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Conditional and Unconditional Conservatism: Concepts and Modeling

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Abstract. We develop a model that captures the distinct natures of and interactions between conditional and unconditional conservatism. Under unconditional conservatism, the book value of net assets is understated due to predetermined aspects of the accounting process. Under conditional conservatism, book value is written down under sufficiently adverse circumstances, but not up under favorable circumstances. The specification of earnings provided by the model yields hypotheses about how unconditional conservatism and other factors preempt conditional conservatism and so affect the asymmetric response of earnings to positive and negative share returns, both current and lagged, documented by Basu (1995, "Conservatism and the Asymmetric Timeliness of Earnings." Ph.D. dissertation, University of Rochester'; 1997, "The Conservatism Principle and the Asymmetric Timeliness of Earnings." *Journal of Accounting and Economics* 24, 3–37).

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We define accounting conservatism as the on average understatement of the book value of net assets relative to their market value (hereafter, the existence of expected unrecorded goodwill). Accounting conservatism is manifested in two general but distinct ways recognized in the literature.[1] First, conservatism can be unconditional (or *ex ante* or news independent), meaning that aspects of the accounting process determined at the inception of assets and liabilities yield expected unrecorded goodwill. Examples of unconditional conservatism include immediate expensing of the costs of most internally developed intangibles, depreciation of property, plant, and equipment that is more accelerated than economic depreciation (hereafter accelerated depreciation), and historical cost accounting for positive net present value projects.[2] A longstanding literature models and empirically investigates the implications of unconditional conservatism, focusing on how it yields growth-dependent biases in accounting numbers.[3]

Second, conservatism can be conditional (or *ex post* or news dependent), meaning that book values are written down under sufficiently adverse circumstances but not written up under favorable circumstances, with the latter being the conservative behavior. Examples of conditional conservatism include lower of cost or market

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accounting for inventory and impairment accounting for long-lived tangible and intangible assets. A body of primarily empirical prior research beginning with Basu (1995, 1997) investigates the implications of conditional conservatism, focusing on why and how it implies that earnings are more positively associated with current share returns when they are negative than when they are positive (hereafter, asymmetry with respect to current returns).[4] This prior research also examines asymmetry with respect to lagged returns and the time-series properties of earnings and its cash flow and accrual components.

The two types of conservatism have many of the same purposes, including capturing investors and others' perceived asymmetric loss functions, minimizing firms' litigation, tax, or regulatory costs, and enabling accounting and industry regulators to minimize economic instability and avoid criticism.[5] The literature on unconditional conservatism puts greater emphasis on the difficulty of valuing certain types of economic assets and liabilities and determining their effects on future income.[6] The literature on conditional conservatism puts greater emphasis on improving contracting efficiency given managers' incentives to report upward-biased accounting numbers. Despite its long history and ongoing use, an ongoing debate exists regarding whether conservatism, especially unconditional conservatism, is desirable.[7]

Because of their different emphases, the literatures on the two types of conservatism have been largely separate until recently. While each literature provides valuable insights into the nature and implications of conservatism, and together they provide the ingredients for a fully articulated theory of conservatism, neither examines the interactions between the two types of conservatism. For example, most papers that empirically assess the extent of conditional conservatism do not control for unconditional conservatism. While recent papers by Pope and Walker (2003), Givoly et al. (2004), Pae et al. (2004), and Roychowdhury and Watts (2004) argue and show empirically that unconditional conservatism as proxied by the market-to-book ratio is associated with lower conditional conservatism as measured by asymmetry, these papers lack modeling to help structure and interpret their empirical analysis.

In this paper, we help unify these literatures by developing and applying a general model of conditional and unconditional conservatism under uncertainty. The model captures the distinct natures of and interactions between the two types of conservatism and demonstrates their implications in a rigorous and comprehensive fashion. Given the importance of conservatism in accounting, we believe it is critical for accounting standard setters, researchers, and teachers and users of financial reports to understand these interactions and their implications. We focus the application of the model on the effect of the following opposition between the two types of conservatism on asymmetry. Unconditional conservatism is a primary (though not the sole) source of unrecorded goodwill, which constitutes a form of "accounting slack" that preempts the application of conditional conservatism unless news is sufficiently bad to use up that slack. This focus reflects the fact that unconditional conservatism is determined at the inception of assets and liabilities and so precedes conditional conservatism. Also important but less obvious, the model captures the fact that conditional conservatism resets the cost bases of net assets and so affects subsequent unconditional conservatism.

In the model, we assume that the firm holds two types of economic assets that have no significant economic differences but are accounted for differently: (1) intangible assets that are subject to extreme unconditional conservatism in the form of immediate expensing of their costs and so are immune to conditional conservatism; and (2) tangible assets that are accounted for using historical cost depreciation, which may be either unbiased or unconditionally conservative in the form of accelerated depreciation. Tangible assets are written down if their book value would otherwise exceed their market value.[8] The unconditionally conservative nature of accelerated depreciation creates unrecorded goodwill for tangible assets that preempts conditional conservatism as long as shocks to the market value of those assets are not negative enough to use up that goodwill. In addition, the historical cost nature of this depreciation also yields unrecorded goodwill that preempts conditional conservatism, because positive shocks to the market value of those assets are not immediately recognized.

We further allow for two frictions in recording write-downs of tangible assets, and demonstrate how their effects on asymmetry are partly similar and partly distinct from those of unconditional conservatism. First, we allow write-downs to be recorded only if the market value of tangible assets falls some amount below their book value (hereafter, a loose impairment trigger). This friction is consistent with FAS 144's requirement that tangible assets and intangible assets with definite lives be written down if their book value exceeds the undiscounted sum of their future cash flows, and with similar requirements of other standards. This friction yields accounting slack distinct from unrecorded goodwill that also preempts the application of conditional conservatism, since after recording a write-down the market value of tangible assets must fall some amount below their book value for another write-down to be recorded. Second, we allow write-downs to be recorded with a less than certain probability conditional on tangible assets being impaired economically (hereafter, an uncertain impairment trigger). This friction reflects the many difficult estimates involved in determining the timing and amount of write-downs, and it yields a probabilistic delay in write-downs of economically impaired assets. We emphasize that both frictions are stylized and intended only to indicate the general nature of the effects of such frictions that surely exist in more complex forms in practice.[9]

The model's constructs affect asymmetry in two general ways, with distinct variations. First, three of the constructs—accelerated depreciation of tangible assets, past unrecognized positive shocks to the market value of tangible assets, and a loose impairment trigger—yield accounting slack for tangible assets that reduces the likelihood of a write-down of those assets and the amount of a write-down if one occurs. The distinct effects of these constructs on asymmetry reflect differences in how this slack accumulates over time: gradually for accelerated depreciation, randomly for past unrecognized shocks to the market value of tangible assets, and immediately at write-downs for a loose impairment trigger. The quicker and more predictably this slack accumulates the larger the effect on asymmetry. Second, two of the constructs—the immediate expensing of the costs of intangibles and an uncertain impairment trigger—yield noise in the relation between share returns and write-downs of tangible assets. The distinct effects of these constructs on asymmetry reflect differences in the time-series properties of the noise they yield. Immediate expensing of the costs of intangibles yields serially independent noise, and so attenuates and smoothes asymmetry. An uncertain impairment trigger yields serially correlated noise, and so affects the direction of asymmetry with respect to lagged returns.

The model captures the probabilistic and history-dependent nature of conditional conservatism more fully than the prior literature. Specifically, the probability and amount of write-downs of tangible assets in the current period depend on both the past unrecognized shocks to the market value of those assets and the uncertainty of the impairment trigger. Relatedly, the timing of the most recent write-down prior to the current period is probabilistic.

Using the specification of earnings derived from the model, we develop hypotheses about asymmetry with respect to both current and lagged returns, and how it is affected by the model's constructs.[10] We do this through both conceptual and simulation analysis of that specification of earnings. Simulation is particularly useful in our setting, because it is the simplest way to demonstrate the implications of the probabilistic and history dependent nature of conditional conservatism.[11] Simulation also allows us to vary the model constructs one at a time and determine their effects on asymmetry.

We hypothesize that asymmetry with respect to current returns is less for firms that have more accounting slack for tangible assets or a noisier relation between returns and write-downs of tangible assets. Exactly how these effects work depends on the model construct being varied. For example, more accelerated depreciation causes this asymmetry to kick in abruptly once returns become negative enough to use up the accounting slack for tangible assets provide by this depreciation with sufficiently high probability. A higher proportion of intangible assets causes this asymmetry to kick in more gradually as returns become more negative, because share returns become a noisier proxy for the returns to tangible assets, and so a more negative share return is required for the average return on tangible assets to be a given negative amount.

A key feature of the model is it allows the derivation of the relation between earnings and lagged returns. The model demonstrates that the direction of asymmetry with respect to lagged returns could be in either the same or opposite direction as asymmetry with respect to current returns. If conditional conservatism is applied such that bad news is always recognized immediately in earnings, then there is no relation between current earnings and past negative returns but a positive relation between current earnings and past positive returns, and so the asymmetries with respect to current and lagged returns are in the opposite directions. In contrast, if conditional conservatism is applied such that bad news tends to be recognized in earnings over a number of periods but faster than good news, then the response of current earnings to sufficiently near lagged returns is stronger if those returns are negative than if they are positive, and so the asymmetries are in the same direction. Consistent with the latter possibility, Pope and Walker (1999) and Ryan and Zarowin (2003) find that on average annual earnings respond more to the first three lagged annual returns when they are negative than when they are positive.

We hypothesize that the direction of asymmetry with respect to lagged returns depends on the amount of accounting slack for tangible assets and the uncertainty of the write-down trigger. If this slack is sufficiently large or the probability that write-downs are recorded when tangible assets are economically impaired is sufficiently low, then asymmetry with respect to lagged returns in the same direction as asymmetry with respect to current returns; otherwise the asymmetries are in opposite directions. The relation between earnings and sufficiently near lagged returns tends to be S-shaped, with asymmetry with respect to these lagged returns being in the same direction as asymmetry with respect to current returns for lagged returns that are not negative enough to use up the available accounting slack with sufficiently high probability, but in the opposite direction for lagged returns that are more negative. Exactly how these effects work again depends on the model construct being varied.

Because of the length and theoretical nature of this paper and non-trivial issues involved in developing empirical proxies for some of the model's constructs, we test these hypotheses in a follow-on empirical project in progress (Beaver et al., 2005).

The remainder of the paper is organized as follows. Section 1 introduces the terminology we use to describe unconditional conservatism's possible effects on asymmetry. Section 2 develops the model of conditional and unconditional conservatism. Section 3 proposes hypotheses supported by simulation analysis based on the model specifications. Section 4 concludes, provides implications for future research, and discusses our follow-on project.

1. Unconditional Conservatism's Possible Effects on Asymmetry

Figure 1 (Panel a) depicts Basu's (1995, 1997) original finding of asymmetry with respect to current returns. That is, earnings are more positively associated with returns when they reflect good news than when they reflect bad news. What return level distinguishes good versus bad news depends on exactly how conditional conservatism works; in our model, this level is the cost of equity capital. This panel also depicts what we mean when we say that this asymmetry is weaker, kicks in later (due to accounting slack for tangible assets), or kicks in more gradually (due to noise in the relation between share returns and write-downs of tangible assets).

Figure 1 (Panel b) depicts Pope and Walker (1999) and Ryan and Zarowin's (2003) findings that asymmetry with respect to up to three lagged annual returns is in the same direction as asymmetry with respect to current returns. This panel also depicts what we mean when we say that this asymmetry is in the opposite direction as asymmetry with respect to current returns (due to lagged returns being reflected in prior earnings with sufficiently high probability) or that the relation between earnings and lagged returns is S-shaped (because mildly bad lagged news does not use up the available accounting slack with sufficiently high probability but worse lagged news does). As in panel a, the effects in this panel could kick in gradually, but we do not depict this possibility.

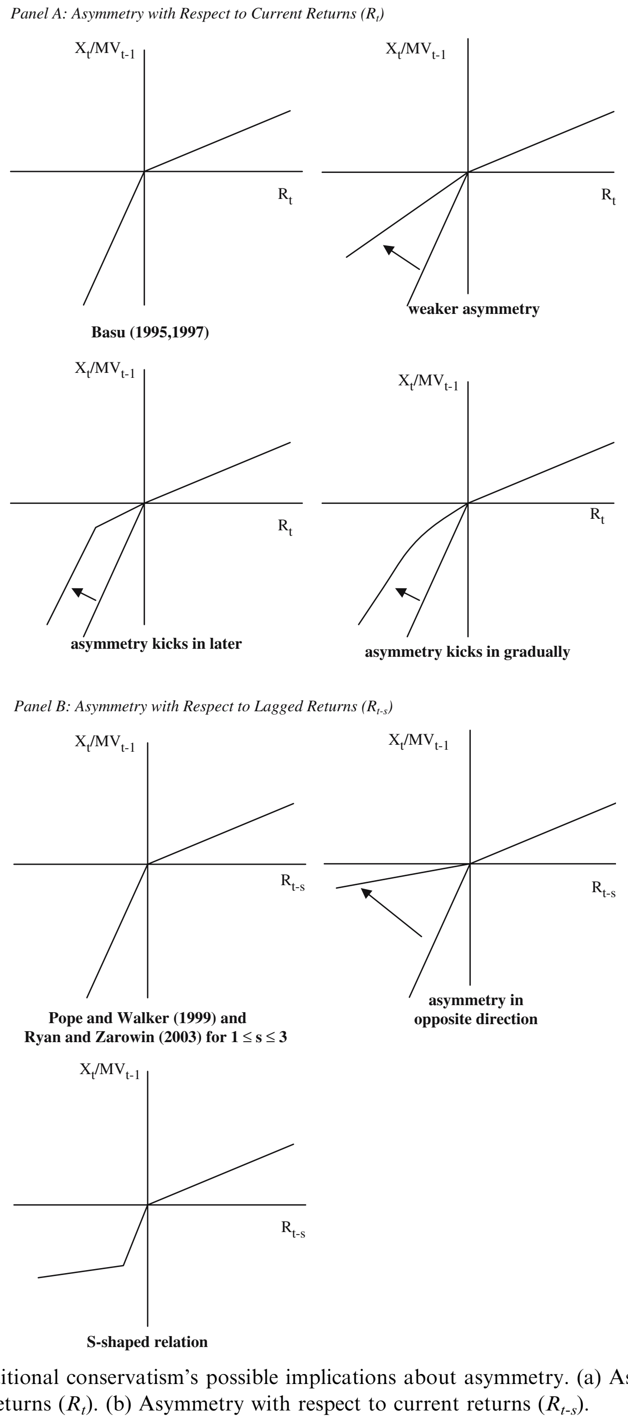

Figure 1. Unconditional conservatism's possible implications about asymmetry. (a) Asymmetry with respect to current returns (R_t). (b) Asymmetry with respect to current returns (R_{t-s}).

