is:

$$\begin{aligned} EG &= (1-\beta)L + \beta H - [(1-\beta)p + \beta(1-q)] \\ &\quad \times \left[\bar{K} - \frac{(1-p) + (1-\alpha)(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right] \\ &\quad - [(1-\beta)(1-p) + \beta q]\left[\bar{K} + \frac{(1-q) + \alpha(p+q-1)}{(\alpha+\beta-1)(p+q-1)}v\right] \\ &= (1-\beta)L + \beta H - \bar{K} - v, \end{aligned}$$

which is independent of w. Thus, $w_0 = \frac{1}{2}(L+H)$ is an optimal threshold. ■

Acknowledgments

We thank G. Feltham (the Editor) and two anonymous referees for helpful comments and suggestions.

Notes

1. Accounting Principles Board Statement No. 4 (APB (1970, p. 171) describes conservatism as follows: "Frequently, assets and liabilities are measured in a context of significant uncertainties. Historically, managers, investors, and accountants have generally preferred that possible errors in measurement be in the direction of understatement rather than overstatement of net income and net assets." Sterling (1970, p. 256) calls conservatism the most influential principle of valuation in accounting.
2. See, for example, Devine (1963), Jensen and Meckling (1976), and Antle and Lambert (1988). Basu (1997) suggests that conservative accounting practices have been observed from the early 15th century.
3. Beaver (1993) provides a brief critique of these arguments.
4. See, for example, Jensen and Meckling (1976) or Watts and Zimmerman (1986) for these arguments.
5. Other recent publications which use an agency setting and contain similar rationales for contract restrictions include Evans and Sridhar (1996), Bushman, Indjejikian, and Smith (1995), and Baiman and Rajan (1995).
6. Sappington (1983, p. 2) justifies the limited liability assumption in the following way: "Contracts in which the liability of one or more parties is explicitly limited are very common in practice. Bankruptcy clauses, statements of conditions under which breach of contract is permissible, and provisions in corporate charters which limit the liability of each stockholder to the value of his shares are all examples of limited liability clauses. Contracts which contain such clauses are particularly conspicuous in practice when: (1) information about risk is incomplete or cannot be attained at the same cost by all parties to the contract . . . , (2) social concerns warrant subsidies for participation in certain activities . . . , (3) paternalism and/or equity consideration mandate risk spreading or the guarantee of a subsistence level of "well-being" for each member of society . . . "

7. The binary outcome setting is also helpful in defining conservatism. Efforts to extend our model to three or more outcomes were unsuccessful, as we found the expanded models intractable.
8. As Beaver (1993, p. 1) points out: "Conservative behavior implies some choice with respect to the reporting of the outcomes from the financial reporting system."
9. Other papers that assume that the dimensionality of the message space is less than the dimensionality of the information space include Evans and Sridhar (1996) and Dye (1988).
10. Antle and Lambert (1988) define conservatism in terms of the accountant's choice of investigation procedures rather than in terms of the accountant's report, because in their setting, the accountant is always induced to report truthfully (in an unbiased fashion) by the revelation principle.
11. We are grateful to an anonymous reviewer who suggested that we consider Kim (1995). In addition, we thank Jerry Feltham, the Editor, for insightful suggestions that motivated the analysis in this subsection.
12. Kim and Suh (1991) make a similar point for more restrictive preference and distribution assumptions.
13. Recall that s_L^w is the solution of condition (4a) for $z = L$.
14. Kim's (1995) conditions (5a) and (5b) are sufficient but not necessary. Thus, situations exist in which the threshold w does not satisfy conditions (5a) and (5b) but nevertheless is more efficient than the neutral threshold w_0.
15. If the solution $s^w(z)$ of (4a) is less than b for $z = H$, constraint (3) is binding for both $z = L$ and $z = H$. This uninteresting case is not considered here.
16. The latter assumption ensures that w^* is optimal if and only if $\left[\frac{\partial EG}{\partial w}\right]_{w=w^*} = 0$.
17. The FASB (SFAS No. 2, p. 60) states: "Since a preference 'that possible errors in measurement be in the direction of understatement rather than overstatement of net income and net assets' introduces a bias into financial reporting, conservatism tends to conflict with significant qualitative characteristics, such as representational faithfulness, neutrality, and comparability (including consistency)." In contrast, Demski and Sappington (1990) argue that bias, in the form of conservatism, need not undermine the informativeness of financial statements.

References

Accounting Principles Board. (1970). *Accounting Principles Board Statement No. 4, Basic Concepts and Principles Underlying Statements of Business Enterprises*. New York: American Institute of Certified Public Accountants.

Antle, R., and R. Lambert. (1988). "Accountants' Loss Functions and Induced Incentives for Conservatism." In G. Feltham, A. Amershi, and W. Ziemba (eds.), *Economic Analysis of Information and Contracts: Essays in Honor of John E. Butterworth*. Boston: Kluwer Academic Publishers.

Baiman, S., and M. Rajan. (1995). "Centralization, Delegation, and Shared Responsibility in the Assignment of Capital Investment Decision Rights." *Journal of Accounting Research* 33 (Supplement), 135–164.

Basu, Sudipta. (1997). "The Conservatism Principle and the Asymmetric Timeliness of Earnings." *Journal of Accounting and Economics* 24, 3–38.

Beaver, W. H. (1993). "Conservatism." Working Paper, Stanford University [presented at the American Accounting Association national meeting].

Bushman, R., R. Indjejikian, and A. Smith. (1995). "Aggregate Performance Measures in Business Unit Manager Compensation: The Role of Intrafirm Interdependencies." *Journal of Accounting Research* 33 (Supplement), 101–128.

Demski, J., and D. Sappington. (1990). "Fully Revealing Income Measurement." *The Accounting Review* 65, 363–383.

Devine, C. (1963). "The Rule of Conservatism Reexamined." *Journal of Accounting Research* 1, 127–138.

Dutta, S., and S. Reichelstein. (2000). "Controlling Investment Decisions: Hurdle Rates and Intertemporal Cost Allocation." Working Paper, University of California, Berkeley.

Dye, R. (1988). "Earnings Management in an Overlapping Generations Model." *Journal of Accounting Research* 26, 195–235.

Evans III, J. H., and S. Sridhar. (1996). "Multiple Control Systems, Accrual Accounting, and Earnings Management." *Journal of Accounting Research* 34, 45–65.

Financial Accounting Standards Board. (1995). *Statements of Financial Accounting Concepts. No. 2, Qualitative Characteristics of Accounting Information*. New York: John Wiley & Sons, Inc.

Jensen, M. C., and W. H. Meckling. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." *Journal of Financial Economics* 3, 305–360.
Kim, S. K. (1995). "Efficiency of an Information System in an Agency Model." *Econometrica* 63, 89–102.
Kim, S. K., and Y. S. Suh. (1991). "Ranking of Accounting Information Systems for Management Control." *Journal of Accounting Research* 29, 386–396.
Reichelstein, S. (1997). "Investment Decisions and Managerial Performance Evaluation." *Review of Accounting Studies* 2, 157–180.
Sappington, D. (1983). "Limited Liability Contracts between Principal and Agent." *Journal of Economic Theory* 29, 1–21.
Scott, W. (1975). "Auditor's Loss Functions Implicit in Consumption-Investment Models." *Journal of Accounting Research* 13, 98–120.
Sterling, R. R. (1970). *Theory of the Measurement of Enterprise Income*. Lawrence, Kansas: University of Kansas Press.
Watts, R. L., and J. L. Zimmerman. (1986). *Positive Accounting Theory*. Englewood Cliffs, New Jersey: Prentice-Hall.