Accounting Conservatism and the Efficiency of Debt Contracts

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Abstract

In this paper we examine how accounting conservatism affects the efficiency of debt contracting. We develop the statistical and informational properties of accounting reports under varying degrees of conditional and unconditional accounting conservatism, consistent with Basu’s [1987] description of differential verifiability standards. Optimal debt covenants and interest rates on debt are derived from a natural tension between debt holders and equity claimants. We show how optimal covenants vary with the degree of conservatism and we derive an efficiency metric that depends on the degree of conservatism. We find that accounting conservatism actually decreases the efficiency of debt contracts, contrary to the suggestions of Watts [2003] and contrary to the hypothesis in numerous empirical studies.
1. Introduction

In this paper we examine whether accounting conservatism facilitates or detracts from the efficiency of debt contracting. We consider both “unconditional” and “conditional” conservatism as discussed in the literature. In both cases, our analysis does not support the positive relationship between accounting conservatism and the efficiency of debt contracting, as suggested by Watts [2003], and as hypothesized in numerous empirical studies. In fact, we find the opposite can be true. Under very plausible conditions, we find that accounting conservatism, that affects the information content of accounting reports, actually decreases the efficiency of debt contracts. Our notion of efficiency is endogenously derived from the joint optimality of the debt covenant and the corresponding interest rate on debt, but differs from the usual efficiency notion assumed in empirical studies. We also develop and use a statistical characterization of conservatism that is new in the literature but which, we believe, is consistent with the widely accepted definition of accounting conservatism originally proposed by Basu [1987].

The argument in favor of conservatism, as enunciated by Watts [2003] and Ball, Robin and Sadka [2005] is as follows. Conservative accounting principles anticipate potential decreases in income or assets well before they are realized, but postpone the recognition of income or asset increasing events until they are sufficiently locked in. Thus, conservatism results in timely loss recognition at the expense of timely gain recognition. Given the asymmetric payoff to debt holders, timely loss recognition is of much greater importance to them than timely gain recognition. Timely loss recognition

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1 See for example Ball and Shivakumar [2005], Ball, Robin, and Sadka [2008], Wittenberg [2005], and Zhang [2004].
results in earlier violation of debt covenants, allowing debt holders to more quickly exercise their contractual rights and restrict the actions of managers. Hence, accounting conservatism enhances the efficiency of debt contracts.

Though the above argument is intuitively appealing, there are at least three components that have not been fully explored. These components are essential to understanding the relationship between accounting conservatism and the efficiency of debt contracting: First, conservative measurement principles not only produce low accounting reports more frequently, but also change the information content of such reports. Second, optimal debt covenants are not invariant to the degree of conservatism in accounting reports. Third, the interest rate on debt is not a measure of efficiency. The appropriate notion of efficiency is determined by the same economic tradeoffs that drive the optimality of the debt covenant. We elaborate on each of these elements below.

Change in Information Content

An analogy will help to provide intuition into how the information content of reports changes with the degree of conservatism. Consider exam/grading policies that report on student performance and communicate student ability. The instructor reads the detailed answers provided by students and translates each student’s answer into a numerical score/letter grade. Outsiders, who are concerned with assessing student abilities, do not have access to the detailed answers provided by students and must rely on the grades assigned by the instructor. The instructor may adopt a stringent (conservative) scoring policy or a more liberal scoring policy. How does the information content of exam scores change with the stringency of the scoring policy? A very
stringent scoring policy would make it almost impossible for low ability students to score a high grade of A, but it inevitably results in some high ability students also scoring a low grade of B. Thus a high grade is very informative; Students scoring an A are very likely to be high ability/high knowledge students. But a low grade of B contains a mixed signal since some high ability students in addition to most low ability students are awarded a B grade. Conversely, a liberal grading policy will result in some low ability students in addition to most high ability students scoring an A grade, thus diluting the information content of the A grade but enhancing the information content of a B grade. An instructor choosing between a stringent grading policy and a liberal grading policy, or equivalently between a tough exam and a more lenient exam, must therefore consider whether it is more desirable to precisely identify high ability students or to precisely identify low ability students. This choice is different from the choice of a more accurate testing procedure which increases the information content of both A and B grades, but which may be infeasible or much more costly to design and implement.

Basu [1987] defines accounting conservatism in terms of the verifiability standards that must be met for reporting income/asset increasing events and for reporting income/asset decreasing events; The greater the difference in the verifiability standards for reporting potentially income increasing events than for reporting potentially income decreasing events, the more conservative the accounting. In a more conservative regime, the disclosure of income increasing events will occur less frequently, but when they do occur, such reports will have high information content because the strict verifiability standards for making such a disclosure conveys that the probability of occurrence of the increased income is very high. Reports of income decreasing events would occur more
frequently, but such reports would have lower information content because the lax verifiability standards for making such a disclosure means it conveys less information about the probability of the loss actually occurring.

**Shift in Debt Covenants**

Optimal debt covenants transfer decision rights from equity holders to debt holders *only* when the future prospects of the firm appear to be sufficiently bad -- otherwise the decision rights would *always* be vested with the debt holders and there would be no need for a covenant. Since the relationship between observed reports and future prospects is altered by accounting conservatism, debt covenants will shift as accounting becomes more conservative. This shift in debt covenants is obvious when conservatism takes the form of a downward monotone transformation of accounting signals. This form of conservatism is benign since it preserves information content and the resultant shift in the debt covenant perfectly offsets the effect of conservatism. However, when the information content of high and low signals change as accounting becomes more conservative the shift in the debt covenant cannot perfectly offset the effect of conservatism. Whether or not the new arrangement with higher conservatism is more “efficient” than the arrangement with less conservatism is an open question, that we explore in this paper.
Efficiency of Debt Contracting

Empirical studies of conservatism usually measure the “efficiency” of debt contracts in terms of the implicit interest rate on the firm’s debt. The claim is that the lower the interest rate, the more efficient the debt arrangement. However, we find that debt holders would always be willing to accept a lower interest rate in return for the decision rights passing more frequently to them, regardless of the efficiency of the arrangement. Therefore, if lower interest rates truly represent increased efficiency, the most efficient debt contract would give decision rights to debt holders regardless of whether or not covenants are violated, thereby making debt covenants redundant. Needless to say, such an arrangement is rarely observed.

A more meaningful notion of efficiency is obtained by explicitly examining the tradeoffs that determine the simultaneous optimality of the implicit interest rate and the debt covenant. We show that, rather than minimizing the interest rate on debt, the optimal debt arrangement minimizes the sum of the expected opportunity costs arising from two kinds of decision errors: errors due to false alarms and errors due to undue optimism. These errors are analogous to the type I and type II decision errors that arise in any binary decision setting. In this sense the debt contract is socially efficient. In fact, we show that any debt arrangement with a covenant that allows more frequent passage of decision rights to debt holders than is socially optimal, and a correspondingly lower interest rate, would be renegotiated upon violation of the debt covenant by raising the interest rate in exchange for a waiver of the decision rights of debt holders. Thus, in our analysis, increased accounting conservatism enhances the efficiency of debt contracting.
only if such conservatism decreases the minimized sum of the opportunity costs described above.

