An Analytical and Empirical Measure of the Degree of Conditional Conservatism

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Abstract

There is a profound gap between models of accounting conservatism and the proxies for conditional conservatism currently used by the empirical literature. Not one of the proxies employed by the empirical literature to date obtains from a rigorous definition of conditional conservatism. In contrast, this study defines conditional conservatism in terms of truncated distributions and derives analytically a nonlinear relation between revisions to returns and earnings news for the conservative firm. This nonlinear relation is shown to be mathematically equivalent to two linear relations conditioned on the firm's degree of conservatism (DCON). From these relations, we derive a model-based proxy of the DCON at the firm-year level, which is a function of the determinants of conditional conservatism. To account for the endogeneity of the firm's DCON and mitigate sample selection bias, the model is implemented empirically using a switching regression approach in which the switch point, namely, the DCON, is unobservable and endogenously determined. Consistent estimates of the parameters of the switching regression, including the endogenous determinants of conservatism posited by Watts (2003a, 2003b), are obtained by simultaneous maximum likelihood estimation. The results indicate that the DCON is a positive function of contractual information asymmetry and litigation risk but a negative function of taxes.

Keywords

conditional conservatism, analytical model, switching regressions, sample selectivity

Introduction

While conditional accounting conservatism has been extensively studied in the empirical literature, its theoretical underpinnings remain relatively unexplored. Specifically, none of the proxies for conditional conservatism employed by the empirical literature to date obtains formally from a model based on underlying primitives. In particular, there is no model linking the definition of conditional conservatism to an even approximate form of...
any of the various proxies for conditional conservatism that are to be found in the literature.¹

Perhaps the most widely used empirical measure of conditional conservatism is based on Basu (1997) who defines conditional conservatism informally as “capturing accountants’ tendency to require a higher degree of verification for recognizing good news than bad news in financial statements”⁰ (p. 4). Basu measures conservatism as the asymmetry in earnings timeliness with respect to future cash flow shocks—the latter measured by returns—in a piecewise linear regression model. Conservatism is gauged by the strength of the relation between earnings and negative returns as compared with the relation between earnings and positive returns. This approach is motivated by accounting principles that require loss contingencies to be accrued once they are probable but gain contingencies to be delayed until they are realized.² Although his definition of conservatism may be conceptually justified, the regression specification that Basu uses to estimate conditional conservatism has never been formally derived. Furthermore, neither the definition nor the empirical methodology lend themselves to formal measurement of the degree of conservatism at the firm level. In other words, the issue of how one should measure the degree of conditional conservatism implied by Basu’s definition has not been satisfactorily resolved as yet.³

Besides the coefficients in the reverse regression model of Basu, other commonly used proxies for conditional conservatism include nonoperating accruals and skewness. While these proxies may be plausible, they can be related back only very loosely to the economic underpinnings of conditional conservatism. One approach that does develop a proxy for conditional conservatism from theoretical underpinnings is the conservatism ratio (CR) metric developed by Callen, Segal, and Hope (2010). However, the nonlinear relation between earnings news, discount rate news, and unexpected returns that forms the basis for their metric was not developed formally nor do they rigorously derive a measure of the degree of conservatism from underlying primitives.⁴

In this article, we formally develop a model-based proxy for the degree of conditional conservatism and show how our proxy can be estimated at the firm-year level without inducing sample selection bias (Dietrich, Muller, & Riedl, 2007). We also use our model-based proxy to empirically test Watts’s (2003a, 2003b) conjectures regarding the determinants of conditional conservatism.⁵ More specifically, we define conditional conservatism formally by reference to truncated distributions and use this definition to develop a formal model of conditional conservatism that yields a piecewise nonlinear relation between revisions to returns, earnings news, and discount rate news.⁶ Our nonlinear relation cannot be estimated by ordinary least squares (OLS) without bias because of sample selectivity. To mitigate this concern, we utilize a switching regression methodology in which the switch point, our proxy for the degree of conditional conservatism, is unobservable and endogenously determined. We find empirically that our proxy for the degree of conservatism is a positive function of contractual information asymmetry and litigation risk, and a negative function of taxes, only partially confirming Watts’s conjectures.

We also validate our measure of the degree of conservatism DCON. The estimated DCON is found to be negatively associated with profitability and total accruals, consistent with more conservative firms reporting lower earnings and more negative accruals. Furthermore, more conservative firms have higher market-to-book ratios consistent with the arguments of Roychowdhury and Watts (2007).⁷ In addition, consistent with Givoly, Hayn, and Natarajan (2007), more conservative firms have higher variability in earnings and accruals, and are more likely to report losses. Finally, firms’ DCON is fairly stable over time.
This study makes three important contributions to the literature. First, we develop and validate a new proxy for conditional conservatism that is model-driven. Second, our measure will enable researchers to investigate and evaluate the determinants and consequences of conservatism at the firm-year level. Third, our model shows that the popular Basu measure does not provide a rigorous measure of the degree of conditional conservatism.

In what follows, section “The Model” describes the model and derives the nonlinear relation between revisions to returns, earnings news, and discount rate news under a conservative accounting system. Proofs are relegated to an appendix. This section also derives a Basu-like relation as a special and highly restrictive case. The “Empirical Estimation of Conditional Conservatism” section discusses the econometrics of the endogenous switching regression methodology with special emphasis on the case where the switch point, that is, the firm’s DCON, is not observable. The section “Empirical Results” provides the empirical results. The section “Conclusion” briefly concludes.

The Model

Revisions to Returns and the Conservative Firm

Our model extends the Vuolteenaho (2002) accounting return decomposition framework to allow for conservative accounting. Vuolteenaho shows that revisions to unexpected returns are a linear function of earnings news and discount rate news.\(^8\) The return decomposition is linear because Vuolteenaho implicitly assumes that the information set which the market uses to form expectations of future earnings is identical to the information set that the accounting system uses. However, this return decomposition fails to consider the conservative nature of the accounting system. By restricting accounting recognition rules to specific (and primarily) negative future cash flow shocks, conservative accounting drives a wedge between the market’s expectations, which are conditioned upon the immediate recognition of positive and negative future cash flow shocks, and expectations based solely on conservative accounting numbers for which some negative shocks and almost all positive shocks remain unrecognized in current earnings until realized in the future. This wedge, as we will show formally, yields a nonlinear relation between unexpected returns, earnings news, and discount rate news. This intuition is similar to that of Gonedes (1978) and Antle, Demski, and Ryan (1994) who show that, except under very restrictive conditions, the relationship between revisions to returns and revisions to earnings need not be linear, or even monotone, if the accounting system uses a more restrictive information set than does the market.

One may be tempted to argue that the Vuolteenaho (2002) model is derived, namely, the definition of the market-to-book ratio and the Clean Surplus relation, are tautological, the Vuolteenaho accounting return decomposition framework must also be a tautology and, in which case, the return decomposition is necessarily linear, independently of the accounting regime. But, in point of fact, the Vuolteenaho accounting return decomposition is not a tautology in the full sense of the word because tautologies are always true, not only in expectation. Yet, the Vuolteenaho accounting return decomposition is expressed in terms of (changes to) expectations—see his Equation 3. The decomposition of current unexpected returns is a function of future earnings and future discount rates that can be known only in expectation. Now, when expectations are unconditional, that is, based on all current time \(t\) information, the decomposition relationship is necessarily linear.\(^9\) However, as long as earnings news is computed based on future expected accounting information, the restrictions imposed by the
accounting system on earnings recognition are necessarily going to affect the relation between unrestricted market returns and restricted (by generally accepted accounting principles [GAAP]) earnings news. In particular, when expectations are conditioned on only part of the current information set as in the case of conservative accounting, then linearity is not guaranteed. In a conservative world, earnings are often truncated in the sense that current earnings are not permitted by GAAP to recognize the market’s expectations of future positive cash flow shocks. Instead, these positive shocks are deferred and recognized in future periods. This implies that current revisions to returns, which reflect positive and negative expected cash flow shocks, are not necessarily linearly related to accounting earnings news, which do not reflect expectations of future positive cash flow shocks. Indeed, we show formally that if the return decomposition in a symmetric (neutral) accounting system is linear, then the return decomposition in a conservative world is necessarily piecewise linear.