2. The Model

In this section, we develop a model of conditional and unconditional conservatism under uncertainty that captures their distinct natures and interactions. In the model, accelerated depreciation, past unrecognized shocks to market value, and a loose impairment trigger yield accounting slack for tangible assets that preempts write-downs of those assets unless news is sufficiently bad to use up that slack. In addition, immediate expensing of the costs of intangibles and an uncertain impairment trigger yield noise in the relation between share returns and write-downs of tangible assets. Using the specification of earnings derived from the model, we discuss how these constructs affect the nature and magnitude of asymmetry, especially with respect to lagged returns, in contextual and complex ways. While the model involves some complexity, it provides many insights both through conceptual analysis in this section and simulation analysis in Section 3 that would be difficult or impossible to intuit.

We characterize earnings using three sets of assumptions. First, assumptions about the economic setting yield characterizations of the market values of tangible and intangible assets, the market value of owners' equity, and dividends.[12] Second, assumptions about accounting measurement for tangible and intangible yield characterizations of book values of those assets and owners' equity. Third, the assumption of the clean surplus relation yields the characterization of earnings.

2.1. Economic Assumptions

We assume the firm holds two types of economic assets and make six assumptions about the market values of those assets, the market value of owners' equity, and dividends.[13] While some of these assumptions are quite general, others are made to allow the distinctions and interactions between conditional and unconditional conservatism to be demonstrated as simply as possible. Most importantly, we assume no significant economic differences between tangible and intangible assets in order to focus on the effects of differences in the accounting for these types of assets.[14] We also assume the same constant expected growth rate for the two types of assets and a simple setting of uncertainty for tangible assets in which the same shocks affect the growth and depreciation rates for those assets.[15] The basic character of our analysis does not change under less restrictive assumptions.

We refer to the end of (accounting) period t as time t. We assume all economic events (e.g., the realization of uncertainty, expenditures for new investments, and payments of dividends) in period t occur at time t.

First, we assume the market values of tangible and intangible assets at time t, denoted MVT_t and MVI_t, respectively, sum to the market value of common owners' equity at time t, denoted MV_t,

$$\mathrm{MV}_t = \mathrm{MVT}_t + \mathrm{MVI}_t. \qquad \text{(ADD)}$$

That is, tangible and intangible assets exhibit no complementarities and there are no financial assets, operating or financial liabilities, or equity other than common stock.[16] This implies that all excess cash is paid out in dividends, which equal free cash flow. The value of any positive net present value projects is included in the market value of intangibles.

Second, we assume the firm's owners' equity is subject to the no arbitrage condition

$$\mathrm{MV}_t + D_t = (1 + r)\mathrm{MV}_{t-1} + \phi_t, \tag{NA}$$

where D_t denotes net dividends at time t, r denotes the constant cost of equity capital, and ϕ_t denotes the shock to the market value of owners' equity at time t. ϕ_t and all other shocks in this paper are mean zero conditional on prior information. NA implies that the stock return in period t, denoted R_t, equals $r + \phi_t/\mathrm{MV}_{t-1}$. ADD implies that ϕ_t can be separated into the sum of the shocks to the market values of tangible and intangible assets and to dividends

$$\begin{aligned}\phi_t &= (\mathrm{MVT}_t - E_{t-1}\{\mathrm{MVT}_t\}) + (\mathrm{MVI}_t - E_{t-1}\{\mathrm{MVI}_t\}) + (D_t - E_{t-1}\{D_t\}) \\ &= \phi_{T,t} + \phi_{I,t} + \phi_{D,t},\end{aligned} \tag{1}$$

where the subscripts indicate whether the shock pertains to the value of tangible assets (T), intangible assets (I), or dividends (D). We distinguish the shocks to the market values of tangible and intangible assets because we assume below that accounting recognizes these shocks in different ways over time.

Third, we assume that tangible assets depreciate economically at a random annual rate $1-\gamma\,(1+\varepsilon_t)$, where $0 < \gamma < 1$ and $\varepsilon_t > -1$ is a shock to the economic depreciation rate of those assets. When ε_t is positive (negative), tangible assets depreciate at a rate that is slower (faster) than the expected rate $1-\gamma$, and so the firm experiences unexpected economic gains (losses) on those assets.[17] Denoting the market value of new investment in tangible assets at time t by IT_t, MVT follows the process

$$\mathrm{MVT}_t = \gamma(1 + \varepsilon_t)\mathrm{MVT}_{t-1} + \mathrm{IT}_t. \tag{T-DEPN}$$

We distinguish the economic and accounting depreciation rates for tangible assets below.

Fourth, we assume that IT has grown over an infinite history and continues to grow at a constant expected rate g, with $-1 < g < r$,

$$\mathrm{IT}_t = (1 + g)(1 + \varepsilon_t)\mathrm{IT}_{t-1}. \tag{T-GROW}$$

For simplicity, we assume that the growth rate is subject to the same shocks as the economic depreciation rate in T-DEPN, which implies the firm acquires new tangible assets in proportion to the current market value of previously acquired tangible assets, consistent with old and new assets being homogeneous.[18] T-DEPN and T-GROW imply that $\mathrm{MVT}_t = \mathrm{IT}_t(1+g)/(1+g-\gamma)$ and $\mathrm{MVT}_t = (1+g)(1+\varepsilon_t)\mathrm{MVT}_{t-1}$. The latter expression implies that $\phi_{T,t} = (1+g)\varepsilon_t\mathrm{MVT}_{t-1}$.

Fifth, we assume that the market value of intangible assets on average grows at the same expected rate g, though with different shocks η to that rate

$$\mathrm{MVI}_t = (1 + g)(1 + \eta_t)\mathrm{MVI}_{t-1}. \tag{I-GROW}$$

implies that $\phi_{I,t} = (1+g)\eta_t\mathrm{MVI}_{t-1}$. Unlike for tangible assets, we do not need to make separate assumptions about the economic depreciation rate or investment growth for intangible assets, because the costs of these assets are expensed immediately for accounting purposes. I-GROW reflects the net effect of investment growth and economic depreciation for these assets.

T-DEPN, T-GROW, and I-GROW imply that the market value of equity grows at rate g on average and that the shock to the market value of equity in each period is a weighted average of the shocks to the market values of tangible and intangible assets in that period. Specifically, $\mathrm{MV}_t = (1+g)(1+\varphi_t)\mathrm{MV}_{t-1}$, where $\varphi_t = (\mathrm{MVT}_{t-1}/\mathrm{MV}_{t-1})\varepsilon_t + (\mathrm{MVI}_{t-1}/\mathrm{MV}_{t-1})\eta_t$.

Sixth, we assume that that dividend yield is constant, which with the constant growth assumptions above implies that $D_t = \mathrm{MV}_t(r-g)/(1+g)$.[19] This implies that the shock to dividends is proportional to the shock to the market value of owners' equity, and so there is no uncertainty about dividends distinct from uncertainty about the value of tangible and intangible assets.

2.2. Accounting Measurement Assumptions and Book Values

2.2.1. Tangible Assets

We assume the tangible assets are acquired for their market value and so are zero net present value investments. Tangible assets are depreciated for accounting purposes using the declining balance method and depreciation rate $1-\delta$, where $0 < \delta \leq \gamma < 1$, so that accounting depreciation is either unbiased ($\gamma = \delta$) or unconditionally conservative ($\gamma > \delta$). Since the historical cost accounting depreciation rate does not reflect shocks to the economic depreciation rate, in the absence of write-downs of tangible assets, economic gains (losses) on those assets are recognized for accounting purposes in a gradual geometric fashion over time through understated (overstated) depreciation, consistent with the analysis in Ryan (1995).

We assume that when the firm's portfolio of tangible assets is deemed impaired, the book value of that portfolio is written down to its market value. While the assumption that impairment accounting works at the portfolio level potentially is inconsistent with FAS 144's requirement to apply impairment accounting at "the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities," this assumption does not change the character of our results while simplifying the algebra considerably.[20] It implies that the amount of a write-down equals the cumulative unrecognized economic losses on the portfolio of tangible assets since the most recent write-down prior to the current period. Consistent with FAS 144, we assume that the market value of tangible assets at the time of a write-down becomes the new cost basis of the assets. We also assume that the accounting depreciation rate remains $1-\delta$.

If impairment accounting worked in a frictionless fashion, then a write-down would be recorded whenever the book value of tangible assets would otherwise exceed their market value. As discussed in the introduction, in the simulation analysis we allow for two types of frictions in recording write-downs of tangible assets. At this point, however, we do not need to specify the precise conditions under such which write-downs are recorded. We denote the number of periods since the most recent write-down as of time t by $\tau(t)$, so that $BVT_{t-\tau(t)} = MVT_{t-\tau(t)}$.

The assumptions above imply that

$$BVT_t = \begin{cases} \delta BVT_{t-1} + IT_t, & \text{if } \tau(t) \geq 1 \\ MVT_t, & \text{if } \tau(t) = 0. \end{cases} \qquad \text{(T-ACC)}$$

That is, if no write-down is recorded at time t, then previously acquired tangible assets are depreciated at rate $1-\delta$, and the new investment in tangible assets is recorded at its market value. If a write-down is recorded at time t, then the book value of the portfolio of tangible assets is reset to its market value.

An equivalent representation of T-ACC, using the previously derived relation $MVT_{t-\tau(t)} = IT_{t-\tau(t)}(1+g)/(1+g-\gamma)$ and the identity $(1+g)/(1+g-\gamma) = 1+\gamma/(1+g-\gamma)$, is

$$BVT_t = \sum_{s=0}^{\tau(t)} \delta^s IT_{t-s} + \delta^{\tau(t)} IT_{t-\tau(t)} \frac{\gamma}{1+g-\gamma}. \qquad \text{(T-ACC}')$$

The presence of γ in the rightmost term in T-ACC′ reflects the fact that a write-down rebalances the relative cost bases (and thus subsequent book values) of the vintages of tangible assets acquired before the write-down to reflect the economic depreciation rate, not the accounting depreciation rate that determines the relative book values of the vintages of tangible assets acquired after the write-down. Specifically, the time t book value of the assets acquired in time $t-\tau(t)-s-1$, $s \geq 0$ (i.e., before the most recent write-down) equals $\gamma/(1+g)$ times the time t book value of the assets acquired in time $t-\tau(t)-s$. In contrast, the time t book value of the assets acquired in time $t-\tau(t)+s-1$, $1 \leq s \leq \tau(t)$ (i.e., at or after the most recent write-down) equals $\delta/(1+g)$ times the time t book value of the assets acquired in time $t-\tau(t)+s$. This rebalancing makes the characterization of the book value of tangible assets more complex when $\gamma > \delta$ than when $\gamma = \delta$.

Substitution for IT_{t-s} in T-ACC′ using equation (1), T-DEPN, and T-GROW yields the following expression for BVT[21]

$$BVT_t = MVT_t + BIAS_t + LAGS_t, \text{ where}$$

$$BIAS_t = MVT_t\left\{-\frac{\gamma-\delta}{1+g-\delta} + \frac{\gamma-\delta}{1+g-\delta}\left(\frac{\delta}{1+g}\right)^{\tau(t)}\right\} \quad \text{and}$$

$$LAGS_t = \sum_{s=0}^{\tau(t)-1} \phi_{T,t-s}\left\{-\left(\frac{1+g-\gamma}{1+g-\delta}\right)\frac{\delta^{s+1}}{1+g} - \frac{\gamma-\delta}{1+g-\delta}(1+g)^s\left(\frac{\delta}{1+g}\right)^{\tau(t)}\right\}. \qquad (2)$$

While equation (2) appears complex, each of its terms is easily interpreted. The book value of tangible assets equals their market value plus the non-positive $BIAS_t$, which equals the bias in book value attributable to the use of accelerated depreciation since the most recent write-down of those assets, and plus $LAGS_t$, which equals the currently unrecognized portion of past shocks to the market value of those assets attributable to the use of historical cost depreciation since that write-down. All shocks to the market value of tangible assets prior to the most recent write-down of those assets have been fully recognized. While the shocks in LAGS_t are each mean zero conditional on prior information, *ex post* LAGS_t includes the bias attributable to conditional conservatism, since this term can take a non-zero value only if $\tau(t) > 0$, which occurs only if the shocks are not negative enough to trigger a write-down at time t. We discuss BIAS_t and LAGS_t in turn.