In this paper, we explicitly take into account the informational properties of conservative accounting, the endogenous determination of the debt covenant and the endogenous notion of efficiency to examine whether accounting conservatism facilitates or detracts from the efficiency of debt contracting. In our setting, accounting provides a report that is informative with respect to the eventual cash flows from a debt-financed project that was initiated at an earlier date. In the light of information provided by the report, a decision is made whether to continue the project or liquidate the firm’s assets and discontinue the project. The right to make this decision is initially in the hands of residual claimants (equity holders), but decision rights switch to debt holders if the report violates an agreed upon debt covenant. We show that because of the asymmetric payoff to debt holders, their preferences over the liquidation/continuation decision are different from that of residual claimants. This tension, arising naturally from the very form of the debt instrument, optimally results in the specification of both a covenant and an interest rate in the debt contract that is ex ante negotiated between the two parties. The efficiency properties of the optimal debt contract are studied and a simple efficiency metric is derived that can be compared across accounting regimes that differ only in the degree of conservatism. We characterize how the optimal debt contract changes as the degree of conservatism is varied. Given these characterizations, we examine how the efficiency of debt contracting is affected by the degree of conservatism in the accounting report.

The rest of the paper is organized as follows. In Section 2 we develop a parsimonious model of debt covenants that incorporates the asymmetric payoff of debt
holders and results in the natural tension between debt holders and equity holders. In Section 3 we derive equilibrium debt contracts, consisting of an implicit interest rate and a debt covenant, for any arbitrary accounting system. We then establish the efficiency properties and the renegotiation properties of optimal debt contracts, and we show that equilibrium debt contracts do not minimize the interest rate on debt. In Section 4 we construct a statistical characterization of accounting conservatism. In Section 5, we compare debt contracting efficiency across accounting regimes that vary in their degree of conservatism. Section 6 concludes with a discussion of possible extensions and avenues for additional research.

2. A Model of Debt Covenants

Consider a firm that has exclusive rights to a project that requires investment of $K$ at date 0. At date 1, after receiving additional information, the firm has the option to either continue the project or liquidate the project. If the project is liquidated it pays a known deterministic liquidation value of $M$ at date 1. If the project is continued, it produces an uncertain cash flow of $x$ at date 2. We assume that the entire investment of $K$ is financed by debt issued at date 0, to be repaid with interest at date 2 upon realization of cash flows from the project. Lenders, and residual claimants to the firm’s cash flows are risk neutral. The risk free rate of return is $R > 0$, so lenders will lend $K$ to the firm if their expected repayment is at least $K(1 + R)$. We assume that at the time the project is initiated,

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2 Since capital structure decisions are not the object of study here, we assume debt financing for un-modeled reasons.
3 We make this assumption only to simplify the algebra. The incorporation of risk aversion would not qualitatively affect our results.
\[ E(\bar{x}) > K(1+R) > M \]  \hspace{1cm} (1)

The first inequality merely says that, at the time of initiation, the project has a positive net present value, and the second inequality implies that neither lenders nor residual claimants have an interest in liquidating the project unless there is a deterioration in their expectations about the future cash flow.

After the project is initiated, but prior to making the liquidate/continue decision at date 1, an accounting system provides a public report \( y \) that is correlated with the date 2 cash flow \( \bar{x} \). Since the relationship between accounting reports and future cash flows is stochastic, we represent the accounting system by a conditional probability density \( \varphi(y|x) \) that produces the accounting signal \( y \). We assume that \( \bar{x} \) has support \([0, \infty)\) and the report \( \bar{y} \) has fixed support \([0, \bar{y}]\). Let \( F(x|y) \), with density \( f(x|y) \), denote the Bayesian posterior distribution of cash flows from the project given the accounting signal \( y \). We assume that higher values of the signal \( y \) constitute “good news” so that higher values of \( y \) shift the conditional distribution of \( x \) to the right in the sense of first-order stochastic dominance (Milgrom [1981]). We additionally assume that for each accounting system there exists a signal \( y^* \) (whose value will, in general, depend on the degree of conservatism in the accounting system) satisfying:

\[ E(\bar{x}|y^*) = M \]  \hspace{1cm} (2)

Because \( E(\bar{x}|y) \) is strictly increasing in \( y \), assumption (2) means that signal values below \( y^* \) induce a sufficient deterioration in expectations so as to make project liquidation the efficient decision and values above \( y^* \) make project continuation the efficient course of action.
We now derive the tension between debt and equity holders. Let $D$ denote the chosen face value of the debt, so that if the project is continued, debt holders receive the amount $D$ if $x > D$ is realized, but receive $x$ if $x \leq D$. Given these payoffs, the value to debt holders of continuing the project, conditional on observing $y$ at date 1, is:

$$V(D, y) = \int_0^D xf(x \mid y)dx + \int_D^\infty Df(x \mid y)dx.$$  

(3)

Notice from expression (3) that $V(D, y) < D, \forall y$. Furthermore, $V(D, y)$ is strictly increasing in $y$ and strictly increasing in $D$. To see this integrate the right-hand-side of (3) by parts to obtain the simpler form:

$$V(D, y) = D - \int_0^D F(x \mid y)dx.$$  

(4)

First-order stochastic dominance implies $F(x \mid y)$ is strictly decreasing in $y$, from which it follows that $V$ is strictly increasing in $y$. Differentiating with respect to $D$ yields

$$\frac{\partial V}{\partial D} = 1 - F(D \mid y) > 0,$$

implying that $V$ is strictly increasing in $D$.

The face value of debt $D$ is determined at date 0 when the debt contract is chosen, and market conditions require that $D$ must be such that the date 0 expectation of payments to debt holders is at least $K(1+R)$. Let $h(y)$ be the marginal density of the accounting signal provided at date 1. As a useful preliminary result, we establish:
Lemma 1: Given the assumptions described in (1), $D > M$.

Proof: Let $y^0 \in [0, \bar{y}]$ be an arbitrary value of $y$ such that observation of $y \leq y^0$ results in liquidation of the project and $y > y^0$ results in continuation of the project. Let $w \leq M$ be the amount paid to debt holders when the project is liquidated. Then lender participation requires that:

$$\int_{y^0}^{\bar{y}} wh(y)dy + \int_{y^0}^{\bar{y}} V(D, y)h(y)dy \geq K(1 + R).$$

Since $w \leq M$ and $V(D, y) < D, \forall y,$

$$\int_{y^0}^{\bar{y}} Mh(y)dy + \int_{y^0}^{\bar{y}} Dh(y)dy \geq K(1 + R), \forall y^0 \in [0, \bar{y}].$$

Because $M < K(1 + R)$, the above inequality implies that $D > K(1 + R)$, which, in turn, implies $D > M, \forall y^0 \in [0, \bar{y}]$.

Our first proposition characterizes the debt holders’ preferences for continuing or liquidating the project.

Proposition 1: For each $D$ there exists a value of the accounting signal $\hat{y}(D) > y^*$ such that debt holders would like to liquidate the project conditional on any signal $y \leq \hat{y}(D)$ and continue the project when $y > \hat{y}(D)$. The signal $\hat{y}(D)$ is strictly decreasing in $D$ and $\lim_{D \to \infty} \hat{y}(D) = y^*$.