A simple stylized example illustrates the intuition behind the nonlinear relation between revisions to returns and earnings news. Consider the stock price of a pharmaceutical company that acquired a pipeline of drugs. Subsequently, one of these drugs receives Federal Drug Administration (FDA) approval. The company’s equity price will adjust upward immediately to the positive news. However, given restrictive conservative accounting revenue recognition rules, accounting earnings will adjust to this information only at a later date when sales revenues from the new drug are realized. Although earnings news is measured over the lifetime of the firm, nevertheless, earnings news in this example is zero because earnings news is the change in current expectations of future cash flows. Because conservative accounting does not recognize any of the positive future cash flows currently, investor expectations about future cash flows will not change if their information set is based solely on conservative accounting information. As a consequence, at the time of FDA approval, the revision to market returns is positive whereas the accounting-based earnings news is zero, resulting in zero correlation between revisions to returns and earnings news. Conversely, suppose that the FDA suddenly disapproves one of the drugs in the pipeline because of severe side effects. In this case, not only will the company’s equity price drop but also conservative accounting will likely require the company to record a loss. Hence, for negative news, there is a positive correlation between revisions to returns and earnings news even if investors first learn of the negative future cash flow shock from nonaccounting sources. Thus, because of conservative accounting, the relation between revisions to unexpected returns and revisions to earnings is piecewise linear and asymmetric; in our example, revisions to returns and earnings news are (perfectly) positively correlated for negative news and uncorrelated for positive news. The remainder of this section is devoted to formally deriving the nonlinear relation between market returns, earnings news, and discount rate news for the conservative firm.

We model the market conceptually as reacting to all positive and negative shocks to the firm’s expected future earnings. Thus, we model the market as if it is privy to a symmetric accounting system, which incorporates all earnings shocks whether positive or negative and forms its return expectations based on those reports. Following Vuolteenaho (2002), we model the dynamics of the market’s expectations as a log-linear stationary vector autoregressive (VAR) process. More specifically, we assume that (log deflated) returns and earnings dynamics can be described by the bivariate VAR process:

\[ r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 \text{roes}_{t-1} + \eta_{1,t}, \]

(1)
Callen and Segal

\[ \text{roe}_t^S = \beta_0 + \beta_1 r_{t-1} + \beta_2 \text{roe}_{t-1} + \eta_{2,t}, \]

where the superscript $S$ denotes a symmetric accounting system, $\text{roe}_t^S = \log(1 + X_t^S / BV_{t-1})$ is the log of (one plus) earnings deflated by prior-period book value, $r_t$ is the log of (one plus) the firm’s cum-dividend equity returns, and $\eta_{1,t}$ and $\eta_{2,t}$ are mean-zero shocks. In particular, $\text{roe}_t^S$ are the (normalized) earnings from a symmetric neutral accounting system. As no firm has a symmetric system, these are “as if” earnings. In contrast, $r_t$ are actual market returns.

While we model the market’s dynamics as if investors react to a symmetric accounting system, in fact, accounting information is generated from a conservative accounting system. In particular, firms recognize negative shocks (perhaps partially) prior to their realization whereas positive shocks are deferred to future periods and recognized only when realized. In other words, the conservative firm’s accounting earnings effectively right-hand truncate future earnings (cash flow) shocks. To simplify the discussion, we initially assume that the firm is “extreme” conservative, which we define to mean that the accounting system recognizes all negative future shocks in current earnings, and defers positive shocks to future periods. Subsequently, to define the DCON, we consider the case where firms partially defer some negative shocks (as well as all positive shocks) to future periods.

In contrast to the symmetric accounting system dynamics, the extreme conservative firm’s dynamics are of the form:

\[ r_t^C = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 \text{roe}_{t-1} + \eta_{1,t}, \]

\[ \text{roe}_t = \beta_0 + \beta_1 r_{t-1} + \beta_2 \text{roe}_{t-1} + \eta_{2,t}^+, \]

where $\text{roe}_t = \log(1 + X_t / BV_{t-1})$ is the log of (one plus) earnings deflated by prior-period book value as obtained from the conservative accounting system and $r_t^C$ is the log of (one plus) cum-dividend equity returns assuming that returns are based on a conservative accounting system. In other words, $r_t^C$ are “as if” returns that would obtain if the market restricts itself solely to the information provided by the (extreme) conservative accounting system, and $\text{roe}_t$ is the actual book return on equity (ROE) generated by the conservative accounting system.

The essential difference between the symmetric accounting system and the (extreme) conservative accounting system lies in the current earnings shock. In the symmetric accounting system, the current earnings shock, denoted $\eta_{2,t}$, is mean-zero so that earnings are a function of positive and negative earnings shocks. By contrast, the earnings of the extreme conservative firm is function of the earnings shock $\eta_{2,t}^+ + \eta_{2,t-1}^-$, where $\eta_{2,t}$ takes on negative values only but is otherwise identical to $\eta_{2,t}$, and $\eta_{2,t}^+$ takes on positive values. Thus, in addition to current time $t$ negative shocks ($\eta_{2,t}^-$), the earnings of the conservative firm are also a function of positive earnings shocks ($\eta_{2,t-1}^+$) from period $(t-1)$ that were deferred to period $t$ because of conservatism. In contrast to the symmetric accounting system, the firm does not recognize positive shocks in current earnings under the conservative accounting system. Referring back to our earlier discussion, the market’s expectations about earnings shocks $\eta_{2,t}$ are unrestricted. They can be positive or negative, arising out of either positive or negative expected future cash flow shocks. By contrast, the extreme conservative accounting system recognizes only negative earnings shocks $\eta_{2,t}$.
arising out of expected future negative cash flow shocks (and past positive shocks) but not positive earnings shocks $\eta_{2,t}$ arising out of expected future positive cash flow shocks.\(^{18}\)

Note that unlike the mean of $\eta_{2,t}$, the mean of $\eta_{2,t}$ is necessarily negative, not zero. For example, if the current earnings shock facing the market is normally distributed, then the current earnings shock facing the extreme conservative firm is effectively half-normal. The mean of the half-normal is $-\sigma(2\pi)^{1/2}$, where $\sigma$ is the standard deviation of $\eta_{2,t}$.

Given these dynamics, one can solve for earnings news ($Ne_t$) and expected return news ($Nr_t$)—both for a symmetric and extreme conservative systems—as in Vuolteenaho (2002). Earnings news is defined as the discounted revision (shock) to earnings over the lifetime of the firm.\(^{19}\) Formally,

$$Ne_t = D\Delta E_t \sum_{j=0}^{\infty} \rho^j \text{roe}_{t+j},$$  \hspace{1cm} (5)

where $\rho$ is a discount factor, $E_t(\cdot)$ is the expectations operator, and $\Delta E_t(\cdot) = E_t(\cdot) - E_{t-1}(\cdot)$ denotes the revision or shock. Clearly, earnings news can be decomposed into the conventional earnings surprise ($\Delta E_t \text{roe}_t$) plus the shock to (discounted) expected future earnings ($\Delta E_t \sum_{j=1}^{\infty} \rho^j \text{roe}_{t+j}$). Similarly, discount rate (or expected return) news, defined formally as

$$Nr_t = D\Delta E_t \sum_{j=1}^{\infty} \rho^j \text{rt}_{t+j},$$  \hspace{1cm} (6)

is the shock to discount rates (expected future returns) over the lifetime of the firm.\(^{20}\)

With this background material, we are ready to demonstrate the relation between earnings news, discount rate news, and (revisions to) returns. The prior discussion leads to our first proposition. All proofs can be found in Appendix B.