The second line of equation (2) represents BIAS_t as MVT_t times the expression in curly brackets, which we refer to as the proportional bias. As discussed below, BIAS_t is zero if $\gamma = \delta$ or $\tau(t) = 0$ and negative if $\gamma > \delta$ and $\tau(t) \geq 1$, reflecting the downward bias in the book value of tangible assets caused by accelerated depreciation.

The first part of the proportional bias, $-(\gamma - \delta)/(1 + g - \delta)$, equals the proportional bias that obtains if there is no prior write-down of tangible assets. This part is zero if $\gamma = \delta$, is negative if $\gamma > \delta$, and becomes more negative as δ decreases towards zero. The second part of the proportional bias, $((\gamma - \delta)/(1 + g - \delta))(\delta/(1 + g))^{\tau(t)}$, is a correction to the first part that results from rebalancing the relative cost bases of tangible assets acquired prior to the most recent write-down $\tau(t)$ periods ago. If $\tau(t) > 0$, this correction partially offsets the first part of the proportional bias, though less so as $\tau(t)$ rises because the most recent rebalancing is further removed in time. In fact, the proportional bias can be represented as a weighted average of the proportional bias of $-(\gamma - \delta)/(1 + g - \delta)$ that obtains if there is no prior write-down of tangible assets and the proportional bias of zero that obtains when there is a write-down in the current period, i.e., $[-(\gamma - \delta)/(1 + g - \delta)] \times (1 - w)$, with $w = (\delta/(1 + g))^{\tau(t)}$. The weight w is 1 when $\tau(t) = 0$ and declines towards zero as $\tau(t)$ rises.

Summarizing the above discussion, BIAS_t is zero if $\gamma = \delta$ or $\tau(t) = 0$, is negative if $\gamma > \delta$ and $\tau(t) \geq 1$, becomes more negative as δ falls towards zero for $\tau(t) \geq 0$, and becomes more negative as $\tau(t)$ rises for $\gamma > \delta$.

The third line of equation (2) represents LAGS_t as a moving average process in the shocks to the market value of tangible assets since the most recent write-down. Since LAGS_t can be non-zero only if the shocks since the most recent write-down prior to time t are not negative enough to trigger a write-down at time t, on average LAGS_t is negative. Moreover, LAGS_t is on average more negative when the frictions in recording write-downs are less. For example, if tangible assets are written down whenever their book values would otherwise exceed their market values, then LAGS_t cannot be positive.

The weights on the shocks in LAGS_t are the expressions in the curly brackets in the summation. The first part of these weights, $-(1 + g - \gamma)/(1 + g - \delta)\delta^{s+1}/(1 + g)$, is negative and decays geometrically towards zero with the length of the lag, s, reflecting the fact that historical cost declining balance depreciation recognizes past shocks to the market value of tangible assets in a gradual geometric fashion. This part rises towards zero as δ falls, because more accelerated depreciation reduces the importance of lags by driving the book value of tangible assets toward zero and so yielding closer to cash basis accounting. The second part of these weights, $-(1 + g)^s(\delta/(1 + g))^{\tau(t)}((\gamma - \delta)/(1 + g - \gamma))$, is the correction to the weights that results from rebalancing the relative cost bases of tangible assets acquired prior to the most recent write-down of tangible assets $\tau(t)$ periods ago. As with the correction in $BIAS_t$, this correction is zero if $\gamma = \delta$, because no such rebalancing occurs in this case. This correction is negative if $\gamma > \delta$, and so reinforces the first part of the weights.[22] This correction decreases towards zero as $\tau(t)$ rises, because the most recent rebalancing is further removed in time.

Generalizing, equation (2) captures the distinct natures of and interactions between unconditional and conditional conservatism. Both types of conservatism yield downward bias in book value (unrecorded goodwill). However, unconditional conservatism in the form of accelerated depreciation yields a deterministic bias given the timing of the most recent write-down of tangible assets that is reflected in $BIAS_t$, while conditional conservatism yields a probabilistic bias that depends on the history of shocks since that write-down that is reflected in $LAGS_t$. Accelerated depreciation preempts conditional conservatism by reducing the likelihood of a write-down of tangible assets, as reflected in a longer lag structure in $LAGS_t$. More accelerated depreciation also implies closer to cash basis accounting, as reflected in smaller coefficients on the shocks in $LAGS_t$. Conditional conservatism also affects unconditional conservatism by rebalancing the cost bases of assets and allowing unconditional conservatism only the time since the most recent write-down to work. This occurs only for unconditional conservatism that takes time to work, like accelerated depreciation, not for unconditional conservatism that works instantly, like immediate expensing of the costs of intangibles.

2.2.2. *Intangible Assets*

As is the case for most internally developed intangible assets,[23] we assume that the costs of intangible assets are expensed immediately and any positive net present value of projects is not recognized, so that the book value of intangible assets, denoted BVI_t, is zero[24]

$$BVI_t = 0. \qquad \text{(I-ACC)}$$

Book values add across balance sheet line items, so I-ACC implies that the book value of owners' equity at time t, denoted BV_t, equals BVT_t.

2.3. *Clean Surplus Accounting and Earnings*

We assume the clean surplus relation holds, so that earnings during period t, denoted X_t, equal net dividends at time t plus the change in the book value of owners' equity during period t

$$X_t = D_t + \Delta BV_t. \qquad \text{(CSR)}$$

Most though not all U.S. GAAP adheres to the clean surplus relation.[25]

We represent earnings in a more interpretable form for our purposes by making the following substitutions into CSR. Using the economic assumptions above, we substitute $D_t=[(r-g)/(1+g)]\text{MV}_t=[r/(1+g)]\text{MV}_t-[g/(1+g)](\text{MVI}_t+\text{MVT}_t)$. Using equation (2), we substitute $\Delta\text{BV}_t=\Delta\text{MVT}_t+\Delta\text{BIAS}_t+\Delta\text{LAGS}_t$. Using T-DEPN and T-GROW, we combine terms using $[g/(1+g)]\text{MVT}_t+\Delta\text{MVT}_t=\phi_{T,t}/(1+g)$. These substitutions yield

$$X_t=\frac{r}{1+g}\text{MV}_t-\frac{g}{1+g}\text{MVI}_t+\frac{\phi_{T,t}}{1+g}+\Delta\text{BIAS}_t+\Delta\text{LAGS}_t. \tag{3}$$

Under the economic assumptions made above, $(r/(1+g))\text{MV}_t$ equals permanent earnings,[26] and $-(g/(1+g))\text{MVI}_t$ is the growth-dependent bias in earnings that results from immediately expensing the costs of intangibles. Consistent with prior research examining such biases, this expression is negative if $g>0$, positive if $g<0$, and zero if $g=0$, where g properly is interpreted as the growth rate for intangible assets. $\phi_{T,t}/(1+g)$ is the transitory portion (i.e., the portion not included in permanent earnings) of the current shock to the value of tangible assets that would be included in current earnings if tangible assets were accounted for at fair value in both periods t and $t-1$.[27] Δ BIAS_t and ΔLAGS_t capture the effects on earnings of our assumption that tangible assets are not accounted for at fair value except when those assets have just been written down.

We first describe the specification of earnings in equation (3) in the cases when a write-down of tangible assets is and is not recorded in the current period, focusing on the aspects of this equation with the greatest implications for asymmetry. We then summarize the implications of this equation for asymmetry with respect to current and lagged returns.

If a write-down of tangible assets is recorded at time t, i.e., $\tau(t)=0$, then $\text{BIAS}_t=\text{LAGS}_t=0$, and so equation (3) becomes

$$X_t=\frac{r}{1+g}\text{MV}_t-\frac{g}{1+g}\text{MVI}_t+\frac{\phi_{T,t}}{1+g}-\text{BIAS}_{t-1}-\text{LAGS}_{t-1}. \tag{3IMP}$$

Equation (3IMP) shows that the non-positive BIAS_{t-1} created by prior accelerated depreciation of tangible assets is recorded in its entirety in current earnings when a write-down of tangible assets occurs, increasing earnings by reducing the amount of the write-down. This is one way that unconditional conservatism reduces asymmetry with respect to current returns. Similarly, the equation shows that LAGS_{t-1}, which reflects all previously unrecognized lagged shocks to the market value of tangible assets, is also recorded in its entirety in earnings when a write-down of tangible assets occurs. As discussed above, LAGS_{t-1} is negative on average and is non-positive if write-downs are recorded whenever tangible assets are economically impaired. Hence, LAGS_{t-1} also tends to increase earnings by reducing the amount of the write-down and so reduces asymmetry with respect to current returns.

If a write-down of tangible assets is not recorded at time t, i.e., $\tau(t)>0$, then it is necessary to evaluate the terms ΔBIAS_t and ΔLAGS_t in equation (3) using equation (2). Since these terms are fairly complex, we discuss only their features with the strongest implications for asymmetry. In particular, ΔBIAS_t does not have a strong effect on asymmetry when $\tau(t)>0$, and so we do not discuss it, although Appendix A provides the expressions for it and for earnings when $\tau(t)>0$.[28]

When $\tau(t) > 0$, ΔLAGS_t can be represented as follows:

$$\Delta\text{LAGS}_t = \phi_{T,t}\left\{ -\left(\frac{1+g-\gamma}{1+g-\delta}\right)\frac{\delta}{1+g} - \frac{\gamma-\delta}{1+g-\delta}\left(\frac{\delta}{1+g}\right)^{\tau(t)} \right\} + (\delta-1)\text{LAGS}_{t-1}. \tag{4}$$

ΔLAGS_t includes two components with different effects on asymmetry. First, the term involving $\phi_{T,t}$ reflects the non-recognition in current earnings of a portion of the current shock to the value of the tangible assets. This term partially offsets $\phi_{T,t}/(1+g)$ in equation (3), implying that less of $\phi_{T,t}$ is recognized in current earnings when $\tau(t) > 0$ then when $\tau(t) = 0$. As emphasized by Basu (1995, 1997) and the prior literature on conditional conservatism, this yields asymmetry with respect to current returns.

Second, $(\delta-1)\text{LAGS}_{t-1}$ in equation (4) reflects the partial (in proportion to the accounting depreciation rate $1-\delta$) recognition in current earnings of the previously unrecognized lagged shocks to the market value of tangible assets. In contrast, LAGS_{t-1} is recognized in its entirety in earnings if a write-down of tangible assets is recorded in the current period, as shown in equation (3IMP). Recall that LAGS_{t-1} only is affected by shocks to the market value of tangible assets subsequent to the most recent write-down of those assets prior to time t. Hence, holding the timing of the most recent write-down prior to time t constant, current earnings has a more positive relation with lagged returns subsequent to that time if a write-down occurs in the current period than if one does not, and earnings has no relation with lagged returns prior to that time regardless of whether a write-down occurs in the current period. This implies that, for an individual firm/period observation for which the timing of the most recent write-down prior to the current period is known, asymmetry with respect to lagged returns subsequent to that write-down is in the same direction as asymmetry with respect to current returns, and asymmetry with respect to returns prior to that write-down is in the opposite direction as asymmetry with respect to current returns.

However, for empirical research estimating asymmetry on samples of observations pooled across firms or time, it does not make sense to hold the timing of the most recent write-down prior to the current period constant, because this timing is probabilistic and depends on the nature and extent of unconditional conservatism and the model's other constructs. In such samples, a given lagged return is subsequent to that write-down with some probability and prior to that write-down with the remaining probability. The direction of asymmetry with respect to that return will depend on which possibility dominates. For example, more accelerated depreciation tends to yield more unrecorded goodwill for tangible assets and thus fewer write-downs of tangible assets, as reflected in a longer lag structure in LAGS_{t-1}. Hence, more accelerated depreciation makes it likelier that asymmetry with respect to a given lagged return is in the same direction as asymmetry with respect to current returns.

We now turn to summarize the implications of equation (3), by which we include the special cases described in equations (3IMP) and (4), for asymmetry with respect to both current and lagged returns. Equation (3) implies that asymmetry with respect to current returns kicks in only for returns negative enough to use up the available accounting slack for tangible assets provided by accelerated depreciation of those assets ($BIAS_{t-1}$), by the unrecognized portion of past positive shocks to the market value of those assets ($LAGS_{t-1}$), and by a loose impairment trigger. Such accounting slack reduces asymmetry with respect to current returns by reducing both the probability that write-downs of tangible assets occur in the current period and the amount of these write-downs when they do occur. Equation (3) also implies that this asymmetry kicks in more gradually the higher the proportion of intangibles immune to write-downs, since share returns become a noisier proxy for the returns to tangible assets.

While equation (3) clarifies the nature of the effects of unconditional conservatism on asymmetry with respect to current returns, and the simulation analyses using that equation reported in Section 3 indicate additional subtleties, the main aspects of these effects can be intuited. This is reflected in recent papers by Pope and Walker (2003), Givoly et al. (2004), Pae et al. (2004), and Roychowdhury and Watts (2004) which argue and show that asymmetry with respect to current returns is less for firms with higher unconditional conservatism as proxied for by the market-to-book ratio.

In contrast, asymmetry with respect to lagged returns and the effect of unconditional conservatism on that asymmetry are far more difficult to intuit, although bits of intuition appear in various papers.[29] As discussed in the introduction, the direction of asymmetry with respect to lagged returns could be in either the same or the opposite direction as asymmetry with respect to current returns, depending on whether bad news about the value of tangible assets is recognized in earnings immediately or just quicker than good news. If such bad news is recognized immediately, then asymmetry with respect to all lagged returns must be in the opposite direction as asymmetry with respect to current returns (i.e., earnings has no association with negative lagged returns but a positive association with positive lagged returns). If such bad news is not always recognized immediately but is recognized quicker than good news, then the asymmetries are in the same direction for near lagged returns for which such bad news has not previously been recognized in earnings with sufficiently high probability (i.e., earnings has a stronger positive association with negative lagged returns than positive lagged returns), and is in the opposite direction for further lagged returns (i.e., earnings has a less positive association with negative lagged returns than with positive lagged returns).