Proof: Debt holders are entitled to a payment of $D$ provided there are enough funds to pay $D$. By Lemma 1, $M < D$, implying that debt holders receive the entire liquidation value of $M$ when the project is liquidated. Therefore, $\hat{y}(D)$ must satisfy:
$V(D, \hat{y}(D)) = M.$

From (3),

$$V(D, y) < E(\tilde{x} \mid y), \forall y, \forall D < \infty.$$ 

Therefore, $E(\tilde{x} \mid y^*) = M \Rightarrow V(D, y^*) < M$. Because $V(D, y)$ is strictly increasing in $y$, $V(D, \hat{y}(D)) = M \Rightarrow \hat{y}(D) > y^*$. The claim that $\hat{y}(D)$ is strictly decreasing in $D$ follows from the observation that $V(D, y)$ is strictly increasing in both arguments and the limiting claim follows from the observation that $V(D, y) \rightarrow E(\tilde{x} \mid y)$ as $D \rightarrow \infty$. 

The result that $\hat{y}(D) > y^*$ means debt holders have an incentive to liquidate the project even when continuation is the efficient decision. This is entirely due to the asymmetric payoffs faced by the debt holders. We now examine the preferences of the equity holders. Their expected payoffs from continuing the project, conditional on any signal $y$, is:

$$U(D,y) = \int_{D}^{\infty} (x - D) f(x \mid y) dx$$

Notice that $U(D,y) > 0, \forall y$, because there is always some chance, no matter how small, that the project’s payoff will exceed the face value of the debt. On the other hand, from Lemma 1, their payoff is zero when the project is liquidated. Thus, equity holders want to continue the project no matter how dismal the future looks.

We have shown that there is a well defined conflict between debt holders and residual claimants arising from the very nature of the debt instrument. Debt holders are too eager to liquidate the project, while residual claimants are too eager to continue the project. Clearly, there is scope for contractually resolving this conflict by regulating the
liquidation/continuation decision. A debt-covenant, taking the form of a threshold signal \( y^C \), is such a contract. The covenant assigns the decision right to liquidate or continue the project to debt holders whenever \( y < y^C \) and leaves the decision right with equity holders whenever \( y \geq y^C \). We next derive the optimal covenant and other features of the optimal debt contract.

3. Properties of the Optimal Debt Contract

A debt contract is a triple \( \{K, D, y^C\} \), where \( K \) is the amount borrowed, \( D \) is the face value of debt defining the upper bound on debt holders’ claims and \( y^C \) defines the debt covenant, the violation of which transfers decision making rights to the debt holders. Because \( K \) is exogenously fixed by the investment needs of the project, we only need to determine the face value of the debt, \( D \), and the covenant \( y^C \) in specifying the debt contract. The face value \( D \), in turn, defines the implicit interest rate on the debt, with higher \( D \) indicating higher implicit interest rates.

Recall that the preferences of debt holders and residual claimants coincide when a signal \( y > \hat{y}(D) \) is observed. Therefore, any covenant \( y^C > \hat{y}(D) \) is equivalent to the covenant \( y^C = \hat{y}(D) \), in that it will result in exactly the same payoffs to all parties. Given \( y^C \leq \hat{y}(D) \), debt holders will liquidate the project whenever the covenant is violated, in which case debt holders receive \( M \) and residual claimants receive zero. Thus, the date 0 expected payment to debt holders from a debt contract \( \{D, y^C\} \), \( y^C \leq \hat{y}(D) \), is:
\[ \hat{V}(D, y^C) \equiv \int_0^{y^C} Mh(y)dy + \int_{y^C}^{\bar{y}} V(D, y)h(y)dy , \]

and the expected payoff of the residual claimants is:

\[ \hat{U}(D, y^C) \equiv \int_{y^C}^{\bar{y}} U(D, y)h(y)dy , \]

where \( h(y) \) is the marginal density of the accounting signal.

We construct the optimal debt contract by maximizing the expected payoff to residual claimants subject to the participation constraint that debt holders are willing to accept the contract. Thus, the optimal debt contract \( \{D, y^C\} \) is the solution to:

\[
\text{Max} \quad \hat{U}(D, y^C) \\
\text{Subject to:} \quad \hat{V}(D, y^C) \geq K(1 + R) .
\]

**Proposition 2:** The optimal debt contract \( \{D^*, y^{C*}\} \) is characterized by:

\[ y^{C*} = y^* \]  

\[ \int_{y^*}^{\bar{y}} V(D^*, y)h(y)dy = K(1 + R) - \int_0^{y^*} Mh(y)dy . \]

**Proof:** From (4) and (5) it follows that,

\[ U(D, y) = E(\tilde{x} \mid y) - V(D, y) . \]

Substituting this into the objective function gives:

\[ \hat{U}(D, y^C) \equiv \int_{y^C}^{\bar{y}} U(D, y)h(y)dy = \int_{y^C}^{\bar{y}} [E(\tilde{x} \mid y) - V(D, y)]h(y)dy . \]
Now, because $V(D, y)$ is strictly increasing in $D$, $\hat{V}(D, y^C)$ is strictly increasing in $D$ and $\hat{U}(D, y^C)$ is strictly decreasing in $D$. Therefore the market constraint (6) must bind, and

$$\int_{y^C}^{\bar{y}} V(D, y)h(y)dy = K(1 + R) - \int_{0}^{y^C} Mh(y)dy.$$  

(10)

Substituting (10) into (9) yields the following unconstrained problem, whose solution yields the optimal covenant:

$$\text{Max } \int_{y^C}^{\bar{y}} E(\bar{x} | y)h(y)dy - K(1 + R) + \int_{0}^{y^C} Mh(y)dy.$$  

The first order condition with respect to $y^C$ is:

$$-E(\bar{x} | y^C)h(y^C) + Mh(y^C) = 0,$$

which implies that $y^C^* = y^*$. Substituting this equality into (10) yields (8).

Several properties of the optimal debt contract are worth noting. First, the optimal debt covenant protects both lenders and residual claimants, not just the former. Lenders are protected over the interval $[0, y^*]$ in that residual claimants would continue the project when $y$ lies in this interval, but the project is liquidated because decision rights are transferred to debt holders. Residual claimants are protected in the interval $(y^*, \hat{y}(D^*))$, because debt holders would liquidate the project if they had the right to do so, but the debt covenant prevents such liquidation. Second, the debt covenant results in efficient liquidation, in the sense that the project is liquidated whenever $E(x | y) < M$ and continued whenever $E(x | y) > M$. Third, because $\hat{y}(D^*) > y^*$, lenders would be willing to accept lower implicit interest rates on the debt in exchange for more stringent debt.
covenants. However, a more stringent debt covenant would result in inefficient liquidation, implying that lower interest rates are not necessarily indicative of contractual efficiency.