**Proposition I**

Assume that returns and earnings follow the stationary bivariate log-linear VAR processes of Equations 1 through 4 and that the Vuolteenaho linear decomposition $r_t - E_{t-1}(r_t) = Ne_t^S - Nr_t^S$ holds for the symmetric accounting (market) system.\(^{21}\) The extreme conservative firm will exhibit a piecewise nonlinear relation between earnings news, discount rate news, and the revisions to returns of the form:

$$Ne_t^C - Nr_t^C = c_0 + c_1 [r_t - E_{t-1}(r_t)] + c_2 D \times [r_t - E_{t-1}(r_t)] + u_t,$$  \hspace{1cm} (7)

where $D = 1$ when $[r_t - E_{t-1}(r_t)] \leq 0$ and 0 otherwise, $c_0 = -[(1 - \rho\alpha_1 - \rho\alpha_2)/Z]E_{t-1}(\eta_{2,t})$, $c_1 = [\rho\beta_1(1 - \rho\alpha_2) - \rho\alpha_1(1 - \rho\beta_2)]/Z$, $c_2 = (1 - \rho\beta_1 - \rho\beta_2)/Z$, $Z = (1 - \rho\alpha_1)(1 - \rho\beta_2) - \rho^2 \alpha_2 \beta_1$, and $u_t$ is mean-zero error term.\(^{22}\) Note in particular that $c_0 > 0$ and $c_1 + c_2 > c_1 > 0$.\(^{23}\)

Proposition 1 indicates that the extreme conservative firm will exhibit a nonlinear asymmetric relation between earnings news (net of discount rate news) and revisions to returns such that the coefficient on negative return news ($c_1 + c_2 = 1$) is greater than the coefficient on positive return news ($c_1$). Only in the case of negative shocks will changes in earnings news (net of discount rate news) equal changes in the revision to market returns—$\partial(Ne_t^C - Nr_t^C)/\partial[r_t - E_{t-1}(r_t)] = c_1 + c_2 = 1$ when $D = 1$. However, positive
future shocks are not recognized currently in the earnings of the conservative firm, although they are recognized currently by the market. Thus, changes in earnings news (net of discount rate news) will be less than changes in revisions to market returns in the case of positive return shocks—$
abla \frac{\Delta N_t^C - \Delta N_{t-1}^C}{\bar{C}_t - \bar{E}_{t-1}(r_t)} = c_1 < 1$ when $D = 0$.

The theoretically derived Equation 7 is related to the regression equation used in Basu (1997) and in many subsequent studies (Ryan, 2006). Basu uses the following structure:

$$\text{roe}_t = b_0 + b_1 r_t + b_2 D^B \times r_t + u_t,$$

where $D^B = 1$ if returns are negative and 0 otherwise, and $\text{roe}_t$ denotes the return on prior-period price. Specifically, under the conditions specified in the corollary below, Equation 7 may be rewritten as

$$\text{roe}_t = c_0 + c_1 \left[ r_t - E_{t-1}(r_t) \right] + c_2 D \times \left[ r_t - E_{t-1}(r_t) \right] + u_t,$$

where $D = 1$ when $[r_t - E_{t-1}(r_t)] \leq 0$ and 0 otherwise (i.e., depending on whether the shock to returns is positive or negative), and $\text{roe}_t$ here denotes (with a slight abuse of notation) the return on prior-period book value equity.$^{24}$ In other words, while formally quite different, the two equations represent similar economic relationships. Nevertheless, our approach explicitly allows for shocks to the discount rate (through the use of the VAR equations) whereas this is absent in Basu’s empirical approach. It bears noting that Equation 9, and by analogy Equation 8, also holds only for an extreme conservative firm, whereas a reasonable measure of conditional conservatism should apply to all conservative firms. Before proceeding to a more general analysis of DCON, we summarize the arguments presented in this paragraph as a formal corollary.

**Corollary:** Assume that returns and earnings follow the stationary bivariate log-linear VAR processes of Equations 1 through 4. An extreme conservative firm will satisfy the Basu-like equation (Equation 9) provided that (a) all shocks to expected future earnings beyond the current period are identically zero and (b) discount rates are intertemporally constant or nonpredictable.$^{25}$

### Comparing Different Levels of Conservatism

In the previous section, we defined an extreme conservative firm as one that recognizes all negative future cash flow shocks, no matter how small, in current earnings. While this analysis is instructive, ultimately firms are heterogeneous in their degree of conservatism. Thus, the important question to be addressed is how does the nonlinear relation obtained above vary with the degree of the firm’s conditional conservatism. The answer of course depends on the definition of the “DCON.” In defining the DCON, we assume that conditional conservatism manifests in the accounts only to the extent that there is a negative shock to future cash flows. This assumption is reasonable given the conservative nature of U.S. GAAP, where positive shocks are normally deferred until realized regardless of the firm’s DCON.$^{26}$ Conditional on negative shocks to future cash flows, we define the DCON as the minimum threshold for which the firm recognizes negative shocks in current earnings; the closer the threshold is to zero (in absolute value), the more conservative is the firm. In other words, the DCON is the minimum magnitude of negative shocks that would entail immediate recognition in current period earnings. Formally, Firm B is more conservative than Firm A if Firm A recognizes earnings negative shocks of $-\gamma_t^A$ or worse in

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*Callen and Segal* 221

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current earnings, whereas Firm B recognizes earnings shocks of \(-\gamma_t^B\) or worse in current earnings where \(0 \leq \gamma_t^B < \gamma_t^C\). For example, suppose that Firm A recognizes earnings shocks of \(-7\%\) and worse whereas Firm B recognizes earnings shocks of \(-4\%\) and worse. Suppose that future cash flows are expected to fall by 6\% (in present value terms). Firm B, the more conservative firm, will write down earnings by 6\% in the current period whereas Firm A, being less conservative, will defer writing down earnings until future periods when the shock to earnings (future cash flows) is realized.

To allow for various DCONs and, hence, partial right truncations (below 0) of the earnings shock, we generalize the earnings dynamics of the extreme conservative firm as follows:

\[
r_t^C = \alpha_0 + \alpha_1 r_{t-1}^C + \alpha_2 \text{roe}_{t-1} + \eta_{1,t},
\]

\[
\text{roe}_t = \beta_0 + \beta_1 r_{t-1}^C + \beta_2 \text{roe}_{t-1} + \eta_{2,t}^R + \left( \eta_{2,t-1} - \eta_{2,t-1}^R \right),
\]

where \(\eta_{2,t}^R\) denotes the right-truncated density of \(\eta_{2,t}\) and \(\eta_{2,t}^R \leq -\gamma_t (\gamma_t \geq 0)\). In addition to the current negative earnings shock \((\eta_{2,t}^R)\), the earnings dynamics also recognize that portion of the period \((t - 1)\) shock \((\eta_{2,t-1} - \eta_{2,t-1}^R)\) not recognized in period \((t - 1)\) because of accounting conservatism and deferred to period \(t\).

Following this definition, Proposition 2 shows the nonlinear relation between earnings news (less discount rate news) and revisions to returns for any DCON.

**Proposition 2**

Assume that returns and earnings follow the stationary bivariate log-linear VAR processes of Equations 1, 2, 10, and 11 and that the Vuolteenaho linear decomposition \(r_t - E_{t-1}(r_t) = \text{Ne}_t^C - \text{Nr}_t^C\) holds for the symmetric accounting (market) system. A conservative accounting firm that recognizes negative earnings shocks of \(-\gamma_t\) or worse \((\gamma_t \geq 0)\) will exhibit a nonlinear relation between earnings news and (the revision in) returns as specified by the nonlinear relation:

\[
\text{Ne}_t^C - \text{Nr}_t^C = c_0 + c_1 [r_t - E_{t-1}(r_t)] + c_2 D \times [r_t - E_{t-1}(r_t)] + u_t,
\]

where \(D = 1\) if \(r_t - E_{t-1}(r_t) \leq -\gamma_t (1 - \rho_1 - \rho_2)/(1 - \rho_1 + \rho_2)\) and \(0\) otherwise, \(c_0 = -[(1 - \rho_1 - \rho_2)/Z]E_{t-1}(\eta_{2,t}^R), c_1 = [\rho_1(1 - \rho_2) - \rho_1(1 - \rho_2)]/Z, c_2 = (1 - \rho_1 - \rho_2)/Z,\) and \(Z = (1 - \rho_1)(1 - \rho_2) - \rho_2^2 \rho_1\). Note again that \(c_0 > 0\) and \(c_1 + c_2 = 1 > c_1\).