Equation (3) implies that negative lagged returns too small to use up the available accounting slack for tangible assets are not fully recognized in earnings when they occur. However, these negative lagged returns still use up some of that slack and so tend to be recognized in earnings quicker than positive lagged returns. For this reason, asymmetry with respect to sufficiently near lagged returns that are not negative enough to trigger write-downs in the prior period with sufficiently high probability is in the same direction as asymmetry with respect to current returns. In contrast, asymmetry with respect to larger sufficiently near lagged returns is in the opposite direction as asymmetry with respect to current returns.

This implies that the relation between earnings and sufficiently near lagged returns tends to be S-shaped, with the asymmetry with respect to these returns being in the same direction as asymmetry with respect to current returns for relatively small negative lagged returns and in the opposite direction for more negative lagged returns. This S-shape should appear for further lagged returns as the expected timing of the most recent write-down of tangible assets prior to the current period becomes further removed. This is the case under more accelerated depreciation of tangible assets, which tends to yield a longer lag structure in LAGS_{t-1}, as discussed above. This S-shape should also be more pronounced the larger the expected accounting slack for tangible assets, as is also the case under more accelerated depreciation of those assets. This S-shape should be smoother the higher the proportion of intangibles, since share returns become a noisier proxy for the returns to tangible assets.

Regardless of the direction of asymmetry with respect to lagged returns, equation (3) implies that accelerated depreciation of tangible assets tends to attenuate that asymmetry, because this depreciation causes the shocks to the market value of tangible assets to be recognized in earnings more quickly in the absence of a write-down of those assets. Reflecting this point, more accelerated depreciation yields lower coefficients on the lagged shocks to the market value of tangible assets in LAGS_{t-1}, as discussed above.

While the prior discussion of equation (3) includes many predictions about asymmetry, we defer our formal statement of hypotheses about asymmetry to next section, in which we describe the results of simulation analyses using that equation. We do this because the simulations both clarify the insights in the conceptual discussion and provide many insights beyond this discussion. This results in part from the simulations' ability to capture the probabilistic and history dependent nature of write-downs of tangible assets. For example, the simulations show the conditions under which one of the offsetting effects that determine whether asymmetry with respect to lagged returns is in the same or opposite direction as asymmetry with respect to current returns dominates. This also results in part from the simulations' ability to capture the effects of noise in the relationship between share returns and write-downs of tangible assets. For example, the simulations show various effects of increasing that proportion of intangibles that are described incompletely in the conceptual discussion above, and they show the effects of an uncertain impairment trigger that are not mentioned in this discussion due to the complex nature of these effects.

In the simulation analyses, we develop hypotheses about asymmetry of earnings for the firm to share returns. We emphasize, however, that if the shocks to the market value of tangible and intangible assets were separately observable, then we could use equation (3) to develop and test hypotheses similar to those in prior research about the effects of unconditional and conditional conservatism on the earnings generated by the two types of assets.[30] Since these variables are not observable, like some prior research we use returns to proxy for shocks to the market value of tangible assets. These proxies contain noise that rises with the proportion of intangible assets. In this regard, the hypotheses developed in the next section also address the limitations of the proxies used in prior research on conditional conservatism.

3. Simulation Analyses and Hypotheses

In this section, we report the results of simulations using the specification of earnings in equation (3).[31] Based on these simulations and our prior conceptual discussion of that equation, we develop hypotheses about asymmetry with respect to current and lagged returns and how it varies with the model's constructs. Specifically, we examine the effects on asymmetry of varying the extent of two types of unconditional conservatism—immediate expensing of the cost of intangible assets and accelerated depreciation of tangible assets—the amount of past unrecognized shocks to the market value of tangible assets arising from historical cost depreciation of tangible assets, and the extent of two frictions in recording write downs of tangible assets—a loose impairment trigger and an uncertain impairment trigger.

As discussed above, the five constructs of the model that we analyze affect asymmetry in only two general ways, specifically, by yielding either accounting slack for tangible assets or noise in the relation between share returns and write-downs of tangible assets. The simulations analyzing constructs that affect asymmetry in the same general way exhibit substantial similarities, but also significant differences as well. This implies that empirical research examining asymmetry from one model construct needs to be able to recognize the distinct effects of the constructs and control for those not of direct interest.

In this regard, the testability of the hypotheses developed in this section depends on the ability of the researcher to obtain suitable proxies for the model's constructs; we expect this ability to vary considerably across the hypotheses. We discuss the proxies we are using to test these hypotheses in our follow-on empirical project in progress in Section 4.

3.1. Technical Assumptions and Implementation Choices

The simulations are based on the following additional technical assumptions and implementation choices. First, we assume that one plus the shocks ε and η to the market values of tangible and intangible assets, respectively, are lognormally distributed, and that the logs of the one plus shocks are mean zero and have standard deviations of 50% per period. We chose a fairly high standard deviation so that the plotted results for extreme realizations of returns would be reliable. The assumption of lognormality is natural given the multiplicative structure assumed in Section 2.

Second, each simulation involves 40 periods (denoted 1 through 40) and 10,000 firms. To correspond to the assumption of infinitely lived firms in T-GROW reasonably well in finite-period simulations, we assume that at time 0 the market value of tangible assets equals their book value, as if a write-down of those assets is recorded at time 0. We then use the first 10 periods to generate a history of shocks for each firm, and plot only the values of variables in periods 11–40. Without loss of generality, we normalize the market value of tangible assets at time 0 to equal 1.

Third, we assume the economic depreciation rate $1-\gamma$ is 0.2, the cost of capital r is 0.1, and the growth rate g is 0.05. Given our focus on asymmetry in this paper, these parameters are not primary concerns.[32]

Fourth, for each simulation, we present and discuss the following four plots (of dependent variable versus independent variable): (1) current-period earnings divided by beginning-of-period price versus the current-period return, (2) current-period earnings divided by beginning-of-period price versus the one-period lagged return, (3) the frequency of a current-period write-down versus the current-period return, and (4) the frequency of a write-down in the current period but not the prior period versus the one-period lagged return. While our hypotheses are derived from the first two plots for each simulation, we present the latter two plots because they facilitate the interpretations of the hypotheses and also indicate some effects more clearly. Asymmetry with respect to the current period return depends on how frequently write-downs are recorded in the current period because of that period's return. Asymmetry with respect to the one-period lagged return depends on how frequently write-downs are recorded in both the current and prior periods because of the one-period lagged return. In particular, asymmetry with respect to the one-period lagged return that is in the same direction as asymmetry with respect to the current return results when write-downs are recorded with sufficiently high frequency in the current period but not in the prior period because of the one-period lagged return.[33]

While all the plots are bivariate, by construction current and one-period lagged returns are uncorrelated, and so the conclusions we draw from the plots generalize to the multivariate reverse regressions estimated by Pope and Walker (1999) and Ryan and Zarowin (2003).

Each plot presents the means of the dependent variable for observations in which the independent variable, current or one-period lagged returns, falls in each of the 0.05 long intervals from −0.5 to 1.

3.2. *Varying the Extent of Unconditional Conservatism*

In this section, we describe the results of two simulations that show how unconditional conservatism affects asymmetry with respect to current and lagged returns. In the first simulation, we vary the proportion of intangibles assuming that accounting depreciation for tangible assets is unbiased; immediate expensing of the costs of intangible assets yields white noise in the relation between share returns and write-downs of tangible assets. In the second simulation, we vary the accounting depreciation rate for tangible assets assuming that there are no intangible assets; accelerated depreciation yields unrecorded goodwill for tangible assets that provides accounting slack (i.e., BIAS_{t-1} in equation (3)) that preempts write-downs of those assets. In order to emphasize the different effects of the two types of unconditional conservatism, we propose hypotheses after discussing both simulations.

3.2.1. *Varying the Proportion of Intangible Assets*

To focus on the effect of varying the proportion of intangible assets, in this simulation we assume accounting depreciation is unbiased ($\gamma = \delta$) and write-downs are recorded whenever the book value of tangible assets would otherwise exceed their market value. We allow the market and book value of intangible assets at time 0 to take three possible values: 0, 1, and 5. This value equals the initial proportion of intangible to tangible assets, since the market and book value of tangible assets at time 0 is 1. When this value is 0, the proportion of intangible to tangible assets remains 0 over all the periods of the simulation. When this value is above 0, the proportion of intangible to tangible assets fluctuates with the independent shocks to the market value of intangible and tangible assets over the periods of the simulation, though this proportion remains the same on average over these periods.

The results of this simulation are plotted in Figure 2a and b. Figure 2a plots current earnings divided by beginning-of-period price versus current returns in the left-hand plot and versus one-period lagged returns in the right-hand plot. Figure 2b plots the frequency of a write-down in the current period versus current returns in the left-hand plot. In the right-hand plot, the frequency of a write-down in the current but not prior period is plotted versus one-period lagged returns. The figures for subsequent simulations have the same structure.

We first discuss Figure 2a. Notice that the response of earnings to both current and lagged returns is stronger the lower the proportion of intangibles. This reflects the fact that earnings are affected by shocks to the market value of intangible assets only through dividends (i.e., free cash flows), while earnings are affected by shocks to the market value of tangible assets through both dividends and the change in the book value of tangible assets (i.e., accruals). Because the response of earnings to returns is weaker the higher the proportion of intangibles, the asymmetry that exists in these cases is somewhat harder to observe in the figures.

In the left-hand plot, in the case of no intangibles, asymmetry with respect to current returns begins to appear for return less than 0.1, the cost of capital. That is, the slope coefficient is more positive for current returns below this level than above it. Moreover, this asymmetry strengthens as returns fall further below the cost of capital. That is, the slope coefficient is more positive when current returns are further below this level. This occurs because returns further below the cost of capital are likelier to use up the available unrecorded goodwill for tangible assets (attributable to past unrecognized shocks to the market value of tangible assets) and so yield write-downs of those assets. Though fairly subtle in the plot, as the proportion of intangibles rises, this asymmetry begins to appear further *above* the cost of capital. This occurs because a higher proportion of intangibles implies share returns are a noisier proxy for the returns to tangible assets; in particular, when share returns are a given amount above the cost of capital, returns to tangible assets are likelier to be bad enough to yield a write-down of those assets. (This effect is easy to see in Figure 2b, as discussed below.) In summary, asymmetry with respect to current returns is stronger and kicks in more abruptly and closer to (less above) the cost of capital when the proportion of intangible assets is lower.

In the right-hand plot, asymmetry with respect to one-period lagged returns is in the opposite direction of asymmetry with respect to current returns described above. Intuitively, a lower one-period lagged return makes it more likely that a write-down of tangible assets was recorded in the prior period, and so more likely that the lagged

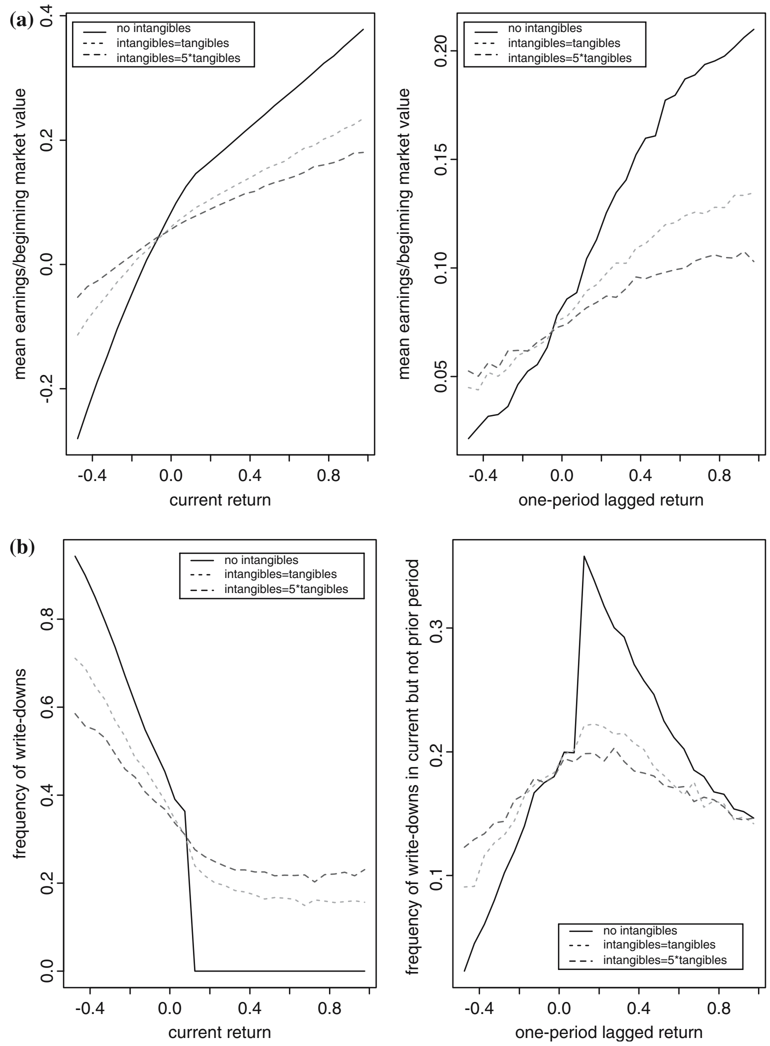

Figure 2. (a) Earnings versus current and one-period lagged returns varying the proportion of intangible assets. (b) Frequency of impairment write-downs versus current and one-period lagged returns varying the proportion of intangible assets.

return was fully recognized in prior earnings. This asymmetry is again stronger and kicks in more abruptly the lower the proportion of intangible assets, because share returns are determined more by shocks to the market value of tangible assets subject to write-downs.