The efficiency property described above will hold for any degree of accounting conservatism, so long as the covenant is optimal relative to that degree of conservatism. This does not mean that accounting conservatism is innocuous. Below, we develop a simple metric that facilitates the comparison of efficiency across differing degrees of conservatism. Any binary decision, such as the continue/liquidate decision we are considering, is prone to type I and type II errors. In our setting, a type I error occurs when a viable project is liquidated because the noisy accounting system sends a false alarm, i.e., when the accounting measure indicates that the covenant has been violated but, unknown to the decision maker, $x > M$. For any given covenant $y^C \leq \hat{y}(D)$, the expected cost of such false alarms is:

$$L_I(y^C) = \int_{0}^{M} \int_{x}^{\infty} (x - M) f(x \mid y) dx h(y) dy.$$

A type II error occurs when the accounting measure fails to send an alarm, i.e., $y > y^C$, even though $x < M$. The expected cost of such undue optimism is:

$$L_{II}(y^C) = \int_{M}^{\infty} \int_{y}^{\infty} (M - x) f(x \mid y) dx h(y) dy.$$

**Proposition 3:** The optimal debt-covenant $y^{C*} = y^*$ is socially efficient in the sense that the decisions resulting from such a covenant minimize the sum of the expected cost of false alarms and undue optimism.
**Proof:** Consider the programming problem:

\[
\min_{\gamma} \int \left[ \int_{0}^{\infty} (x - M) f(x \mid y) dx \right] h(y) dy + \int \left[ \int_{y^C}^{\infty} (M - x) f(x \mid y) dx \right] h(y) dy.
\]

The first-order condition with respect to \( y^C \) is:

\[
\int_{0}^{\infty} (x - M) f(x \mid y^C) h(y^C) dx - \int_{0}^{M} (M - x) f(x \mid y^C) h(y^C) dx = 0
\]

\[
\Rightarrow \int_{0}^{\infty} x f(x \mid y^C) h(y^C) dx - \int_{M}^{\infty} M f(x \mid y^C) h(y^C) dx - \int_{0}^{M} M f(x \mid y^C) h(y^C) dx + \int_{0}^{M} x f(x \mid y^C) h(y^C) dx = 0
\]

\[
\Rightarrow \int_{0}^{\infty} x f(x \mid y^C) h(y^C) dx = M \int_{0}^{\infty} f(x \mid y^C) h(y^C) dx
\]

\[
\Leftrightarrow E(x \mid y^C) = M , \text{ implying } y^C = y^*.
\]

Proposition 3 establishes that the efficiency properties of accounting conservatism, vis-à-vis debt contracting, should be examined in terms of the effect of conservatism on the minimized sum of the expected cost of false alarms and the expected cost of undue optimism. Given that conservatism increases the frequency of low signals, one would expect that if the covenant was held fixed while the accounting measure was made more conservative, the expected cost of false alarms would increase. This upsets the balance between false alarms and undue optimism, causing the covenant to be revised downwards. However, when conservatism changes the information content of low and high signals, a shift in the covenant does not generally restore the previous equilibrium. The minimized sum of expected costs of the two kinds of errors could become larger or
smaller as accounting becomes more conservative. If this sum becomes smaller, then the hypothesis that accounting conservatism enhances the efficiency of debt contracts is confirmed. If not, the hypothesis is not supported.

Proposition 4 strengthens our claim that the metric \( L_I(y^*) + L_H(y^*) \) is a robust indicator of the efficiency properties of accounting conservatism.

**Proposition 4:** Let \( \{D, y^C\} \) be any arbitrary initial debt contract, with \( y^C \neq y^* \).

(i) If \( y > y^* \) is observed, and the initial debt contract is such that debt holders want to liquidate the project and have the right to do so, the debt contract will be renegotiated and the project will be continued.

(ii) If \( y < y^* \) is observed, and the initial debt contract is such that the residual claimants have the right to continue the project, the debt contract will be renegotiated and the project will be terminated.

(iii) Any renegotiation proof debt contract must have the covenant \( y^C = y^* \).

**Proof:**

Consider any arbitrary initial debt contract \( \{D, y^C\} \) with \( y^C \neq y^* \) and \( D < \infty \). Let \( \hat{y}(D) \) satisfy \( V(D, \hat{y}(D)) = M \). First, consider the case where \( y > y^* \). From Proposition 2, \( \hat{y}(D) > y^* \). If \( y > \hat{y}(D) \) is observed, there is no need for renegotiation and the project is continued regardless of who has the decision rights since the preferences of the two parties coincide. If \( y^C < y < \hat{y}(D) \) then also the project is continued without renegotiation since residual claimants have the decision rights. Now consider the non-empty interval of signals satisfying \( y^* < y \leq y^C \leq \hat{y}(D) \). This is the interval where debt
holders prefer to liquidate the project and have the right to do so. If there is no renegotiation, the project will be liquidated resulting in a payoff of $M$ to debt holders and a payoff of zero to residual claimants. We show that there exists a renegotiated face value $D^N > D$ which if proposed by residual claimants will be accepted by debt holders in exchange for a waiver of the covenant and this renegotiated arrangement will make both parties better off. Since $y > y^*$, $E(x \mid y) > M$, and since $y < \hat{y}(D)$, $V(D, y) < M$. Therefore there exists $D^N > D$ such that $V(D^N, y) = M$, and $U(D^N, y) = E(x \mid y) - V(D^N, y) = E(x \mid y) - M > 0$. This proves claim (i) of the proposition.

Now consider $y < y^*$. Since $\hat{y}(D) > y^*$, it must be the case that $y < \hat{y}(D)$, so debt holders would like to liquidate while residual claimants would like to continue the project. Suppose debt holders have the decision rights. Liquidation yields them the payoff $M$. Since $E(x \mid y) < M$, there is no offer that can be made by residual claimants that yields a payoff greater than $M$ to debt holders and provides a non-negative expected payoff to residual claimants. Therefore there is no scope for renegotiation and the project will be liquidated. Finally, suppose that residual claimants have the decision rights. If the project is continued the expected payoff is strictly positive to both parties, but the sum of these expected payoffs $V(D, y) + U(D, y) = E(x \mid y) < M$. Since liquidation results in a larger aggregate payoff $M$, this larger amount can be divided between the two parties so as to make both parties better off from liquidation than from continuation of the project. Therefore Pareto improving renegotiation is feasible and will occur, resulting in
liquidation of the project. This proves claim (ii) of the Proposition. Claim (iii) of the Proposition is obvious from the preceding analysis.

In deriving the optimal debt contract, characterized in Proposition 2, we assumed that residual claimants had all the bargaining power and were restricted only by the risk free interest rate prevailing in the market. Proposition 4 indicates that regardless of how the bargaining power is distributed between the two parties, and regardless of the procedure for choosing the original debt contract, ex post renegotiation between the two parties will effectively result in the covenant \( y^C = y^* \). Therefore, in any equilibrium that does not prohibit renegotiation, the efficiency of debt contracting is equivalent to the efficiency of the covenant \( y^C = y^* \). Proposition 3 implies that such efficiency is measured by the sum of opportunity costs \( L_1(y^*) + L_2(y^*) \). Therefore, our investigation of the efficiency properties of accounting conservatism will next focus on how this sum varies with the degree of accounting conservatism.

4. A Statistical Characterization of Unconditional and Conditional Accounting Conservatism

In this section we motivate and construct a characterization of accounting conservatism purely in terms of its statistical properties. We think of accounting conservatism as a measurement principle, rather than a principle governing disclosure. We do not think of accounting conservatism as the observation of both good and bad news, suppression of the good news and reporting of only the bad news. Nor do we think of accounting conservatism as the calculation of the “true economic earnings” of the firm.
and subtraction of some reserves from it to arrive at the earnings that are disclosed to the public. We think such a view of conservatism is overly simplistic. Conservatism is usually incorporated into accounting measurement in the form of judgments that cannot be unraveled by outside observers. For example, conservatism affects judgments about when to recognize revenue from sale transactions, anticipations of operating expenses before they are paid out, the reluctance to capitalize cash outflows as assets unless the assets can be measured with sufficient precision, the recognition of asset impairments, etc. These judgments are analogous to the judgments made by an instructor who scores student answers to an exam described in our earlier example. Just like an instructor who translates a detailed answer into a numerical score, accounting measurement and aggregation rules translate a myriad of complex economic transactions and economic events into summary financial statistics that are publicly disseminated and that can be contracted upon. This translation can be done with greater or lesser degrees of conservatism.