The nonlinear relation in Proposition 2 generalizes the nonlinear relation of Proposition 1. In Proposition 1, the extreme conservative firm recognizes all negative earnings shocks, so that in the definition of the dummy variable \(D\), \(-\gamma_t = 0\); hence, the nomenclature is *extreme* conservative. In contrast, a firm that is less than extreme conservative will satisfy the same nonlinear relation except that \(-\gamma_t\) in the definition of the dummy variable \(D\) will be less than zero. Therefore, the nonlinear relation between earnings news and (revision in) returns generalizes to any DCON and only the definition of the dummy variable changes.

Importantly, Equation 12 and its concomitant dummy variable suggest a new metric (proxy) for the DCON, namely, \(-\gamma_t\). \(-\gamma_t\) is the DCON because this parameter determines how much of the negative shock to future cash flows the firm is willing to recognize in current earnings. The smaller is \(-\gamma_t\), the more conservative is the firm, with \(-\gamma_t = 0\) for the
extreme conservative firm. Interestingly, neither of the coefficients $c_1$ and $c_2$ of the non-linear relation (Equation 12) are functions of the DCON $-\gamma_t$, contradicting Basu’s contention that the relative coefficients ($c_2/c_1$) of the piecewise linear regression measure the DCON.

In the following section, we will in fact estimate the unobservable $-\gamma_t$ endogenously as a function of the determinants of conditional conservatism espoused by Watts (2003a, 2003b).

**Empirical Estimation of Conditional Conservatism**

In the model considered above, the DCON is intimately related to the parameter $-\gamma_t$. To estimate $-\gamma_t$, we decompose Equation 12 of Proposition 2 into two equations—depending on whether $D = 0$ or 1—of the form:

$$\begin{align}
\text{Ne}_t^C - \text{Ne}_{t-1}^C &= c_0 + [r_t - E_t(r_t)] + u_{1t}, \\
&\text{if } [r_t - E_{t-1}(r_t)] \leq -\gamma_t(1 - \rho\alpha_1 - \rho\alpha_2)/(1 - \rho\beta_1 - \rho\beta_2). \quad (13)
\end{align}$$

$$\begin{align}
\text{Ne}_t^C - \text{Ne}_{t-1}^C &= c_0 + c_1 [r_t - E_{t-1}(r_t)] + u_{2t}, \\
&\text{if } [r_t - E_{t-1}(r_t)] > -\gamma_t(1 - \rho\alpha_1 - \rho\alpha_2)/(1 - \rho\beta_1 - \rho\beta_2). \quad (14)
\end{align}$$

From the proof of Proposition 2 in Appendix B—see the discussion of Equations B24 and B25—these latter equations can be reformulated as

$$\begin{align}
\text{Ne}_t^C - \text{Ne}_{t-1}^C &= c_0 + [r_t - E_t(r_t)] + u_{1t}, \quad \text{if } \eta_{2,t} \leq -\gamma_t. \quad (15)
\end{align}$$

$$\begin{align}
\text{Ne}_t^C - \text{Ne}_{t-1}^C &= c_0 + c_1 [r_t - E_{t-1}(r_t)] + u_{2t}, \quad \text{if } \eta_{2,t} > -\gamma_t. \quad (16)
\end{align}$$

The two-regime structure of Equations 13 and 14—or Equations 15 and 16—conditioned on a truncated endogenous variable, namely, unexpected returns, implies that OLS will necessarily yield biased coefficient estimates (Dietrich et al., 2007; Maddala, 1983, 1986, 1991; Shehata, 1991). Intuitively, conditioning on an endogenous variable results in sample selectivity bias unless one accounts for sample selectivity in the estimation procedure. To mitigate the bias, we use the endogenous switching regression methodology discussed extensively by Maddala (1983, 1986, 1991) where the parameters are estimated by simultaneous maximum likelihood. The two-regime structure of our model lends itself to the switching regression approach. Unlike OLS, the switching regression approach yields consistent estimators of the parameters of Equations 15 and 16 and of the switching parameter $-\gamma_t$. In essence, the two-regime structure indicates that when the shock is less (more) than $-\gamma_t$, then the relation between earnings news and revisions to returns is described as in Equations 15 (16). As Equations 15 (16) describe the relation between earnings news and revisions to returns when conditional conservatism is (is not) manifested, $-\gamma_t$ necessarily measures the degree of conditional conservatism.

To the best of our knowledge, the first accounting study to use a switching regression methodology is Shehata (1991), who analyzes the impact of Statement of Financial Accounting Standard (SFAS) No. 2 on R&D expenditures. Prior to SFAS No. 2, firms could choose to expense or capitalize R&D. As sample firms align themselves
endogenously along these two regimes (capitalizers or expensers), an endogenous switching regression approach that accounts for sample selectivity suggests itself naturally. Although similar, there is one major difference between Shehata’s environment and ours that simplifies his analysis considerably. In his case too, sample selection is endogenous. However, sample separation, namely, which firms are the expensers and which are the capitalizers, is observable so that an efficient two-step maximum likelihood estimation procedure is feasible. In our case, as the endogenously determined DCON − γt is unobservable, the switching regression is of the unknown sample separation variety. Therefore, we estimate the switching regression parameters by a simultaneous maximum likelihood approach described below rather than the standard two-step maximum likelihood approach.

We elect to model the firm’s DCON (the switch point) based on the conjectures of Watts (2003a, 2003b). Watts argues that firms’ demand for conservatism is an increasing function of contractual information asymmetry, litigation risk, and tax avoidance. Inter alia, one purpose of this study is to determine empirically if in fact the DCON is an increasing function of these latter factors.

We denote the determinants of the degree of firm conservatism by the vector Zt. Let ψ be the vector of parameters that relates the DCON − γt to Zt. Our empirical model then takes the three-equation form:

\[ \text{Ne}_t^C - \text{Nr}_t^C = c_0 + [r_t - E_{t-1}(r_t)] + u_{1t}, \quad \eta_{2,t} \leq -\gamma_t, \]  
\[ \text{Ne}_t^C - \text{Nr}_t^C = c_0 + c_1 [r_t - E_{t-1}(r_t)] + u_{2t}, \quad \eta_{2,t} > -\gamma_t, \]  
\[ -\gamma_t = Z_t \psi + \mu_t, \]

where \([u_{1t}, u_{2t}, \mu_t]\) is a mean-zero vector. Equations 17 and 18 simply replicate the two model-driven regimes of Equations 15 and 16. Equation 19 relates the unobservable DCON − γt to its endogenous determinants Zt inclusive of a mean-zero error term.

As −γt is unobservable, Equation 19 cannot be estimated directly. Instead, we substitute Equation 19 into Equations 17 and 18 to obtain

\[ \text{Ne}_t^C - \text{Nr}_t^C = c_0 + [r_t - E_{t-1}(r_t)] + u_{1t}, \quad Z_t \psi + \varepsilon_t \geq 0, \]  
\[ \text{Ne}_t^C - \text{Nr}_t^C = c_0 + c_1 [r_t - E_{t-1}(r_t)] + u_{2t}, \quad Z_t \psi + \varepsilon_t < 0, \]

where \(\varepsilon_t = \mu_t - \eta_{2,t}\) is a mean-zero error term.