Figure 2b helps interpret these results. In the left-hand plot, the frequency of write-downs is more sensitive to current returns when the proportion of intangible assets is less, because share returns are more highly correlated with the returns on tangible assets. For example, when there are no intangible assets, there are no write-downs if the current return is above the cost of capital, but the frequency of write-downs rises sharply (discontinuously, in fact) as returns fall below this level. In contrast, when there are intangible assets, there are some write-downs even if returns are very positive, since the return on tangible assets may still be negative. Similarly, the frequency of write-downs rises more gradually as the current return falls, since share returns are a noisy proxy for the return on tangible assets.

In the right-hand plot, the frequency of write-downs in the current but not prior period is again more sensitive to one-period lagged returns when the proportion of intangible assets is less. If the firm has no intangible assets, this frequency is highest when the prior period return equals the cost of capital, which precludes a write-down in the prior period but does not add to unrecorded goodwill. As the one-period lagged return falls below this level, the likelihood of a write-down in the prior period rises sharply (and again discontinuously), yielding a sharp decline in this frequency. This sharp decline explains why asymmetry with respect to one-period lagged returns has the opposite direction of asymmetry with respect to current returns. As one-period lagged returns rise above the cost of capital, unrecorded goodwill is created that lowers the probability of a write-down in the current period.

As the proportion of intangible assets rises, the relationship between the frequency of write-downs in the current but not prior period and one-period lagged returns retains its basic shape but its slope is attenuated everywhere, because returns are a noisier proxy for the shocks to tangible assets. In particular, this frequency falls more slowly as the one-period lagged return deviates in either direction from the cost of capital. This explains why an increase in the proportion of intangibles reduces asymmetry with respect to one-period lagged returns.

3.2.2. Varying the Accounting Depreciation Rate

To focus on the effect of varying the accounting depreciation rate, in this simulation we assume that the firm holds no intangible assets and that write-downs are recorded whenever the book value of tangible assets would otherwise exceed their market value. We allow the accounting depreciation rate to take three possible values: (1) $1-\delta=0.2=1-\gamma$, so that accounting depreciation is unbiased; (2) $1-\delta=0.3$, so that accounting depreciation is mildly unconditionally conservative; and (3) $1-\delta=0.5$, so that accounting depreciation is strongly unconditionally conservative.

While both this and the prior intangibles simulations examine types of unconditional conservatism, the mechanism by which unconditional conservatism affects asymmetry varies. In the intangibles simulation, greater unconditional conservatism (a higher proportion of intangibles) yields more noise in the relation between share returns and write-downs of tangible assets. In this simulation, greater unconditional conservatism (more accelerated depreciation) yields more unrecorded goodwill for tangible assets. As we shall see, asymmetry with respect to lagged returns varies in a different and more complex fashion with the extent of unconditional conservatism than in the intangibles simulation. We focus our discussion on the most salient differences between the two simulations.

The results of this simulation are plotted in Figure 3a and b. We first discuss Figure 3a. The left-hand plot indicates that when accounting depreciation is more accelerated, asymmetry kicks in only for returns further *below* the cost of capital. The reason for this is accelerated depreciation yields unrecorded goodwill for tangible assets that provides accounting slack for tangible assets that preempts write-downs of those assets, and so the return has to use up that goodwill before triggering a write-down. If and when a write-down is triggered, it tends to be smaller for more accelerated depreciation (since the pre-write-down book value of the assets to be written down is on average lower), and so the asymmetry is weaker.

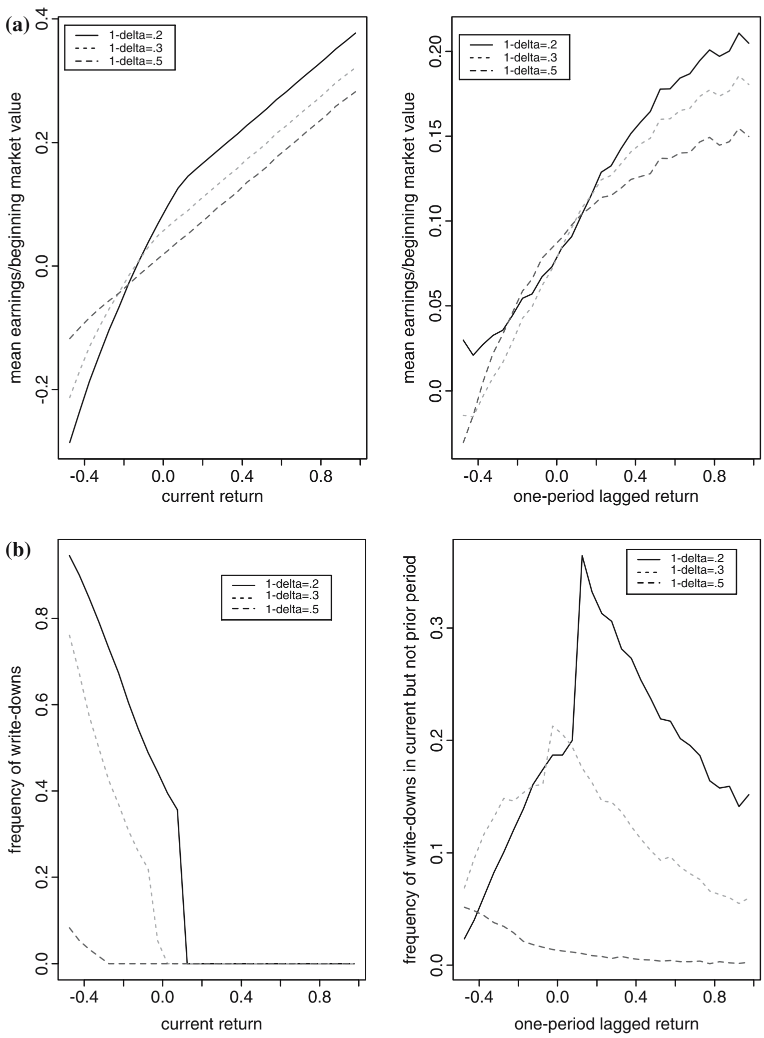

Figure 3. (a) Earnings versus current and one-period lagged returns varying the accounting depreciation rate. (b) Frequency of impairment write-downs versus current and one-period lagged returns varying the accounting depreciation rate.

In the right-hand plot, in the unbiased accounting depreciation case, asymmetry with respect to one-period lagged returns is in the opposite direction of asymmetry with respect to current returns, similar to the results in the intangibles simulation. However, these asymmetries are in the same direction for the accelerated depreciation cases as long as one-period lagged returns are not sufficiently negative so as to use up the available unrecorded goodwill with sufficiently high probability. The reason for this is more accelerated depreciation yields more unrecorded goodwill for tangible assets, and a more negative one-period lagged return uses up more of that goodwill and so raises the probability of a write-down in the current period, as long as that return is not negative enough to yield a write-down in the prior period.

Notice that there can be relatively constant slope over large ranges of negative lagged returns for moderately accelerated depreciation rates, as is the case for $1-\delta=0.3$ in this plot. Intuitively, while a more negative lagged return raises the probability of write-down in the prior period, in the absence of such a write-down, it uses up unrecorded goodwill created by the accelerated depreciation, raising the probability of a write-down in the current period, and the two effects roughly cancel.

While the effect is difficult to see in the plot, for the accelerated depreciation cases, when one-period lagged returns are sufficiently negative so as to yield a write-down in the prior period with sufficiently high probability, the asymmetry with respect to one-period lagged returns switches to have the opposite sign as the asymmetry with respect to current returns. This yields an S-shaped relation between earnings and the one-period lagged return. For example, *very* close study of the plot indicates an inflection point in the relation appears at one-period lagged returns of about −30% in the case of $1-\delta=0.3$. This sort of S-shaped relation is much easier to see in the next simulation.

Figure 3b helps interpret these results. In the left-hand plot, the frequency of write-downs is zero if current returns are above the cost of capital, regardless of the accounting depreciation rate. This frequency rises sharply when current returns fall below a level that decreases as the accounting depreciation rate becomes more accelerated, since a write-down is recorded only if returns are sufficiently negative to use up the unrecorded goodwill created by the accelerated depreciation with sufficiently high probability.

In the right-hand plot of Figure 3b, in the case of unbiased accounting depreciation, the relationship between the frequency of write-downs in the current but not prior period and one-period lagged returns is identical (ignoring sampling error) to the relationship for the case of zero intangibles in the corresponding plot in Figure 2b, and so it is not re-explained. More accelerated accounting depreciation creates more unrecorded goodwill for tangible assets that preempts write-downs of those assets, and so the one-period lagged return that maximizes the frequency of write-downs in the current but not prior period falls. This is in contrast to the corresponding plot in Figure 2b, in which this frequency is maximized when one-period lagged returns equal the cost of capital, regardless of the proportion of intangible assets.

3.2.3. Summary of Hypotheses

The above discussion of the two simulations yields the following hypotheses about how unconditional conservatism affects asymmetry with respect to current and one-period lagged returns.

[H1] Unconditional conservatism reduces asymmetry with respect to current returns in the following two ways:

- Unconditional conservatism that reduces the proportion of assets subject to conditional conservatism, such as an increase in the proportion of intangible assets whose costs are immediate expensed, yields asymmetry of smaller magnitude that kicks in more gradually as returns fall. The asymmetry appears for returns further above the cost of capital, however.

- Unconditional conservatism that provides more unrecorded goodwill for a given set of assets subject to conditional conservatism, such as more accelerated depreciation, yields asymmetry of smaller magnitude that kicks in only for returns further below the cost of capital.

[H2] Unconditional conservatism affects the magnitude and direction of asymmetry with respect to one-period lagged returns in the following two ways:

- Unconditional conservatism that reduces the proportion of assets subject to conditional conservatism yields asymmetry in the opposite direction as for current returns, of smaller magnitude, and that kicks in more gradually.

- Unconditional conservatism that provides unrecorded goodwill for a given set of assets subject to conditional conservatism yields asymmetry with respect to one-period lagged returns in the same direction as for current returns, as long as one-period lagged returns are not negative enough to use up the available goodwill with sufficiently high probability. Otherwise, the asymmetries are in the opposite directions. This yields an S-shaped relation between earnings and one-period lagged returns.

3.3. Varying the Amount of Unrecorded Goodwill from Past Unrecognized Positive Shocks to the Market Value of Tangible Assets

In this simulation, we vary the amount of unrecorded goodwill for tangible assets reflecting past unrecognized positive shocks to the market value of those assets as of the beginning of the period (i.e., $LAGS_{t-1}$ in equation (3)). Historical cost depreciation gives rise to this unrecorded goodwill, which also preempts write-downs of tangible assets. To focus on the effect of varying this unrecorded goodwill, in this simulation we assume that the firm holds no intangible assets, accounting depreciation is unbiased, and write-downs are recorded whenever the book value of tangible assets would otherwise exceed the market value of those assets.

We analyze observations partitioned into three groups based on the market-to-book ratio, denoted MTB, which is a perfect measure of the unrecorded goodwill from positive shocks to the market value for tangible assets in this simple setting. (In general, MTB is also a function of unconditional conservatism, of course.) The low group contains all the observations for which MTB equals 1, its minimum value given the assumptions of the simulation, and the middle and high groups each contain one-half of the remaining observations. When analyzing asymmetry with respect to the current (one-period lagged) return, we partition observations based on MTB at the beginning of the current (prior) period, so that the partitioning variable is not correlated with the return.

This simulation yields results that are similar in many respects to the accelerated depreciation simulation, because both examine aspects of the accounting process that give rise to unrecorded goodwill for tangible assets. Because we partition observations directly on the amount of unrecorded goodwill for tangible assets in this simulation, certain effects (in particular, the S-shaped relation between earnings and one-period lagged returns) are easier to see in this simulation than in the accelerated depreciation simulation, where we partition on the (accelerated) depreciation rate that gives rise to unrecorded goodwill for tangible assets. It should be noted, however, that *ex ante* the effect of accelerated depreciation on asymmetry is more predictable than is the effect of historical cost depreciation, because accelerated depreciation gives rise to unrecorded goodwill for tangible assets in a deterministic fashion given the timing of the last write-down of those assets, while unrecognized past shocks to the market value of those assets arise randomly.

The results of this simulation are plotted in Figure 4a and b. We first discuss Figure 4a. The left-hand plot indicates that earnings are higher when MTB is higher, reflecting the fact that these observations experienced positive shocks that are being recognized gradually in earnings through understated historical cost depreciation. Asymmetry with respect to current returns kicks in only for more negative returns as MTB increases. This is for the same reason as in the accounting depreciation rate simulation. More unrecorded goodwill for tangible assets that preempts write-downs of those assets, in particular, the return has to use up that goodwill before triggering a write-down.

The right-hand plot indicates that asymmetry with respect to one-period lagged returns is in the opposite direction of asymmetry with respect to current returns if MTB is one. In contrast, if MTB is above one, asymmetry with respect to one-period lagged returns that are not negative enough to use up the available unrecorded goodwill with sufficiently high probability is in the same direction as asymmetry with respect to current returns. The reason is the same as for the accounting depreciation rate simulation. When there is more unrecorded goodwill for tangible assets, a more negative return in the prior period uses up more of that goodwill, and so raises the probability a write-down is recorded in the current period.