Even though conservatism is a measurement principle, we do not seek to characterize the effect of conservatism by modeling the actual measurement process. Such a task would be difficult given the enormous complexity and variety of accounting judgments in which conservatism is incorporated. Instead, we exploit the fact that the true relationship between past economic events and a firm’s future wealth is inherently stochastic. Therefore, any accounting measurement of these events must produce signals (reports) that are also stochastically related to the firm’s future wealth. The need for accounting judgment and the inevitability of imperfections in accounting measurement are due to the inability to perfectly observe all of the economic characteristics of the
complex transactions and events that accountants seek to measure. Such judgments and imperfections distort the stochastic relationship between accounting signals and the firm’s future wealth and affect the information content of accounting reports. Conservatism in accounting measurement can be similarly viewed as affecting the stochastic relationship between the accounting signals that are produced and the firm’s future wealth. We postulate that this effect is systematic and can be described statistically. Our goal here is to motivate and capture these statistical effects of conservatism, without formulating an explicit model of the measurement process. One advantage of our approach is that it facilitates the modeling of continuous variation in the degree of conservatism.

We have previously specified the stochastic relationship between accounting signals \( y \) and the firm’s future cash flow \( x \) via the conditional probability density \( \varphi(y|x) \). We now consider a family of probability densities indexed by a parameter \( \delta \) that represents the degree of conservatism. Henceforth, the conditional probability density \( \varphi(y|x,\delta) \) describes an accounting system with degree of conservatism \( \delta \). Decreases in the value of \( \delta \) are to be interpreted as increases in the degree of accounting conservatism (and increases in the value of \( \delta \) represent increasing accounting liberalism), in the precise sense to be described below.

It is easiest to understand the effect of conservatism in settings where the future wealth of the firm is binary\(^4\). With this goal of expositional clarity, and without loss of

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\(^4\) The extension to a continuum of outcomes and a continuum of signals is not difficult, but the intuitive development that follows is much more transparent in the case of binary outcomes. We indicate the continuous analog in a series of footnotes. None of the results are qualitatively altered in settings with continuous outcomes.
generality, we now specialize the model to a setting where the outcome of the project is binary, i.e. \( x \in \{x_L, x_H\} \) with non-zero prior probabilities \( p_L, p_H \). We continue to maintain the assumption that the accounting signal \( y \) is a continuous random variable with fixed support, \([0, \bar{y}]\). Consistent with earlier assumptions, we now assume:

\[
x_L < M < x_H
\]

and,

\[
E[\bar{x}] \equiv p_H x_H + p_L x_L > K(1 + R) > M.
\]

Below, we specify conditions on the family of densities \( \{\phi\} \) that describe how the distribution and information content of accounting signals change as accounting becomes more conservative.

**Condition (A1):** For any given \( \delta \), \( \frac{\phi(y|x_H, \delta)}{\phi(y|x_L, \delta)} \) is strictly increasing in \( y \).

As shown in Milgrom (1981), this MLRP condition\(^5\) guarantees that higher values of \( y \) move the posterior distribution of \( x \) to the right, for every non-degenerate prior distribution on \( x \). In this sense higher values of \( y \) constitute good news. In our binary setting MLRP implies that the posterior probability assessment \( \text{Prob}(x_H|y, \delta) \) is strictly increasing in \( y \). By itself, condition (A1) does not say much about the effect of conservatism. However, there seems to be a natural ordering of accounting signals such as earnings reports whereby higher reports are interpreted more favorably, and we see no reason why this natural order would be altered by accounting conservatism. Condition (A1) says just that.

\(^5\) The analogous condition for continuous \( x \) is \( \frac{\phi_x}{\phi} \) strictly increasing in \( y \) at each \( \delta \).
Condition (A1) also guarantees that, regardless of the degree of conservatism, increases in \( x \) shift the distribution of accounting signals to the right, i.e., for any \( a > 0 \) and any \( \delta \),

\[
\int_a^\infty \phi(y|x_H, \delta)dy > \int_a^\infty \phi(y|x_L, \delta)dy \tag{13}
\]

**Condition (A2):** For every \( a > 0 \) and for every \( x \in \{x_L, x_H\} \), \( \int_a^\infty \phi(y|x, \delta)dy \) is strictly increasing in \( \delta \).\(^6\)

**Condition (A3):** For any given \( y \), \( \frac{\phi(y|x_H, \delta)}{\phi(y|x_L, \delta)} \) is strictly decreasing in \( \delta \).\(^7\)

We think that conditions (A2) and (A3) are quintessential properties of accounting conservatism. Condition (A2) says that when the degree of conservatism is increased the distribution of accounting signals shifts to the left, conditional on each value of the future cash flow. Thus, a move towards conservatism results in lower accounting signals on average.

However, it is unclear how the information content of accounting signals is affected by this downward shift. Condition (A3), which is a variation on the standard MLRP assumption (A1), is an informational condition. It describes how the likelihood

\(^6\) For continuous \( x \) simply replace \( x \in \{x_L, x_H\} \) with \( x \in (0, \infty) \).

\(^7\) For continuous \( x \) use \( \frac{\phi_x}{\phi} \) strictly decreasing in \( \delta \).
ratio at each fixed value of $y$ changes as the degree of accounting conservatism is varied. (A3) implies that, for each observable value of the accounting signal $y$, the posterior probability assessment $\text{Prob}(x_H | y, \delta)$ is strictly decreasing in $\delta$. In other words, the assessed probability of high future cash flows given the observation of a signal $y$ is greater when that signal is observed from a conservative accounting system than when the same signal value is observed from a liberal accounting system.

Our earlier analogy of tough and lenient exams, or stringent versus liberal scoring of exam answers, provides the intuition for (A3). Suppose that a student is observed to score 70 out of 100 points on an exam. Intuition suggests that the score of 70 points is more impressive if it was earned on a tough exam than if it was earned on a more lenient exam. This implies that the probability that the student is of high ability, given that she scored 70 points on the exam, is higher if the exam were tough than if the exam were lenient.

Condition (A3) also implies that when the accounting regime becomes more conservative the information content of sufficiently high signals is enhanced and the information content of sufficiently low signals is diminished. We illustrate this in Figure I by comparing the likelihood ratios for liberal (less conservative) and conservative accounting systems, plotted as functions of $y$. Consistent with condition (A1) the likelihood ratios, in Figure I are increasing in $y$, and consistent with condition (A3) the likelihood ratios for the liberal accounting regime are everywhere below the corresponding likelihood ratios for the conservative accounting regime.
To see the informational implications of the likelihood ratio ordering described in (A3), note that the likelihood ratio at each value of $y$ is equivalent to the ratio of posterior probabilities divided by the corresponding ratio of prior probabilities:

$$
\frac{\phi(y|x_H, \delta)}{\phi(y|x_L, \delta)} = \frac{\text{Prob}(x_H | y, \delta)}{\text{Prob}(x_L | y, \delta)} \frac{p_H}{p_L}.
$$

(14)