We estimate the empirical model—Equations 20 and 21—allowing the parameters of the equations to be unconstrained. Formally,

\[ \text{Ne}_t^C - \text{Nr}_t^C = d_0 + d_1 [r_t - E_{t-1}(r_t)] + u_{1t}, \quad Z_t \psi + \varepsilon_t \geq 0, \]  
\[ \text{Ne}_t^C - \text{Nr}_t^C = f_0 + f_1 [r_t - E_{t-1}(r_t)] + u_{2t}, \quad Z_t \psi + \varepsilon_t < 0. \]
We then test to see whether \( d_1 = 1 \) and \( f_1 < d_1 \). Following Maddala (1983, 1986), we assume that the mean-zero vector \([u_{1t}, u_{2t}, \varepsilon_t]\) is normally distributed with variance-covariance matrix\(^{28}\):

\[
\begin{pmatrix}
\sigma_1^2 & \sigma_{12} & \sigma_{1e} \\
\sigma_{12} & \sigma_2^2 & \sigma_{2e} \\
\sigma_{1e} & \sigma_{2e} & 1
\end{pmatrix}.
\]

Although we cannot observe the firm’s DCON and, hence, the regime that the firm is in, we can specify and calculate the probability with which each regime occurs:

\[
\begin{align*}
\text{Prob}(N_{Ct}^C - N_{tC}^C = \delta_0 + \delta_1 [r_t - E_{t-1}(r_t)] + u_{1t}) &= \text{Prob}(Z_{it}\psi + \varepsilon_t \geq 0) \\
&= \text{Prob}(\varepsilon_t \geq -Z_{it}\psi) \\
&= \Phi(-Z_{it}\psi).
\end{align*}
\]

\[
\begin{align*}
\text{Prob}(N_{Ct}^C - N_{tC}^C = \delta_0 + \delta_1 [r_t - E_{t-1}(r_t)] + u_{2t}) &= \text{Prob}(Z_{it}\psi + \varepsilon_t < 0) \\
&= \text{Prob}(\varepsilon_t < -Z_{it}\psi) \\
&= 1 - \Phi(-Z_{it}\psi).
\end{align*}
\]

where \( \Phi \) is the normal distribution function. The likelihood density function \( (L_t) \) for each observation of \( N_{Ct}^C - N_{tC}^C \) is a weighted conditional density function of \( u_{1t} \) and \( u_{2t} \) with weights \( \text{Prob}(\varepsilon_t < -Z_{it}\psi) \) and \( \text{Prob}(\varepsilon_t \geq -Z_{it}\psi) \). Specifically,

\[
L_t = \phi(u_{1t}|\varepsilon_t \geq -Z_{it}\psi) \Phi(-Z_{it}\psi) + \phi(u_{2t}|\varepsilon_t < -Z_{it}\psi) \left[ 1 - \Phi(-Z_{it}\psi) \right]
\]

\[
= \phi(u_{1t})\Phi\left( -Z_{it}\psi - \frac{\sigma_{1e}/\sigma_1^2 u_{1t}}{\left[ 1 - (\sigma_{1e}/\sigma_1^2)^2 \right]^{1/2}} \right) + \phi(u_{2t})\Phi\left( -Z_{it}\psi - \frac{\sigma_{2e}/\sigma_2^2 u_{2t}}{\left[ 1 - (\sigma_{2e}/\sigma_2^2)^2 \right]^{1/2}} \right),
\]

where \( \phi \) is the normal density function. Maximizing \( \sum_t \log (L_t) \) yields estimates of the parameters \( d_0, f_0, d_1, f_1 \) of Equations 24 and 25 and \( \psi \) of Equation 19.

**Empirical Results**

**The Sample**

The data for this study are obtained from annual COMPUSTAT and monthly Center for Research in Security Prices (CRSP) files for the years 1962 to 2006. ROE is computed as income before extraordinary items (DATA18) scaled by the beginning of the period stockholders’ equity (DATA60). Annual stock returns are computed from monthly CRSP data adjusted for dividends, starting 9 months before and ending 3 months after the fiscal year-end. The risk-free rate is the annualized 3-month T-Bill rate.

We impose the following restrictions on the data. We remove firms in the financial industry (Standard Industrial Classification [SIC] 6000-6999). We require nonmissing values of contemporaneous and one lag of each of book ROE, annual market equity returns, and the book-to-market ratio (computed as book value of equity scaled by market value of
We eliminate small firms with market cap of less than $10M. We remove the top and bottom 1% of the variables that are required for the VAR estimation—current and lagged of each of annual returns, book ROE, and the book-to-market ratio. Imposing these restrictions results in a sample of 101,241 (10,917) firm-years (firms). We use this sample to estimate the VAR system and the earnings and discount rate news. Following Callen and Segal (2004), Callen, Hope, and Segal (2005) and Callen, Livnat and Segal (2006), we implement the return decomposition using a parsimonious log-linear VAR model with state variables consisting of log stock returns, log of one plus book ROE (earnings scaled by initial book value of equity), and the log book-to-market ratio. We estimate the VAR equations by industry using the Fama and French (1997) industry classification. Appendix A describes the estimation procedure in detail.

The switching regressions are estimated based on firm-years for which the revision to unexpected returns is negative (see “Switching Regression Estimation” section), where the revision to unexpected returns is the residual from the return equation in the VAR system—see Equation A2a. The initial sample consists of 49,611 observations. Each observation has to have nonmissing standard deviation of stock returns, leverage, effective tax rate, and high litigation dummy. Standard deviation of stock returns is computed using monthly returns in the preceding 3 years. We require a minimum of 12 nonmissing monthly returns. Leverage is computed as the sum of long-term debt (DATA9), debt in current liabilities (DATA34), preferred shares (DATA130), and notes payable (DATA206), all scaled by total assets (DATA6). The effective tax rate is computed as income tax expense over the past 3 years scaled by total pretax income over the same period. Income tax expense is computed as income tax expense (DATA16) minus deferred taxes (DATA50). Income before tax is computed as pretax income (DATA170) minus minority interest (DATA49). If the effective tax rate is negative or greater than the statutory maximum tax rate, then we set it to 0 or to the maximum statutory tax rate, respectively. The high litigation dummy takes the value of 1 if the firm belongs to an industry with a high incidence of litigation, and 0 otherwise. Following Francis, Hanna, and Vincent (1996), we classify the following four-digits SIC codes as high litigation industries: 2833-2836, 3570-3577, 7370-7374, 3600-3674, and 5200-5961.

In addition to requiring nonmissing values of the variables above, we mitigate potential outliers by eliminating the top and bottom percentile of earnings news, discount rate news, revision to unexpected returns, and standard deviation of monthly stock returns. These restrictions reduce the sample available for the switching regression analysis to 46,253 (9,215) firm-years (firms).

Table 1 shows the distribution of the major variables of interest for the full sample. Sample firms exhibit large variation in market capitalization; the mean and median market values of equity are $1,544 million and $148 million, respectively. The mean (median) cum-dividend equity market return is 17% (10%). The mean and median returns on book value of equity are 11% and 12%, respectively. The median book-to-market ratio is 0.64. The median effective tax rate is 0.34 and the median standard deviation of monthly stock returns is 11%. The mean and median of $Ne^C_t$ (0.012 and 0.033, respectively) are positive and significant, indicating that the earnings news is “good” on average. The mean and median of $N_C_t$ are also significantly positive (0.003 and 0.005, respectively) and, similar to the findings of Vuolteenaho (2002), Callen and Segal (2004), Callen et al. (2005), and Callen et al. (2006), significantly smaller than $Ne^C_t$, indicating that earnings news is the main driver of revisions in unexpected returns at the firm level. The mean and median revisions in unexpected returns (0.002 and
0.009, respectively) are also positive, consistent with the positive mean and median earnings news.

### Switching Regression Estimation

We estimate the switching regression using observations with negative revision to unexpected returns. This restriction is a consequence of our definition of the DCON and the assumptions behind the model, in particular, the assumption that firms defer positive shocks to future periods when the cash flow effects are realized. Consistent with the model, we define the DCON as the minimum threshold for which the firm recognizes negative shocks in current earnings; the closer the threshold is to zero (in absolute value), the more conservative is the firm.