For cases in which MTB exceeds one, when one-period lagged returns are sufficiently negative to use up the available unrecorded goodwill and yield a write-down in the prior period with sufficiently high probability, the asymmetry with respect to one-period lagged returns switches to have the opposite sign as the asymmetry with

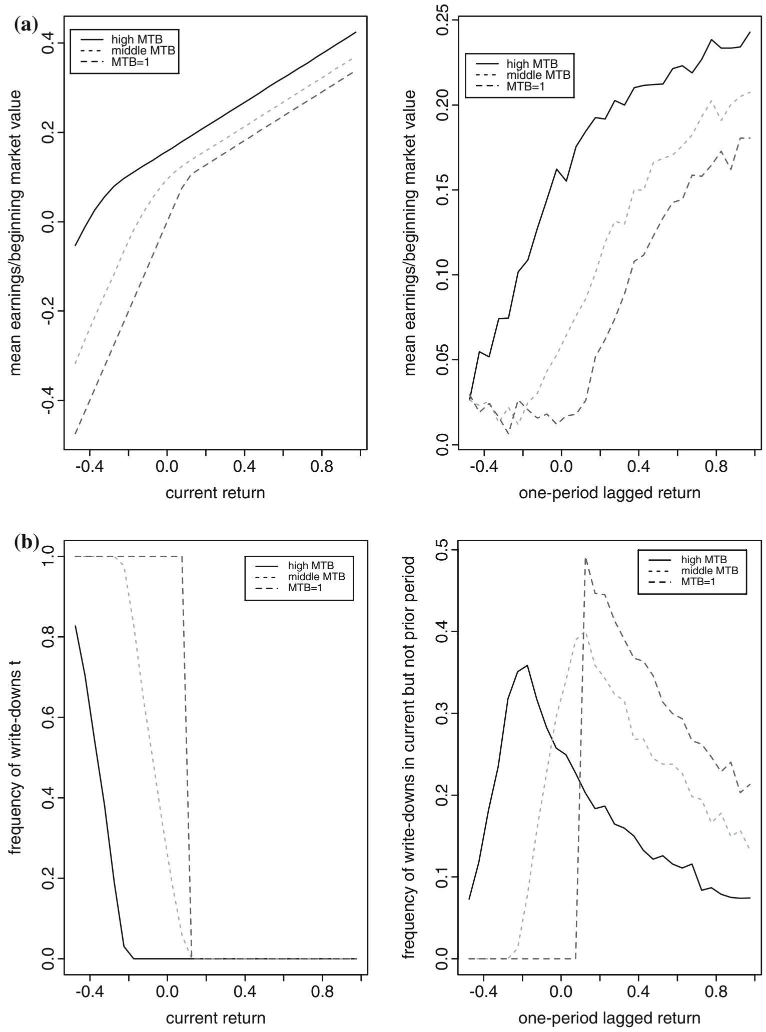

Figure 4. (a) Earnings versus current and one-period lagged returns varying the magnitude of accounting slack at the beginning of the return period. (b) Frequency of impairment write-downs versus current and one-period lagged returns varying the magnitude of accounting slack at the beginning of the return period.

respect to current returns. For example, study of the plot indicates an inflection point in the relation appears at one-period lagged returns of about −10% in the case the middle MTB group. This S-shaped relation is much easier to see than in the prior accounting depreciation rate simulation, because we partition directly on the amount of unrecorded goodwill for tangible assets in this simulation.

Figure 4b helps interpret these results. The left-hand plot shows that when MTB is higher the frequency of a write-down in the current period rises above zero only for a lower current return.

The right-hand plot shows that when MTB is one, the frequency of write-downs of tangible assets in the current but not prior period is maximized if the return equals the cost of capital, which does not cause a write-down in the prior period but adds no unrecorded goodwill. This frequency falls discontinuously to zero if the one-period lagged return is lower than the cost of capital, since there is a write-down in that prior period. This frequency also falls as the one-period lagged return rises above the cost of capital, because unrecorded goodwill is created. When MTB is above one, the one-period lagged return for which the frequency of write-downs in the current but not prior period is maximized falls (this cannot be seen in the plot for the middle MTB group due to the grouping of observations returns in returns intervals 0.05 long). The discontinuity in this frequency disappears for the middle and high MTB groups because these groups contain observations with varying levels of MTB, unlike the group for which MTB equals one.

The above discussion of the simulation results yields the following hypotheses about how unrecorded goodwill from past unrecognized positive shocks to the market value of tangible assets affects asymmetry with respect to current and one-period lagged returns.

> [H3] Greater unrecorded goodwill resulting from past unrecognized shocks to the market value of tangible assets causes asymmetry with respect to current returns to appear only at current return levels further below the cost of capital.

> [H4] Unrecorded goodwill resulting from past unrecognized shocks to the market value of tangible assets causes the direction of asymmetry with respect to one-period lagged returns to be in the same direction as for current returns, as long as the one-period lagged return is not negative enough to yield write-downs in that period with sufficiently high probability. Otherwise, the asymmetries are in the opposite directions. This yields an S-shaped relation between earnings and one-period lagged returns.

3.4. Varying the Extent of Frictions in Recording Write-downs of Tangible Assets

In this section, we describe the results of two simulations that show how frictions in recording write-downs of tangible assets affect asymmetry with respect to current and lagged returns. In the first simulation, we vary the looseness of the impairment trigger, assuming that write-downs are recorded only if the book value of tangible assets would otherwise exceed 1 + IMPBUFF times the current market value of tangible assets, where IMPBUFF > 0. IMPBUFF represents a simplified characterization of FAS 144's requirement that tangible assets and intangible assets with definite lives be deemed impaired if their book value exceeds the undiscounted value of their future cash flows. IMPBUFF yields accounting slack for tangible assets distinct from unrecorded goodwill that preempts write-downs of those assets. IMPBUFF yields accounting slack for tangible assets immediately upon recording a write-down; in prior simulations examining accelerated depreciation and unrecognized past shocks to the market value of tangible assets, unrecorded goodwill for tangible assets arose over time.

In the second simulation, we vary the uncertainty of the impairment trigger, assuming that write-downs are recorded with some probability IMPPROB < 1 conditional on tangible assets being economically impaired. IMPPROB represents a simplified characterization of the effect of estimation difficulties on the timing of write-downs. IMPPROB randomly delays write-downs of economically impaired tangible assets and may even prevent these write-downs if subsequent positive shocks to the market value of those assets render them unimpaired before they are written down. Hence, IMPPROB introduces a considerably more complex noise in the relation between share returns and write-downs than does immediate expensing of the costs of intangibles. In order to emphasize the different effects of the two types of friction, we propose hypotheses after discussing both simulations.

3.4.1. Varying the Looseness of the Impairment Trigger

To focus on the effect of varying IMPBUFF, in this simulation we assume the firm holds no intangible assets, accounting depreciation is unbiased, and write-downs are recorded whenever the book value of tangible assets would otherwise exceed $1 +$ IMPBUFF times their current market value. In the main set of plots analyzed below, we allow IMPBUFF to take the values 0, 0.2, or 0.4. IMPBUFF has its most deterministic and observable effect on asymmetry when a write-down is recorded in the period prior to the return period, however, because in this case the accounting slack equals IMPBUFF times the beginning of period market value of tangible assets. To demonstrate this point, we also briefly discuss supporting plots in which IMPBUFF takes the values 0 or 0.4 and for which the observations are partitioned based on whether or not a write-down was recorded in the period prior to the return period.

The results of this simulation are plotted in Figure 5a and b. We first discuss Figure 5a. The left-hand plot indicates that asymmetry with respect to the current return appears at higher (closer to the cost of capital) return levels and more abruptly when IMPBUFF is smaller. For example, when IMPBUFF $= 0$, asymmetry appears abruptly when returns are lower than the cost of capital, since a sizeable proportion of observations will have had write-downs in the prior period and thus no accounting slack. Asymmetry continues to increase as returns become more negative, however, because the remaining observations have accounting slack at the beginning of the period that is used up if returns are sufficiently negative. In contrast, when IMPBUFF $= 0.4$, asymmetry initially appears more gradually, because there is a lower proportion of observations with no accounting slack at any point in time. In this case, asymmetry kicks in sharply when returns are negative enough to use up the accounting slack that is created if a write-down was recorded in the prior period, however. Overall, the differences across the different values of IMPBUFF appear fairly mild; this is not because IMPBUFF is unimportant, but rather because it interacts with the recording of a write-down in the prior period, as discussed below.

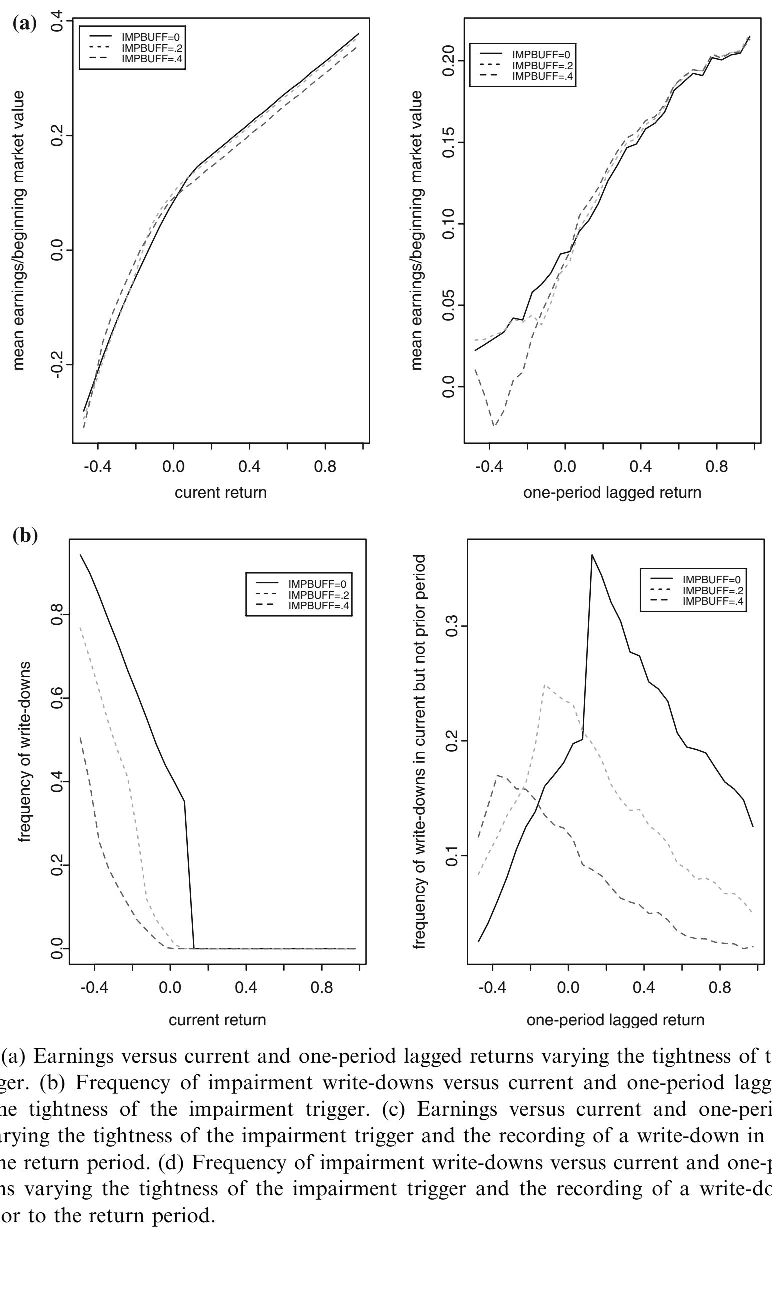

Figure 5. (a) Earnings versus current and one-period lagged returns varying the tightness of the impairment trigger. (b) Frequency of impairment write-downs versus current and one-period lagged returns varying the tightness of the impairment trigger. (c) Earnings versus current and one-period lagged returns varying the tightness of the impairment trigger and the recording of a write-down in the period prior to the return period. (d) Frequency of impairment write-downs versus current and one-period lagged returns varying the tightness of the impairment trigger and the recording of a write-down in the period prior to the return period.

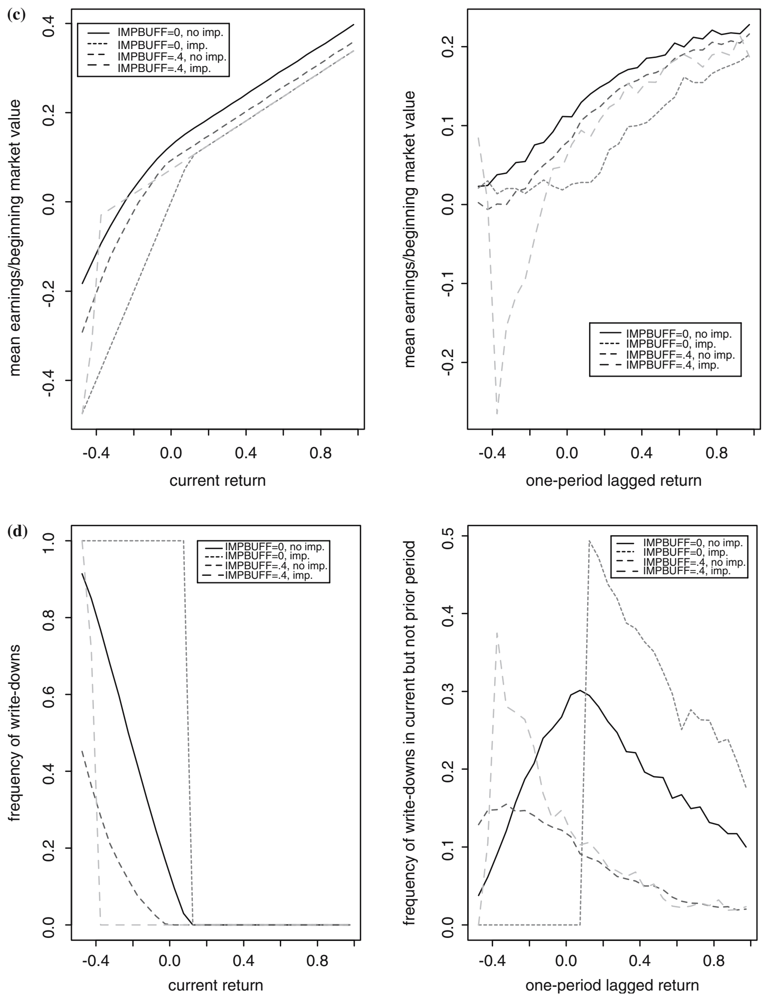

Figure 5. Continued.