The equivalence can be established by calculating the posterior probabilities on the right-hand side of (14), via Bayes’ rule, and cancelling common terms. Since the likelihood
ratio is equivalent to the extent of probability revision, the likelihood ratio at the value $y$ can be interpreted as a measure of the amount of information contained in that signal realization. The observation of a $y$ value at which the likelihood ratio equals one conveys no information, because it causes no probability revision. Values of $y$ at which the likelihood ratio is greater than one cause upward revisions in the probability of high cash flows, while values of $y$ at which the likelihood ratio is less than one cause downward revisions. The greater the deviation of the likelihood ratio at $y$ from one, the greater the extent of probability revision caused by observation of that signal realization and, therefore, the greater its information content. It is immediate from Figure I that Assumption (A3) implies that there exist signal values, $c$ and $d$, $d > c$, such that at each $y > d$ there is a greater upward probability revision when the same signal is drawn from a more conservative accounting regime than when it is drawn from a liberal accounting regime. Conversely, at each $y < c$ there is a greater downward probability revision when the signal is drawn from a liberal accounting regime than when the same signal is drawn from a conservative accounting regime. It is additionally clear from Figure I that liberal accounting regimes can attain low values of the likelihood ratio that cannot be attained by conservative accounting regimes, while conservative accounting regimes can attain high values of the likelihood ratio that cannot be attained by liberal accounting regimes. Thus, (A3) implies that a movement towards accounting conservatism enhances the information content of high signals and diminishes the information content of low signals.

Condition (A3) explicitly rules out a characterization of conservatism as a one-to-one transformation of accounting signals. Such a transformation, say $\Omega = T(Y)$,

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Every likelihood ratio must equal 1 for some value of $y$ by the law of iterated expectations.
preserves information content, in the sense that the likelihood ratio at any signal realization \( \omega \) of the transformed variable would equal the likelihood ratio at \( T^{-1}(\omega) \) of the untransformed variable. (A3) precludes such a one-to-one mapping of likelihood ratios from liberal to conservative accounting systems. Additionally, (A3) implies that liberal and conservative accounting systems cannot be ordered in the sense of Blackwell. While the information content of some signal realizations can be ordered across liberal and conservative accounting regimes, it is not the case that the overall information content of a conservative accounting regime is greater or less than the overall information content of a liberal accounting regime.

**Unconditional Conservatism**

So far, we have not distinguished between unconditional and conditional conservatism, as is often done in the accounting literature.\(^9\) Unconditional conservatism, sometimes called “ex ante” or “news independent” conservatism, is an accounting measurement bias that is unaffected by the characteristics of the event that is measured. A commonly cited example of unconditional conservatism is the immediate expensing of all R&D irrespective of the probabilities of success of the underlying R&D projects. Conditional conservatism (or “ex post, or “news dependant” conservatism) means that the extent of conservatism in the accounting measurement depends on the characteristics of the event being measured. Examples usually have a “lower of cost or market” feature, such as accounting for inventory and asset impairments. Translating these different types

\(^9\) See for example Ball, Kothari, and Robin [2000], Ball and Shivakumar [2005] and Beaver and Ryan [2005].
of measurement bias to our way of characterizing conservatism requires the specification of how each type of conservatism affects the probability distribution of accounting signals conditional on the future cash flows of the firm.

Condition (A2), which we feel is an essential property of accounting conservatism of any form, already requires that the distribution of accounting signals move downward when accounting becomes more conservative. Unconditional conservatism must mean that such a shift in the distribution of accounting signals is independent of the characteristics of the current events being measured and therefore independent of the future cash flow of the firm. This motivates the following definition of unconditional conservatism for the setting under study.

**Definition:** The parameter $\delta$ is an index of unconditional conservatism if in addition to conditions (A1), (A2) and (A3) the following condition is satisfied:

**Condition (A4):** For each $a > 0$ and for each $\delta$,

$$\frac{\partial}{\partial \delta} \left( \int_a^\infty \varphi(y|x_H, \delta)dy \right) = \frac{\partial}{\partial \delta} \left( \int_a^\infty \varphi(y|x_L, \delta)dy \right)$$

Since, (A4) must be satisfied for every $a > 0$, it is equivalent to:

$$\varphi_\delta(y|x_H, \delta) = \varphi_\delta(y|x_L, \delta), \forall \delta, \text{ and almost all values of } y.$$  \hspace{1cm} (15)

It is tempting to think of unconditional conservatism as having no information effect on the accounting system because any unconditional bias can simply be “unraveled”. Such

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$^{10}$ Equation (15), and therefore condition (A4), has an obvious counterpart when $x$ is continuous, i.e., $\varphi_{\delta x}(y|x, \delta) = 0$. 

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unraveling is true only for monotone transformations of accounting measurements. We have argued earlier that condition (A3), which is required to hold in addition to (A4), precludes such monotone transformations as representations of conservatism. Since (A3) is required to hold, unconditional conservatism, as we have defined it, is not benign. To see how unconditional conservatism interacts with (A3) differentiate the likelihood ratio with respect to $\delta$ so that (A3) is equivalent to:

\[
\varphi_\delta(y|x_H,\delta) < \varphi_\delta(y|x_L,\delta) \left( \frac{\varphi(y|x_H,\delta)}{\varphi(y|x_L,\delta)} \right)
\]

(16)

Next define $y^0(\delta)$ by:

\[
\frac{\varphi(y^0(\delta)|x_H,\delta)}{\varphi(y^0(\delta)|x_L,\delta)} \equiv 1.11
\]

(17)

Then since (A1) requires that the likelihood ratio is strictly increasing in $y$, (15) and (16) and (17) imply that (A3) and (A4) are simultaneously satisfied if and only if:

\[
\varphi_\delta(y|x_H,\delta) = \varphi_\delta(y|x_L,\delta) < 0, \ \forall y < y^0(\delta), \text{ and}
\]

\[
\varphi_\delta(y|x_H,\delta) = \varphi_\delta(y|x_L,\delta) > 0, \ \forall y > y^0(\delta).
\]

When accounting is made more liberal in the unconditional sense of (A4), (A3) is also satisfied if the probabilities of all signals above the uninformative signal $y^0(\delta)$ increase and the probabilities of all signals below $y^0(\delta)$ decrease. In this case unconditional accounting conservatism changes the information content of accounting signals and so may have implications for efficient debt contracting.

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11 When $x$ is continuous define $y^0$ as the value of $y$ where $\varphi_x/\varphi = 0$. 

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Conditional Conservatism

A change in conditional conservatism, on the other hand, implies that the shift in the distribution of accounting signals is *conditional* on the characteristics of the events being measured and therefore conditional on the future cash flow of the firm, i.e., \( \varphi_{\delta}(y|x,\delta) \) is *not* independent of \( x \). We use Basu’s [1987] verifiability criteria to formalize how changes in the degree of conditional conservatism interacts with the future cash flow \( x \) to affect the distribution of accounting signals. In terms of this interaction, we describe both conditional conservatism and “conditional liberalism.” The more stringent verifiability standards for reporting good news than for reporting bad news implies that the effect of conditional conservatism on the distribution of accounting signals is stronger when the future cash flow is high, \( x_{H} \), than when it is low, \( x_{L} \). The converse must be true when accounting is conditionally liberal. This motivates the following definition:

**Definition:** The parameter \( \delta \) is an index of conditional conservatism (or conditional liberalism) if the following conditions are satisfied:

**Condition (A5):** There exists \( \delta^{0} \) such that for each \( a > 0 \):

\[
(A5i) \quad \frac{\partial}{\partial \delta} \left( \int_{a}^{\overline{y}} \varphi(y|x_{H},\delta) dy \right) > \frac{\partial}{\partial \delta} \left( \int_{a}^{\overline{y}} \varphi(y|x_{L},\delta) dy \right), \quad \forall \delta < \delta^{0}, \text{ and}
\]

\[
(A5ii) \quad \frac{\partial}{\partial \delta} \left( \int_{a}^{\overline{y}} \varphi(y|x_{H},\delta) dy \right) < \frac{\partial}{\partial \delta} \left( \int_{a}^{\overline{y}} \varphi(y|x_{L},\delta) dy \right), \quad \forall \delta > \delta^{0}.
\]
Additionally, conditions (A1) and (A2) must be satisfied and (A3) must be satisfied in the region $\delta < \delta^0$.