Despite conditioning on negative news, sample selectivity, insofar as positive news is concerned, is not a problem. In general, sample selectivity is a problem only to the extent one tries to generalize the estimated parameters based on a selected nonrandom sample to the entire population. Indeed, if we should apply parameters estimated from the negative news sample to the case of positive return shocks as well, then sample selectivity is at issue. But, our intent is to apply our parameter estimates to negative news situations only, obviating sample selectivity issues in this regard.

Nevertheless, sample selectivity is an issue even as it concerns negative news because of the (potential) endogeneity of return revisions and the model structure that conditions on a truncation of negative return revisions. Specifically, return revisions are likely to be endogenous because returns react (at least partially) to the information conveyed by earnings news and discount rate news. Moreover, the DCON is endogenously determined as a function of negative return revisions. Some firms choose to recognize more negative

### Table 1. Descriptive Statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>1,544</td>
<td>9,018</td>
<td>41</td>
<td>148</td>
<td>655</td>
</tr>
<tr>
<td>RET</td>
<td>0.170</td>
<td>0.444</td>
<td>-0.125</td>
<td>0.103</td>
<td>0.379</td>
</tr>
<tr>
<td>ROE</td>
<td>0.110</td>
<td>0.152</td>
<td>0.051</td>
<td>0.124</td>
<td>0.186</td>
</tr>
<tr>
<td>BM</td>
<td>0.841</td>
<td>0.987</td>
<td>0.392</td>
<td>0.638</td>
<td>1.000</td>
</tr>
<tr>
<td>STD_RET</td>
<td>0.123</td>
<td>0.061</td>
<td>0.083</td>
<td>0.112</td>
<td>0.150</td>
</tr>
<tr>
<td>ETR</td>
<td>0.273</td>
<td>0.153</td>
<td>0.165</td>
<td>0.339</td>
<td>0.358</td>
</tr>
<tr>
<td>HL</td>
<td>0.236</td>
<td>0.425</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>LEV</td>
<td>0.273</td>
<td>0.204</td>
<td>0.103</td>
<td>0.258</td>
<td>0.408</td>
</tr>
<tr>
<td>Ne</td>
<td>0.012</td>
<td>0.255</td>
<td>-0.082</td>
<td>0.033</td>
<td>0.145</td>
</tr>
<tr>
<td>Nr</td>
<td>0.003</td>
<td>0.155</td>
<td>-0.086</td>
<td>0.006</td>
<td>0.096</td>
</tr>
<tr>
<td>$r_t - E_{t-1}(r_t)$</td>
<td>0.002</td>
<td>0.364</td>
<td>-0.218</td>
<td>0.009</td>
<td>0.229</td>
</tr>
</tbody>
</table>

Note. This table provides descriptive statistics of the main variables used in the article. MV is market value of equity at the end of fiscal quarter. RET is annual return computed from monthly returns, starting 4 months after previous fiscal year-end. ROE is return on equity. BM is the book-to-market ratio. STD_RET is standard deviation of monthly stock returns in the previous 3 years. ETR is the effective tax rate. HL is a dummy with 1 if the firm belongs to an industry with high litigation risk and 0 otherwise. LEV is leverage. Ne (Nr) is the earnings news (discount rate news). $r_t - E_{t-1}(r_t)$ is the revision in unexpected stock returns. We obtain earnings news and discount rate news by estimating a vector autoregressive (VAR) system by industry (Fama & French, 1997; industry classification). The model variables include the mean-adjusted cum-dividend annual excess log return, the mean-adjusted log of earnings normalized by prior-period book values, and the mean-adjusted log book-to-market ratio.
shocks in current earnings and others less, conditioned on negative revisions to returns. The switching regression methodology accounts for the endogeneity of the switch point, that is, the DCON and the endogeneity of returns, thus yielding consistent parameter estimates. Indeed, the switch point methodology is natural in our context given the two-regime structure of the model—one regime in which the firm chooses to recognize the negative shock in current earnings, because the shock is greater than or equal to the switch point (in absolute value); and the other regime in which the firm defers the negative shock to future earnings because the shock is less than the switch point. Thus, even the negative news sample is not random and OLS will yield biased coefficients.

The switching regression methodology in our analysis yields a system of three estimated equations: (a) an equation that describes the relation between earnings news and unexpected returns when the firm recognizes the negative shock in current earnings, which we elect to call the high conservatism regime; (b) an equation that describes the relation between earnings news and unexpected returns when the firm defers the negative shock to future periods, which we elect to call the low conservatism regime; and (c) an equation that describes the relation between the (unobservable) DCON (i.e., the switching point) and its endogenous determinants.

Table 2 presents the switching regression results. Panel A shows that the coefficient on unexpected returns for the high conservatism regime (1.963) and the coefficient on unexpected returns for the low conservatism regime (0.931) are positive and significant at the 1% significance level. Although the coefficient for the high conservatism regime is significantly greater than 1, crucially, as predicted by the model, the coefficient for the high conservatism regime is significantly greater than the coefficient for the low conservatism regime at the 1% significance level. The intercepts are positive and significant as predicted by the model, although they are significantly different from each other. This is likely due to the fact that the intercept terms typically pick up the effects of correlated omitted variables that could differ across the equations.

The estimated endogenous and unobserved DCON is assumed to be a function of proxies for the demand for conditional conservatism as posited by Watts (2003a, 2003b), including leverage, the standard deviation of monthly stock returns, firm size, litigation risk, and the tax rate. Leverage is a proxy for the agency conflict between shareholders and bondholders. The higher the degree of leverage, the greater is the demand for conservatism by bondholders to constrain diversion of resources from the firm to equity holders. The standard deviation of returns is a proxy for operational uncertainty. The greater is the firm’s operational uncertainty, the greater is the demand for conservatism by shareholders primarily because managerial performance is harder to verify and less certain. In addition, firms with greater operational uncertainty are exposed to a greater litigation risk because of higher risk of shareholder losses. Litigation risk increases the demand for conservatism because litigation is much more likely when earnings and net assets are overstated. The tax rate should also increase the demand for conservatism to minimize tax liabilities to the extent that taxable income and book income are related. The relation between size and the DCON is ambiguous. On one hand, larger firms face lower operational uncertainty and, therefore, lower demand for conservatism. On the other hand, larger firms are likely to have more resources and, hence, are subject to greater litigation risk, which increases the demand for conservatism.

Given our setting in which we estimate the DCON using the negative news sample and the ubiquitous unconditional conservatism of U.S. GAAP, we predict that the intercept on the determinants equation—which provides an estimate of the unconditional DCON—will
have a negative sign. As the degree of conditional conservatism is higher the closer the switching point is to zero, we expect positive coefficients on all the determinants of conservatism except for the possible exception of size.

Table 2, Panel B, presents the estimates of the determinants of the DCON. To estimate which of the determinants has the most impact on the DCON, we also standardize the parameter estimates. The intercept is negative and significant consistent with it being a proxy for unconditional conservatism. The estimated coefficients on leverage, standard deviation of monthly stock returns, and litigation risk are significant and positive as predicted by Watts (2003a, 2003b). A positive and significant coefficient is also obtained when operational efficiency is measured by the bid-ask spread instead of the standard deviation of monthly stock returns (untabulated). These results imply that the greater the asymmetry of information in debt contracts (as proxied by leverage), the greater the asymmetry of information in equity contracts (as proxied by the variability of the firm’s equity returns and the bid-ask spread), and the greater the litigation risk, the more likely is the firm to be in the high conservatism regime for a given negative shock to future cash flows. The coefficient on size is also positive and significant, indicating that greater litigation risk dominates lower operational uncertainty at least with respect to the demand for conservatism. The coefficient estimate on the tax variable, which is significantly negative, is contrary to Watts’s hypothesis. However, there are good reasons why the parameter estimates for the tax rate do not conform. Watts argues that firm tax minimization activities will lead to an increase in the demand for conservatism on its financial statements. This posited tax
effect is based on the notion that income for tax purposes is closely related to net income on the firm’s financial statements. One could argue alternatively that conservatism and tax expense are essentially substitutes for each other to the extent that they both reduce net income and net asset values so that as tax expense increases, the demand for conservatism goes down. The latter notion rather than the former is consistent with our empirical results. The standardized coefficients indicate that operational uncertainty has by far the greatest impact on the DCON followed by taxes, size, high litigation, and leverage in that order.