The right-hand plot indicates that when IMPBUFF > 0 the direction of asymmetry with respect to one-period lagged returns depends on the magnitude of the return. For returns that are below the cost of capital but not sufficiently bad to yield write-downs in the prior period with sufficiently high probability, asymmetry is in the same direction as for current earnings, because these returns use some of the accounting slack and raise the probability of a write-down in the current period. In contrast, for lower returns, asymmetry is in the opposite direction as for current returns. This again yields an S-shaped relation between earnings and one-period lagged returns.

Figure 5b helps interpret these results. In the left-hand plot, the frequency of write-downs rises for less bad current returns and more abruptly when IMPBUFF is lower. In the right-hand plot, the frequency of write-downs in the current but not prior period is always highest for the return that equals the cost of capital less IMPBUFF.

As mentioned above, to demonstrate the interaction between IMPBUFF and the recording of a write-down in the prior period, Figure 5c and d include analogous plots in which IMPBUFF takes the values 0 or 0.4 and for which the observations are partitioned based on whether or not a write-down was recorded in the period prior to the return period. These plots demonstrate how the recording of a write-down in the period prior to the return period makes the effect of IMPBUFF more deterministic and observable. If a write-down is recorded in the prior period and returns are less than the cost of capital minus IMPBUFF, then a write-down also is recorded in the current period with a dramatic effect on earnings. On the other hand, if a write-down has not been recorded in the prior period (more generally, the recent past), then the effect of IMPBUFF is considerably harder to observe, because observations have a wide range of levels of accounting slack.

3.4.2. Varying the Uncertainty of the Impairment Trigger

To focus on the effect of varying IMPPROB, in this simulation we assume that the firm holds no intangible assets and that accounting depreciation is unbiased. Write-downs are recorded with probability IMPPROB when the book value of tangible assets would otherwise exceed their market value. We allow IMPPROB to take the values 1, 0.8, or 0.5.

The results of this simulation are plotted in Figure 6a and b. We first discuss Figure 6a. The left-hand plot indicates that when IMPPROB is higher asymmetry with respect to current returns is stronger and appears more abruptly when returns fall due to more certain write-downs of economically impaired tangible assets. More perceptibly than in the intangibles simulation, this asymmetry appears for returns above the cost of capital, because these returns may not be favorable enough to prevent write-downs of previously impaired tangible assets for which the write-down was delayed.

The right-hand plot indicates that the direction of asymmetry with respect to one-period lagged returns is in the opposite direction of asymmetry with respect to current returns when IMPPROB = 1, but quickly changes to be in the same direction as asymmetry with respect to current returns when IMPPROB falls below one. Comparison of this plot with the corresponding plot in Figure 5a indicates that uncertainty in impairment trigger has a stronger effect than looseness of the impairment trigger on the direction of asymmetry with respect to one-period lagged write-downs. This reflects the direct effect of a decrease in IMPPROB on raising the likelihood that an economic impairment that arose in the prior period is recorded in the current period.

Figure 6b helps interpret these results in the usual fashion.

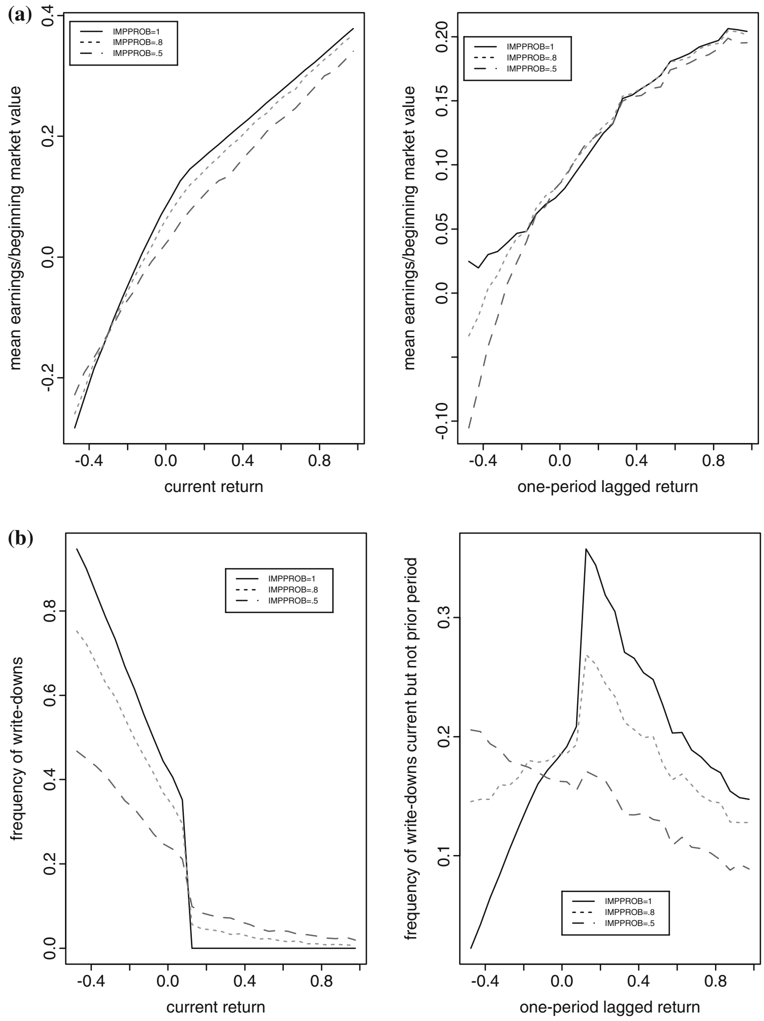

Figure 6. (a) Earnings versus current and one-period lagged returns varying the probability a write-down is recorded when tangible assets are economically impaired. (b) Frequency of impairment write-downs versus current and one-period lagged returns varying the probability a write-down is recorded when tangible assets are economically impaired.

3.4.3. Summary of Hypotheses

The above discussion of the simulation results yields the following hypotheses about how frictions in recording write-downs of tangible assets affect asymmetry with respect to current and one-period lagged returns.

[H5] Larger frictions in recording write-downs of tangible assets cause asymmetry with respect to current returns to weaken in the following ways:

- Looser impairment triggers cause asymmetry to kick in for returns further below the cost of capital and more gradually.

- More uncertain impairment triggers cause asymmetry to be weaker and to kick in more gradually, and to kick in further above the cost of capital.

[H6] Larger frictions in recording write-downs of tangible assets affect the direction of asymmetry with respect to one-period lagged returns in the following ways:

- Looser impairment triggers cause this asymmetry to be in the same direction as for current returns as long as returns are not negative enough to use up the accounting slack for tangible assets with sufficiently high probability. Otherwise, the asymmetries are in the opposite directions. This yields an S-shaped relation between earnings and one-period lagged returns.

- Modestly uncertain impairment triggers cause this asymmetry to be in the same direction as for current returns, more so the more uncertain the impairment trigger.

4. Conclusions, Implications for Future Research, and Proposed Empirical Tests

Using ingredients provided by the prior literature, in this paper we develop a general model of conditional and unconditional conservatism under uncertainty that captures the interactions between them, most notably, how unconditional conservatism yields unrecorded goodwill that preempts the application of conditional conservatism unless news is sufficiently bad to use up that goodwill. Given the importance of conservatism in accounting, we believe it is critical for accounting standard setters, researchers, and teachers and users of financial reports to understand these interactions and their implications. Relatedly, the model allows for two distinct types of unconditional conservatism and two distinct frictions in the application of conditional conservatism, and as a result it more fully captures the probabilistic and history dependent nature of conditional conservatism than does the prior literature. Research on conditional conservatism is more recent and empirical than research on unconditional conservatism, beginning with Basu (1995, 1997), and in our view merits considerable further attention by accounting researchers.

The model leads to a characterization of earnings that we analyze conceptually and using simulation analysis to develop testable hypotheses about how the asymmetric response of earnings to current and lagged returns depends on the nature and extent of unconditional conservatism and the frictions in the operation of conditional conservatism. Estimation of such asymmetry is the primary (though not sole) empirical analysis conducted in the literature on conditional conservatism. We contribute to that literature in part because a number of recent papers are concerned with estimating the extent of conditional conservatism, but do not control for the extent of unconditional conservatism, and in part because we provide modeling support for the recent studies (Pope and Walker, 2003; Givoly et al., 2004; Pae et al., 2004; Roychowdhury and Watts; 2004) that argue and show empirically that unconditional conservatism as proxied by the market-to-book ratio is associated with lower conditional conservatism as measured by asymmetry.

While our hypotheses only pertain to the asymmetric response of earnings to returns, our model could be used to generate many other testable empirical implications. For example, the model implies that the growth-dependent biases in accounting numbers that result from unconditional conservatism depend on the application of conditional conservatism, in particular, the timing of the most recent write-down. The model has implications for the frequency, timing, and amount of write-downs and thus for earnings forecasting. The model has implications for any specification of the relations between the market variables market value and returns and the accounting variables book value and earnings. For example, the model implies that reverse regressions of earnings on returns are strongly non-linear in current and especially lagged returns, suggesting that non-linear or spline regressions would be better specified than the linear regressions with dichotomous slope dummies estimated in the literature (Pope and Walker; 1999; Ryan and Zarowin, 2003).

While our model is quite general in its characterization of the measurement aspects of conditional and unconditional conservatism, we emphasize that it does not allow for discretionary behavior (either efficient or opportunistic) regarding the nature or extent of conservatism or for this behavior to convey information to the market. In practice, firms have considerable leeway regarding both types of conservatism that they could use in various ways. For example, firms could choose to be more unconditionally conservative to reduce the likelihood of future write-downs and so smooth income. Alternatively, they could choose to take a write-down to mute the growth-dependent biases caused by unconditional conservatism in future periods. In our view, discretionary behavior regarding conditional and unconditional conservatism is fertile ground for future research, both theoretical and empirical. Relatedly, firms' choices regarding the two types of conservatism could reflect macroeconomic, industry, and firm-specific factors, such as the rate of technological change and the regulatory environment.[34]

In a follow-on empirical project in progress (Beaver et al., 2005), we have begun to test the hypotheses developed in this paper for which we are able to obtain suitable proxies. We briefly discuss our plans for and the success of some preliminary empirical analysis in this project below.

We intend to test our hypotheses regarding unconditional conservatism that reduces the proportion of assets subject to conditional conservatism, such as an increase in the proportion of intangible assets whose costs are immediate expensed, using various measures of the relative amounts of investments in intangible and tangible assets that have been used in prior research on the market pricing of intangible assets (e.g., Lev and Zarowin, 1999). We expected these proxies to be fairly good, because prior research has employed them successfully, and have found this to be the case in preliminary empirical analysis.

We intend to test our hypotheses regarding unconditional conservatism that yields unrecorded goodwill for a given set of assets subject to conditional conservatism, such as accelerated depreciation, using measures of the speed of depreciation. We expect these proxies to be fairly noisy, because firms' economic depreciation rates are unknown and may vary considerably even for firms in the same industry, and we have found this to be the case in preliminary analysis in the follow-on project.

We intend to test our hypotheses regarding unrecorded goodwill caused by unrecognized past positive shocks to the market value of tangible assets using Beaver and Ryan's (2000) measure of the portion of the market-to-book ratio associated with past returns. We expect this proxy to be fairly good, since Beaver and Ryan have employed it successfully in the prediction of future book return on equity.

We intend to test our hypotheses regarding a loose impairment trigger using measures of the useful life of assets, the risk of assets, and discount rates, reflecting FAS 144's requirement that write-downs be recorded for tangible assets and intangible assets with definite lives be recorded if their book values would otherwise exceed the undiscounted sum of their future cash flows. We expect these proxies to be fairly noisy, in part because the estimation of each measure involves some difficulties, and in part because the measures have to be combined to obtain an aggregate measure of the looseness of the impairment trigger.

We have not yet determined a suitable proxy to test our hypotheses regarding an uncertain impairment trigger. In principle, the probability that write-downs are recorded when assets are economically impaired should depend on the extent to which those assets have observable or estimable values, which should depend on the extent to which the assets are commodity like in nature and tradable in liquid markets.