In the region $\delta < \delta^0$ accounting is conditionally conservative in an absolute sense, and in the region $\delta > \delta^0$ it is conditionally liberal in an absolute sense. Nevertheless, in both regions an increase in $\delta$ represents a (relative) decrease in conditional conservatism or a movement towards more liberal accounting. In our earlier specifications we refrained from defining “unconditional liberalism” and “unconditional conservatism” in an absolute sense, because this would require some notion of a “neutral” accounting system which is difficult to formalize. Instead, we only formalized what it means for one accounting regime to be more unconditionally conservative than another accounting regime. Such relative statements suffice for our purpose (see Propositions 5 and 6 in Section 5).

Again we use the analogy of tough and lenient exams to lend intuition to (A5). Suppose initially that the exam is so tough (or that the scoring of student answers is so stringent) that all students, regardless of ability, almost certainly fail the exam. In our terminology, the exam is conservative in the absolute sense. Now suppose the exam is made progressively easier. As the exam becomes easier, we expect the distribution of scores to move upward, for students of all abilities. However, if the effect of relaxing the exam falls unevenly on students of different ability, we would expect that initially high ability students would benefit more than low ability students in terms of improved scores, moving the former students’ distribution more rapidly to the right, as described in (A5i).
But once the exam has become sufficiently easy (in an absolute sense), the distribution of scores for the high ability students has already moved so much to the right that there is not much “room” for it to move further. The distribution of scores for the low ability students then begins to “catch up”, as described in (A5ii). In the limit the exam becomes so easy that all students, regardless of ability, almost certainly score the highest number of points.

Mathematically, the difference between unconditional and conditional conservatism is as follows. Fix $a$ in the interior of the common support of the two distributions, i.e., $0 < a < \bar{y}$. Now consider the quantity:

$$\text{Prob}(y \geq a|x_H, \delta) - \text{Prob}(y \geq a|x_L, \delta) = \int_a^{\bar{y}} (\varphi(y|x_H, \delta) - \varphi(y|x_L, \delta)) dy.$$ 

By (A1) this quantity is positive at all values of $\delta$. The issue is: How does this positive quantity vary with $\delta$, i.e, how does it change as accounting is made less conservative? If $\delta$ is an index of unconditional conservatism, the difference between the two probabilities remains the same at every $\delta$. But if $\delta$ is an index of conditional conservatism, the difference increases at a decreasing rate in $\delta$, reaches a maximum at $\delta^0$, then declines.

Our characterization of accounting conservatism is consistent with the way it has been modeled in prior accounting literature which is restricted to binary signal settings. Antle and Lambert (1988), Gigler and Hemmer (2000) and Venugopalan (2001) reason that conservative accounting practices have a high likelihood of reporting a low signal given unfavorable fundamentals, and a low likelihood of reporting a high signal given favorable fundamentals. Demski and Sappington (1990) define a conservative
transformation as one that places more weight on unfavorable outcomes and less weight
on favorable outcomes. In contrast to previous models of conservatism, our
characterization allows for continuous variation in the degree of conservatism, allows for
continuous adjustment to the debt covenant in response to increased conservatism, and
allows a distinction between conditional and unconditional conservatism.

5. How the Efficiency of Debt Contracts Varies with Accounting Conservatism

Having developed a formalization of accounting conservatism, we now return to
the problem of debt contracting and analyze how changing the degree of accounting
conservatism affects the efficiency of optimal debt contracts. Recall that for any degree
of conservatism $\delta$ the optimal debt covenant $y^*$ is described by $E(x \mid y^*, \delta) = M$. Since
$E(x \mid y, \delta)$ is strictly increasing in $y$ (condition (A1)) and strictly decreasing in $\delta$
(condition (A3)), it must be the case that $y^*(\delta)$ is strictly increasing in $\delta$. This is
consistent with the intuition that optimal covenants, stated in terms of accounting reports,
will adjust to the degree of conservatism built into the accounting system. The optimal
covenant must move downward as the degree of conservatism is increased. This result
holds regardless of whether the conservatism is unconditional or conditional, since in
both cases conditions (A1) and (A3) are satisfied. Also recall that for any degree of
conservatism the optimal debt covenant $y^*(\delta)$ minimizes the sum of two opportunity
costs, the expected cost of false alarms and the expected cost of undue optimism. Below,
we analyze how this minimized sum of opportunity costs, and thereby the efficiency of
debt contracting, varies with the degree of accounting conservatism.
Given that \( x_L < M < x_H \) the potential opportunity cost of liquidating the project is \( x_H - M \), and since the project is optimally liquidated only when signals below \( y^*(\delta) \) are observed, the probability of incurring such an opportunity cost is \( p_H \int_0^{y^*(\delta)} \varphi(y|x_H, \delta) dy \). Therefore the optimized expected cost of false alarms is:

\[
L_I(\delta) = p_H (x_H - M) \int_0^{y^*(\delta)} \varphi(y|x_H, \delta) dy.
\]

The potential opportunity cost of continuing the project is \( M - x_L \) and, under the optimal covenant, the probability of incurring this loss is \( p_L \int_{y^*(\delta)}^{\bar{y}} \varphi(y|x_L, \delta) dy \). Therefore the optimized expected cost of undue optimism is:

\[
L_{II}(\delta) = p_L (M - x_L) \int_{y^*(\delta)}^{\bar{y}} \varphi(y|x_L, \delta) dy.
\]

In order to examine how the sum of these opportunity cost varies with accounting conservatism, we need to determine the sign of the derivative \( \frac{d}{d\delta} [L_I(\delta) + L_{II}(\delta)] \), taking into account the change in the optimal covenant \( y^*(\delta) \) as \( \delta \) is varied. But, since \( y^* \) minimizes the sum of these opportunity costs, the Envelope Theorem implies:

\[
\frac{d}{d\delta} [L_I(\delta) + L_{II}(\delta)] =

p_H (x_H - M) \int_0^{y^*(\delta)} \varphi(\delta|y, x_H, \delta) dy + p_L (M - x_L) \int_{y^*(\delta)}^{\bar{y}} \varphi(\delta|y, x_L, \delta) dy.
\] (19)

Now, because \( \int_0^{\bar{y}} \varphi(\delta|y, x, \delta) dy = 0, \forall x, \delta \),
where the last inequality follows from condition (A2). Thus, the first term in (19) is negative and the second term is positive, regardless of whether $\delta$ is an index of conditional or unconditional conservatism. This indicates that every increase in conservatism (decrease in $\delta$), conditional or unconditional, will increase the expected cost of false alarms and decrease the expected cost of undue optimism, even after taking into account the adjustment to the optimal debt covenant. Accounting conservatism enhances the efficiency of debt contracting only if the latter effect dominates the former.