Validation of the DCON Measure

We use the estimated determinants equation to compute the DCON for the sample firm-years with negative unexpected returns. In essence, DCON is the predicted value of the switching point for bad news years. The mean and median DCONs are $-0.251$ and $-0.367$, respectively. Inspecting DCON over time (untabulated) reveals that the DCON has increased over time and is at its highest point in 2002 to 2004 coinciding with the major accounting scandals and the ensuing Sarbanes-Oxley Act. Table 3, Panel A, shows that DCON is negatively correlated with the firm profitability as measured by ROE and positively correlated with the incidence of losses and the market-to-book ratio. These correlations are consistent with DCON being a measure of the degree of conditional conservatism. Specifically, the more conditionally conservative the firm, the smaller should be its book profitability and the larger its unconditional conservatism as measured by the market-to-book ratio (Roychowdhury & Watts, 2007). Furthermore, the more conditionally conservative the firm, the greater the incidence of firm losses. Table 3, Panel B, presents the association between DCON and profitability, size, accruals, and the market-to-book ratio. Specifically, we rank DCON by deciles and show the means of the selected variables discussed above for each decile. The results indicate that the incidence of losses and the market-to-book ratio increase monotonically with DCON deciles. In contrast, profitability and total accruals decrease monotonically with DCON deciles. The panel also shows the volatility of accruals and ROE increase monotonically with DCON deciles, consistent with Givoly et al. (2007), who argue that conservatism is manifested partly in greater volatility of accruals and profitability.

As conservatism is a policy variable, it should be fairly stable over time. Table 3, Panel C, provides evidence on the stability of DCON. DCON is ranked by terciles of high, medium, and low DCONs for period $t$ and period $t + 1$. The diagonal shows that DCON is fairly stable. For example, high, medium, and low DCONs in period $t$ have a probability of 76%, 60%, and 74%, respectively, of remaining in the same tercile in period $t + 1$.

Conclusion

Defining conditional conservatism in terms of truncated shocks to earnings, we generate a nonlinear relation between earnings news (less discount rate news) and revisions to returns for the conservative firm. This nonlinear relation provides a model-driven proxy for the degree of conditional conservatism. Inter alia, the model shows that the Basu approach does not yield a measure of the degree of conditional conservatism.

The model is then applied empirically, in tandem with a switching regression methodology, to estimate the endogenous and unobservable degree of conditional conservatism at the firm-year level. We are able to test the Watts (2003a, 2003b) conjecture regarding the determinants of conditional conservatism in a manner that obviates sample selectivity.
biases. With one exception, we find that the DCON is a positive function of the determinants of conservatism as posited by Watts. Specifically, the DCON is increasing with operational uncertainty, leverage, and litigation risk. Only taxes yield contrary result, most probably because taxes are a substitute for conditional conservatism.

We also validate our DCON metric. We find that the measure is negatively associated with profitability and total accruals, and positively associated with the incidence of losses, the market-to-book ratio, and the volatilities of accruals and earnings. These findings are consistent with conservative firms having lower earnings, more negative accruals, greater unconditional conservatism, and greater volatilities of earnings and

### Table 3. Descriptive Statistics of the Estimated DCON.

#### Panel A: Correlation of the DCON With Selected Variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE</td>
<td>-0.126***</td>
</tr>
<tr>
<td>DLOSS</td>
<td>0.176***</td>
</tr>
<tr>
<td>TACC</td>
<td>0.001</td>
</tr>
<tr>
<td>BM</td>
<td>-0.104***</td>
</tr>
</tbody>
</table>

#### Panel B: Means of Variables by DCON Deciles.

<table>
<thead>
<tr>
<th>Period t</th>
<th>DLOSS</th>
<th>ROE</th>
<th>STD_ROE</th>
<th>TACC</th>
<th>STD_TACC</th>
<th>BM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest</td>
<td>0.051</td>
<td>0.116</td>
<td>0.075</td>
<td>-0.018</td>
<td>0.063</td>
<td>1.174</td>
</tr>
<tr>
<td>1</td>
<td>0.067</td>
<td>0.116</td>
<td>0.085</td>
<td>-0.019</td>
<td>0.067</td>
<td>1.167</td>
</tr>
<tr>
<td>2</td>
<td>0.078</td>
<td>0.115</td>
<td>0.094</td>
<td>-0.022</td>
<td>0.070</td>
<td>1.183</td>
</tr>
<tr>
<td>3</td>
<td>0.101</td>
<td>0.112</td>
<td>0.104</td>
<td>-0.022</td>
<td>0.075</td>
<td>1.146</td>
</tr>
<tr>
<td>4</td>
<td>0.138</td>
<td>0.102</td>
<td>0.116</td>
<td>-0.026</td>
<td>0.079</td>
<td>1.111</td>
</tr>
<tr>
<td>5</td>
<td>0.175</td>
<td>0.093</td>
<td>0.131</td>
<td>-0.026</td>
<td>0.080</td>
<td>1.082</td>
</tr>
<tr>
<td>6</td>
<td>0.212</td>
<td>0.077</td>
<td>0.148</td>
<td>-0.028</td>
<td>0.083</td>
<td>1.059</td>
</tr>
<tr>
<td>7</td>
<td>0.292</td>
<td>0.050</td>
<td>0.169</td>
<td>-0.031</td>
<td>0.090</td>
<td>1.031</td>
</tr>
<tr>
<td>8</td>
<td>0.400</td>
<td>0.006</td>
<td>0.204</td>
<td>-0.040</td>
<td>0.093</td>
<td>0.971</td>
</tr>
<tr>
<td>Highest</td>
<td>0.566</td>
<td>-0.064</td>
<td>0.223</td>
<td>-0.045</td>
<td>0.093</td>
<td>0.898</td>
</tr>
</tbody>
</table>

#### Panel C: Stability of the DCON at the Firm Level

<table>
<thead>
<tr>
<th>Period t + 1</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>0.76</td>
<td>0.21</td>
<td>0.03</td>
</tr>
<tr>
<td>Medium</td>
<td>0.20</td>
<td>0.60</td>
<td>0.20</td>
</tr>
<tr>
<td>Low</td>
<td>0.03</td>
<td>0.23</td>
<td>0.74</td>
</tr>
</tbody>
</table>

**Note.** Panel A presents the partial correlation of DCON with selected variables. DLOSS is a dummy with 1 if the firm reports negative income before extraordinary items and 0 otherwise. TACC is total accruals, ROE is return on equity, and BM is the book-to-market ratio. Panel B shows the means of selected variables by DCON deciles, labeled “RDCON.” STD_ROE is the standard deviation of ROE, and STD_TACC is the standard deviation of total accruals. Panel C shows frequency table of the rank of DCON. DCON is ranked by terciles of high, medium, and low DCONs for period $t$ and period $t + 1$. The table entries show the proportions of frequencies. For example, the upper left cell (high conservatism in period $t$ and high conservatism in period $t + 1$) indicates that 79% of the companies that were classified as high conservatism firms in period $t$ are classified as high conservatism firms in period $t + 1$. DCON = degree of conservatism.

***Indicates significance level of 1%.
accruals as posited by the literature. The degree of conditional conservatism is also stable over time.

Appendix A

Estimation of the Vuolteenaho Model

Because “as if” conservative returns are not visible, we estimate the vector autoregressive (VAR) using actual returns. This is consistent with the theory if we assume that “as if” returns are a linear stochastic function of actual market returns.33

In general, the VAR estimation is facilitated by assuming that the dynamics of the data are well described by a (stationary) time-series model. Specifically, define $z_{i,t}$ to be a vector of firm-specific state variables that follows the VAR process:

$$z_{i,t} = A z_{i,t-1} + \eta_{i,t}. \quad (A1)$$

Consistent with Vuolteenaho (2002), Callen and Segal (2004), Callen, Hope, and Segal (2005) and Callen, Livnat and Segal (2006), the VAR coefficient matrix $A$ is assumed to be constant over time and over firms. The error term vectors $\eta_{i,t}$ are vectors of mean-zero shocks and are assumed to have a variance–covariance matrix $\Omega$ and to be independent of all variables known at $t - 1$.