Appendix A

4.1. Expressions for Earnings and $\Delta BIAS_t$

Substitution for BIAS_{t-1} and LAGS_{t-1}in equation (3IMP) using equation (2) yields the following expression for earnings if $\tau(t)=0$

$$\begin{aligned} X_t = {} & \frac{r}{1+g}\text{MV}_t - \frac{g}{1+g}\text{MVI}_t \\ & + \text{MVT}_t\left\{\frac{(\gamma-\delta)}{(1+g)(1+g-\delta)} - \frac{(\gamma-\delta)}{(1+g)(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\} \\ & + \sum_{s=0}^{\tau(t-1)} \phi_{T,t-s}\left\{\frac{(1+g-\gamma)}{(1+g-\delta)}\frac{\delta^s}{(1+g)} + \frac{(1+g)^{s-1}(\gamma-\delta)}{(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\}. \end{aligned} \tag{3IMP$'$}$$

Using equation (2), the expression for ΔBIAS_t if $\tau(t)>0$ is

$$\Delta\text{BIAS}_t = -\text{MVT}_t\left\{\frac{g(\gamma-\delta)}{(1+g)(1+g-\delta)} + \frac{(1-\delta)(\gamma-\delta)}{(1+g)(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\}$$
$$+\,\phi_{T,t}\left\{\frac{-(\gamma-\delta)}{(1+g)(1+g-\delta)} + \frac{\gamma-\delta}{(1+g)(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\}.$$

Substitution the above expression for ΔBIAS_t and the expression for ΔLAGS_t in equation (4) into equation (3) yields the following expressions for earnings if $\tau(t) > 0$

$$X_t = \frac{r}{1+g}\text{MV}_t - \frac{g}{1+g}\text{MVI}_t$$
$$+\text{MVT}_t\left\{-\frac{g(\gamma-\delta)}{(1+g)(1+g-\delta)} - \frac{(1-\delta)(\gamma-\delta)}{(1+g)(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\}$$
$$+\sum_{s=0}^{\tau(t-1)}\phi_{T,t-s}\left\{\frac{(1+g-\gamma)}{(1+g-\delta)}\frac{\delta^s(1-\delta)}{(1+g)} + \frac{(1+g)^{s-1}(1-\delta)(\gamma-\delta)}{(1+g-\delta)}\left(\frac{\delta}{1+g}\right)^{\tau(t-1)}\right\}. \quad \text{(3NOIMP)}$$

Derivations of these equations are available from the authors.

Appendix B

4.2. Derivation of the Analog to Equation (2) that Results without the Assumption of T-GROW

If T-GROW is not assumed, then T-ACC′ becomes

$$\text{BVT}_t = \sum_{s=0}^{\tau(t)-1}\delta^s\text{IT}_{t-s} + \delta^{\tau(t)}\text{MVT}_{t-\tau(t)}. \quad \text{(T-ACC}''\text{)}$$

Substituting for IT_{t-s} in T-ACC″ using T-DEPN yields the more complex equation analogous to equation (2) that results without the assumption of T-GROW

$$\text{BVT}_t = \text{MVT}_t - \sum_{s=1}^{\tau(t)}\delta^{s-1}(\gamma-\delta)\text{MVT}_{t-s} - \sum_{s=0}^{\tau(t)-1}\delta^s\gamma\varepsilon_{t-s}. \quad (2')$$

Equation (2′) expresses the book value of tangible assets as equal to their market value less a bias term that depends on the market values of tangible assets in each prior period beginning with the most recent write-down of tangible assets and a lags term that depends on the shocks to the economic depreciation rate in each period since that write-down. Note that the bias term is not proportional to the market value of tangible assets in any period, however, and so it effectively includes lags related to shocks to both the economic depreciation rate and to the growth rate in investment in intangible assets since that write-down. This reflects a primary benefit, in terms of algebraic and conceptual simplification, of assuming T-GROW is it yields a clean distinction between the bias and lags terms.

Acknowledgments

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Notes

1. The literature refers to the two types of conservatism using several pairs of names. ARB 43 (1953), Basu (1995, 1997), Ball et al. (2000), and Pae et al. (2004) refer to income statement and balance sheet conservatism; despite its historical roots, we do not employ this terminology because conservatism affects the income statement and balance sheet consistently if the clean surplus relation holds and transactions in the firm's equity are accounted for at fair value. Pope and Walker (2002) refer to *ex post* and *ex ante* conservatism. Chandra et al. (2004) refer to news dependent and news independent conservatism. Ball and Shivakumar (2005) refer to conditional and unconditional conservatism, as we do; we believe our common use of this terminology stems from the discussion at a seminar presented by Ray Ball at NYU several years ago.
2. Roychowdhury and Watts (2004) emphasize that the non-recognition of firm-level rents constitutes a distinct type of conservatism from understatement of the value of separable net assets (or something other than conservatism).
3. See Greenball (1969), Beaver and Dukes (1973, 1974), Feltham and Ohlson (1995, 1996), Myers (1999), Pope and Walker (1999), Givoly and Hayn (2000), Ahmed et al. (2000), Beaver and Ryan (2000), Zhang (2000), Penman and Zhang (2002), Watts (2003b), and Monahan (2004).
4. See Pope and Walker (1999, 2003), Givoly and Hayn (2000), Holthausen and Watts (2001), Ball et al. (2000), Ball et al. (2000), Giner and Rees (2001), Ryan and Zarowin (2003), Ball and Shivakumar (2005), Pae et al. (2004), and Roychowdhury and Watts (2004).
5. Devine (1963), Sterling (1967, 1970), Staubus (1985), Antle and Lambert (1988), Antle and Nalebuff (1991), Levitt (1998), Basu (1995, 1997), and Watts (2003a) discuss these rationales for conservatism.
6. For example, in the basis for conclusions of FAS 2 (1974), the FASB concludes that research and development costs be charged to expense for reasons such as "the relationship between current research and development costs and the amount of resultant future benefits to an enterprise is so uncertain that capitalization of any research and development costs is not useful in assessing the earnings potential of the enterprise" (paragraph 50).
7. The FASB is generally critical of conservatism. In particular, CON 2 (1980), paragraphs 91–97, states that conservatism works against the more fundamental principles of neutrality and representational faithfulness and can yield overstated earnings and book rates of return depending on a firm's growth. Research that focuses primarily on contracting effects tends to criticize unconditional conservatism. For example, Ball and Shivakumar (2005) state that that "an unconditional bias of unknown magnitude introduces randomness in decisions based on financial information and can only reduce contracting efficiency. In contrast, the conditional form of conservatism (timely loss recognition) can improve contracting efficiency." In contrast, Watts (2003a) states that "non-contracting parties also value conservatism's constraint on opportunistic payments to managers and other contracting parties. Given that, conservatism and the net asset bias it generates are probably necessary components of efficient financial reporting."

8. We use the designations "tangible" and "intangible" for the two types of assets because these designations generally are descriptive of existing GAAP. Of course, in principle and sometimes in practice, the costs of intangible assets could be capitalized and amortized over time. Similarly, in principle, the costs of tangible assets could be expensed immediately.
9. We do not explicitly consider the possibility of discretionary behavior with respect to write-downs in this paper, though we could superimpose postulated discretionary behaviors on our specification of (unmanaged) earnings. Such discretion behavior likely depends on contextual factors, including the specific accounting rules involved. For example, Alciatore, Easton, and Spear (2000) examine a specific context (oil and gas firms' application of the "ceiling test" under the full cost method of accounting for the costs of oil and gas exploration, which functions like a lower of cost or market rule) in which discretion appears to have been applied to delay write-downs.
10. Our modeling and simulation approach could also be used to demonstrate other effects of conditional conservatism, such as the time-series properties of accounting numbers, and of unconditional conservatism, such as growth-dependent biases.
11. Studies using simulation for much the same reason as we do include Healy et al. (2002), who examine the effect of alternative accounting treatments for R&D, and Givoly et al. (2004), who examine the effect of aggregation of shocks on asymmetry.
12. We refer to "market" rather than "economic" or "fair" value, regardless of the context. We do not mean to suggest that all assets are tradable in liquid markets.
13. With some additional notation and algebra, we could state our assumptions in terms of the cash flows generated by assets rather than their market values. While this would more descriptively capture the aggregation properties of accounting, it is not necessary for any of our purposes.
14. Intangible assets are likely to differ economically from tangible assets in various ways, of course. For example, intangible assets are likely to have more uncertain benefits and useful lives and to exhibit more real options aspects than do tangible assets.
15. We could relax our assumptions about growth and uncertainty and conduct simulations using the considerably more complex equations that result. We do not do this for the following reasons. First, it would be more difficult to explain those equations intuitively, making the pedagogical contributions of the paper less apparent. Second, conducting a simulation requires making some well-defined assumption about growth and uncertainty, and it is not obvious to us what cases would be of most interest to analyze, although examples of the paradigm life-cycle stages could be constructed and examined. Third, we do not focus on growth-dependent biases in accounting numbers, although our model could be applied to this issue.
16. Our model does not incorporate leverage. With additional assumptions about the firm's capital structure, it is straightforward to show that riskless debt has minor effects on asymmetry that stem from the resulting increases in the cost of equity capital and the variability of share returns. Risky debt would have a more significant effect on asymmetry, however, because this debt would absorb the value consequences of bad news more than good news. Empirically, leverage is associated with constructs that our model predicts are associated with asymmetry, e.g., fixed-asset asset intensity.
17. If ε_t exceeds $(1-\gamma)/\gamma$, then tangible assets appreciate economically, which causes no problems.
18. The assumption of T-GROW simplifies the analysis considerably because it implies (in conjunction with the assumption regarding the measurement of the book value of tangible assets in T-ACC below) that the bias in the book value of tangible assets is proportional to the current market value of tangible assets. This yields a clean distinction between bias and lags in the book value of tangible assets in equation (2) below. Were T-GROW not assumed, then the bias in the book value of tangible assets would depend on the history of investments in tangible assets since the last impairment write-down, and so this bias would not be entirely distinct from lags in the book value of tangible assets. The more complex equation analogous to equation (2) that results without this assumption is provided in Appendix B.
19. The constant dividend yield assumption is consistent with but not implied by our prior assumptions. Specifically, T-DEPN, T-GROW, and I-GROW imply constant expected growth in market value and thus in *expected* dividends, i.e., $E_{t-1}(D_{t+s}) = (1+g)E_{t-1}(D_{t+s-1})$, for $s \geq 1$. Given constant expected growth in market value, NA implies that $E_{t-1}(D_t) = (r-g)\mathrm{MV}_{t-1}$, so that constant dividend yield is equivalent to constant expected growth in dividends, i.e., $E_{t-1}(D_t) = (1+g)D_{t-1}$.

20. An impairment accounting standard applied to a portfolio is less conservative than one applied to the individual assets within the portfolio, since economic gains and losses on individual assets may offset.
21. The derivation of equation (2) is available from the authors.
22. The reason why the correction reinforces the weights on the shocks in $LAGS_t$ when $\gamma > \delta$ is rather subtle. As discussed above, the most recent write-down of tangible assets rebalances the book values of the vintages of those assets acquired prior to that write-down to reflect the economic depreciation rate. Thus, proportionately more of the book value of tangible assets is attributable on average to vintages of those assets acquired before that prior write-down than is implied by the conservative accounting depreciation rate. Relatedly, shocks subsequent to that write-down are recognized proportionately slower in the book value of tangible assets than is implied by the conservative accounting depreciation rate.
23. Exceptions to this statement occur for certain intangible assets under industry-specific GAAP (e.g., FAS 50, FAS 51, FAS 63 and SOP 00-2), computer software under FAS 86, and direct response advertising under SOP 93-7.
24. Given that assets are acquired at the end of periods and depreciation is recorded annually, the immediate expensing of the cost of intangible assets is not equivalent to a depreciation rate of 1. Thus, the modeling of intangible assets is not a special case of the modeling of tangible assets. In contrast, it would be such a special case if assets were acquired at the beginning of periods and depreciation was recorded continuously (at an infinite rate).
25. See Penman (2001) for a summary of the U.S. GAAP rules that violate clean surplus accounting. Violations of clean surplus accounting that are uncorrelated with share returns in any period do not affect any of our results. Of course, many violations of clean surplus accounting are correlated with share returns in some period, often the current period (e.g., gains and losses on available-for-sale securities that are recorded in accumulated other comprehensive income).
26. Ryan (1988) defines permanent earnings as a perpetuity in advance that has the same value as the market value plus dividends during the period, and shows permanent earnings equal $(r/(1+r))(MV_t+D_t)$. Since the economic assumptions above imply that $D_t=((r-g)/(1+g))MV_t$, permanent earnings equals $(r/(1+g))MV_t$.
27. This total effect of $\phi_{T,t}$ on current earnings under fair value accounting for tangible assets is the permanent portion, $(r/(1+g))\phi_{T,t}$, plus the transitory portion, $(1/(1+g))\phi_{T,t}$, which equals $((1+r)/(1+g))\phi_{T,t}$. Note this equals $\phi_{T,t}$ only if $r=g$. The reason for this is that $\phi_{T,t}$ also affects dividend in the amount $((r-g)/(1+g))\phi_{T,t}$. The sum of the effects of $\phi_{T,t}$ on earnings and dividends is $\phi_{T,t}$.
28. As shown in Appendix A, when $\tau(t)>0$, $\Delta BIAS_t$ has two distinct pieces. First, it includes the decrease in the correction to the bias in book value that results from the most recent write-down of tangible assets becoming one period further removed. Second, it includes the change in the bias attributable to both expected and unexpected growth in tangible assets. Unexpected growth in tangible assets has a minor effect on asymmetry because this growth results from the current shock to the value of tangible assets.
29. See Basu (1995, 1997, 2001), Pope and Walker (1999, 2003), Giner and Rees (2001), Ryan and Zarowin (2003), and Roychowdhury and Watts (2004).
30. This sort of analysis could be done particularly effectively for single-segment commodity (e.g., oil and gas) firms, for which changes in commodity prices could be used instead of share returns.
31. The full expression for earnings in equation (3) when $\tau(t)>0$ is provided in Appendix A.
32. These parameters would be primary concerns if we used our model to examine growth-dependent biases in accounting numbers. Each of these parameters could be manipulated in future applications of the model.
33. As discussed above, asymmetry with respect to the one-period lagged return could be in the opposite direction as asymmetry with respect to the current return. This type of asymmetry depends only on how frequently write-downs are recorded in the prior period because of the one-period lagged return. We do not plot this frequency because it can be inferred from the plots we do provide.
34. For example, Sivakumar and Waymire (2003) examine how the rate regulation of railroad companies affected the conditional conservatism of their accounting.

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