We argue that the opposite is true: The increase in the expected cost of false alarms more than offsets the decrease in the expected cost of undue optimism. From (19) and (20) it follows that \( \frac{d}{d\delta} [L_1(\delta) + L_{II}(\delta)] < 0 \) if,

\[
P_H(x_H - M) \int_{y^*(\delta)}^{\bar{y}} \varphi_\delta(y|x_H, \delta) dy > P_L(M - x_L) \int_{y^*(\delta)}^{\bar{y}} \varphi_\delta(y|x_L, \delta) dy.
\]

Now,

\[
E(x) > M \Rightarrow p_{II}(x_H - M) > p_L(M - x_L).
\]

Because unconditional conservatism (A4) implies that, at every $\delta$:

\[
\int_{y^*(\delta)}^{\bar{y}} \varphi_\delta(y|x_H, \delta) dy = \int_{y^*(\delta)}^{\bar{y}} \varphi_\delta(y|x_L, \delta) dy > 0,
\]

it must be true that \( \frac{d}{d\delta} [L_1(\delta) + L_{II}(\delta)] < 0 \), at every $\delta$. Thus we have established:
**Proposition 5:** The efficiency of debt contracting declines monotonically as accounting becomes more conservative in an unconditional sense.

The extension of this result to the case of conditional conservatism is straightforward. Recall that in our discussion of (A5) we argued that in the region where accounting is conditionally conservative ($\delta < \delta^0$):

$$\int_{y^*(\delta)}^{\overline{y}} \varphi_\delta(y|x_H,\delta) dy > \int_{y^*(\delta)}^{\overline{y}} \varphi_\delta(y|x_L,\delta) dy > 0,$$

which implies that (21) continues to hold when $\delta$ is an index of conditional conservatism. It is clear from (21) and (22) that,

$$\int_{y^*(\delta)}^{\overline{y}} \varphi_\delta(y|x_H,\delta) dy < \int_{y^*(\delta)}^{\overline{y}} \varphi_\delta(y|x_L,\delta) dy$$

is a necessary condition for an interior optimal degree of conservatism. Condition (A5ii) asserts that this inequality can only be satisfied in the region where accounting is conditionally liberal ($\delta > \delta^0$). Thus, we have established:

**Proposition 6:** The efficiency of debt contracting declines monotonically as accounting becomes more conservative in a conditional sense. An accounting system that maximizes the efficiency of debt contracting must be conditionally liberal.

The intuition underlying Propositions 5 and 6 is as follows. Because an increase in conservatism decreases the information content of low signals, the downward adjustment to the debt covenant cannot fully undo the effect of conservatism causing the probability
of false alarms to necessarily increase. Because $E[x] > M$, from an ex ante point of view, increases in the cost of false alarms is very expensive and more than offsets the gain from decreasing the cost of undue optimism. Clearly, the assumption that $E[x] > M$ is crucial to our results, so it is important to ask how realistic it is. This assumption merely states that at the time a project is initiated, the expected cash inflows from the project exceed the liquidation value of the project. The assumption also implies that there needs to be a deterioration in expectations for project liquidation to become more attractive than project continuation. It would be quite surprising if real world data contradicted this assumption, because violation of this assumption would mean that firms would start projects with the prior expectation of liquidating them before the returns to the project are realized!

6. Conclusion

The Basu [1987] description of accounting conservatism (higher verifiability standards for reporting potentially income increasing events and lower verifiability standards for reporting potentially income decreasing events) is widely accepted in the literature and seems to accord well with popular intuition. We believe our statistical characterization of conservatism is faithful to such a description. Yet our analysis yields the result that accounting conservatism actually detracts from the efficiency of debt contracts, a result that is strikingly different from that suggested by Watts [2003], Ball and Shivakumar [2005], and Ball, Robin, and Sadka [2008]. Our analysis underscores the importance of explicitly considering how the information content of
accounting is changed by accounting conservatism. The intuition in the literature is that conservatism is beneficial because it provides “timely loss recognition.” In the terminology of our characterization, this simply means that conservatism increases the probability of low signals when the future is gloomy. However, one also needs to ask whether conservatism increases the probability of low signals when the future is bright. If the answer is in the affirmative, as Basu’s notion of conservatism would seem to suggest, then conservatism could increase the probability of false alarms, and this by itself would detract from the efficiency of debt contracts.

It is also important to distinguish conservatism from a strict increase in the informativeness of the accounting regime. If the only effect of conservatism is that losses that have already occurred are recognized in the financial statements in a more timely fashion, then clearly accounting reports would become more informative in the Blackwell sense. In this case, we have no doubt that contractual efficiency would improve. But, such a notion of timely recognition of realized losses is inconsistent with Basu’s idea that conservatism consists of differential verifiability standards.

Our analysis also underscores the importance of explicitly understanding the tensions between debt holders and residual claimants that create the need for debt covenants. Without explicit consideration of these tensions, it is not clear what is meant by the “efficiency” of debt contracts. Empirical studies indicate that accounting conservatism is negatively correlated with implicit interest rates on debt (Zhang 2004). It has become commonplace in the literature to equate this empirical finding to higher contractual efficiency. Our analysis does not contradict the empirical data, but it does
indicate that the *interpretation* of such empirical findings is incorrect\textsuperscript{12}. Most importantly, our findings call into question the *policy* prescription suggested by Watts [2003], that standard setters should maintain the conservatism that exists in current accounting practice because such conservatism facilitates debt contracting. Our analysis indicates that the demand for accounting conservatism does not arise from debt contracting considerations; the demand must come from other sources.

Perhaps the analytical results obtained here are specific to the particular conflict between debt holders and residual claimants that we have modeled. It would be useful to examine other tensions that may arise between the two parties. Debt covenants are also written to prevent residual claimants from “running away with the money” in the form of excess dividends, etc. The role of accounting conservatism in such settings merits investigation. However, we think that, regardless of the setting considered, if the action that is regulated by the covenant requires an assessment of future cash flows, errors of false alarms and errors of undue optimism will play an important role in determining efficiency and the desirability of accounting conservatism will rest on a balancing of these two forces.

Another setting that clearly merits investigation is the case where accounting provides hard contractible information, but there are other sources of information that

\textsuperscript{12} We have investigated whether $D^*(\delta)$ increases or decreases with $\delta$. In general, this comparative static is non-monotone and therefore there is nothing systematic about the behavior of implicit interest rates as the degree of conservatism is varied. Interest rates could decrease or increase with conservatism depending upon parameter values, depending upon the initial degree of conservatism, and depending on the relative magnitudes of change in the likelihood ratio with respect to variations in $\delta$ and variations in the signal $y$. Thus, for some firms an increase in conservatism could decrease interest rates on debt while for other firms the interest rate could increase.
provide soft, mutually observed, but non-contractible information about future cash flows. The issue here is whether the presence of supplementary non-contractible information alleviates the informational aspects of accounting conservatism in such a way that accounting conservatism actually becomes desirable. The answer is far from obvious. Much would depend on the correlations between hard and soft information and on the outcome of renegotiations that would become inevitable in such settings.

Yet another possible avenue of investigation is to study the effect of conservatism when residual claimants have superior information to debt holders about the continuation cash flows from the project. Finally, in our model all debt holders are symmetrically informed and act in concert. With information asymmetries among debt holders, co-ordination becomes an issue, and it would be interesting to examine how accounting conservatism affects the coordination problem that debt holders would face.
References


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