We estimate a parsimonious VAR where the state variables consist of log of one plus equity returns ($r_t$), log of one plus book return on equity (roe$_t$), and the log book-to-market ratio (bm$_t$).34 The VAR model can then be described as a system of (mean-adjusted) equations35:

$$r_t = \alpha_1 r_{t-1} + \alpha_2 \text{roe}_{t-1} + \alpha_3 \text{bm}_{t-1} + \eta_{1t}, \quad (A2a)$$

$$\text{roe}_t = \beta_1 r_{t-1} + \beta_2 \text{roe}_{t-1} + \beta_3 \text{bm}_{t-1} + \eta_{2t}, \quad (A2b)$$

$$\text{bm}_t = \gamma_1 r_{t-1} + \gamma_2 \text{roe}_{t-1} + \gamma_3 \text{bm}_{t-1} + \eta_{3t}. \quad (A2c)$$

We estimate the regressions separately by industry (using the Fama & French, 1997, classifications) using weighted least squares with one pooled regression per state variable.36 Each annual cross section is weighted equally by deflating the data for each firm-year by the number of firms in that year.37

As shown by Campbell (1991), the variance decomposition of these valuation models can be implemented empirically by combining the residuals from the VAR estimation with the unexpected current return valuation equation. Formally, let $e'_{k} = (0, \ldots, 1, \ldots, 0)$, where the 1 is in the k’th position. The unexpected change in returns is computed as

$$r_t - E_{t-1}(r_t) = e'_{k} \eta_{it}. \quad (A3)$$

Equation A1 implies that forecasts of the state vector $z_{i,t}$ can be computed as

$$E_{t}z_{i,t+1+j} = A^{j+1}z_{i,t}. \quad (A4)$$
Using Equation A4, the revision in expected future returns (discount rate news) is computed as

\[ \Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} \]

\[ = E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} - E_{t-1} \sum_{j=1}^{\infty} \rho^j r_{t+j} \]

\[ = e^{'1} \rho A (I - \rho A)^{-1} \eta_{t, t} = \lambda^{'1} \eta_{t, t}. \]  

(A5)

Similarly, the revision in expected current and future earnings (earnings news) is computed as

\[ \Delta E_t \sum_{j=0}^{\infty} \rho^j (\text{roe}_{t+j} - i_t) \]

\[ = E_t \sum_{j=0}^{\infty} \rho^j (\text{roe}_{t+j} - i_t) - E_{t-1} \sum_{j=0}^{\infty} \rho^j (\text{roe}_{t+j} - i_t) \]

\[ = e^{'2} \rho A (I - \rho A)^{-1} \eta_{t, t} = \lambda^{'2} \eta_{t, t}. \]  

(A6)

where \( i_t \) is the log of (one plus) the risk-free rate.

Appendix B

Proofs of the Propositions

*Proof of Proposition 1*

Consider the stationary bivariate log-linear vector autoregressive (VAR) system of the form:

\[ r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 \text{roe}_{t-1} + \eta_{1, t}, \]

(B1)

\[ \text{roe}_t = \beta_0 + \beta_1 r_{t-1} + \beta_2 \text{roe}_{t-1} + \eta_{2, t}, \]

(B2)

representing the market’s information (equivalent to a neutral accounting system) where \( E_{t-1}(\eta_{1, t}) = E_{t-1}(\eta_{2, t}) = 0. \)

Because of stationarity, it is straightforward to show that

\[ r_t = \alpha_1 r_{t-1} + \alpha_2 \text{roe}_{t-1} + \eta_{1, t}, \]

(B3)

\[ \text{roe}_t = \beta_1 r_{t-1} + \beta_2 \text{roe}_{t-1} + \eta_{2, t}, \]

(B4)

where with slight abuse of notation, \( r_t \) and \( \text{roe}_t \) are now mean-adjusted.

Following Vuolteenaho (2002), earnings news (\( \text{Ne}_S^S \)) for the symmetric neutral accounting system (i.e., the market) is equal to
\[ Ne_t^S = \frac{p\beta_1}{Z} \eta_{1,t} + \frac{1 - p\alpha_1}{Z} \eta_{2,t}, \]  

(B5)

where \( Z = (1 - p\alpha_1)(1 - p\beta_2) - p^2\alpha_2\beta_1 \). Similarly, discount rate news (\( Nr_t^S \)) for the symmetric neutral accounting system is equal to

\[ Nr_t^S = \frac{p\alpha_1(1 - p\beta_2) + p^2\alpha_2\beta_1}{Z} \eta_{1,t} + \frac{p\alpha_2}{Z} \eta_{2,t}. \]  

(B6)

Now let us consider an asymmetrical extreme conservative accounting system that recognizes all negative shocks to earnings, whether realized or not, but defers all positive shocks to the future when realized. We will show that if the Vuolteenaho return decomposition holds for the symmetric accounting system, the return decomposition for the extreme conservative firm is necessarily nonlinear. To simplify the analytics, we assume that positive shocks are always realized one period hence. Specifically, the stationary bivariate log-linear VAR system for the extreme conservative firm takes the form:

\[ r_t^C = \alpha_0 + \alpha_1 r_{t-1}^C + \alpha_2 \text{roe}_{t-1} + \eta_{1,t}, \]  

(B7)

\[ \text{roe}_t = \beta_0 + \beta_1 r_{t-1}^C + \beta_2 \text{roe}_{t-1} + \eta_{2,t-1}^+, \eta_{2,t-1}^- \]  

(B8)

As with the neutral accounting system, we proceed to mean adjust the conservative system. This yields

\[ r_t^C = \alpha_1 r_{t-1}^C + \alpha_2 \text{roe}_{t-1} + \eta_{1,t}, \]  

(B9)

\[ \text{roe}_t = \beta_1 r_{t-1}^C + \beta_2 \text{roe}_{t-1} + \nu_{t-1} + \eta_{2,t}^+, \eta_{2,t}^-, \]  

(B10)

where \( \eta_{2,t}^+ = \eta_{2,t}^+ - E_{t-1}(\eta_{2,t}^-) \), \( \nu_{t-1} = E_{t-1}(\eta_{2,t-1}^+) \), and the variables \( r_t^C \) and \( \text{roe}_t \) are once more (with slight abuse of notation) mean-adjusted. Crucially, note that \( E_{t-1}(\eta_{2,t}^-) = 0 \) even though \( \eta_{2,t}^- \) is distributed asymmetrically (e.g., truncated normal). Note that although \( \nu_{t-1} \) is not stochastic since it is known at time \( t \), it does vary with time. As (the time series of) past positive shocks provide information about current earnings, we elect to model these shocks too as an autoregressive (AR(1)) process of the form:

\[ \nu_t = \delta \nu_{t-1} + \eta_{3,t}, \]  

(B11)

where \( \delta \) is the persistency of the positive earnings shocks and \( \eta_{3,t} \) is a mean-zero error term.

Utilizing Equations B9, B10, and B11 to solve for earnings news of the extreme conservative accounting system (\( Ne_t^C \)) yields

\[ Ne_t^C = \frac{p\beta_1}{Z} \eta_{1,t} + \frac{1 - p\alpha_1}{Z} \eta_{2,t}^+ + \frac{p(1 - p\alpha_1)(1 - p\gamma)^{-1}}{Z} \eta_{3,t}. \]  

(B12)

Similarly, solving for expected return news (\( Nr_t^C \)) of the extreme conservative accounting system yields
\[
N_{t}^{C} = \frac{\rho \alpha_{1} (1 - \rho \beta_{2}) + \rho^{2} \alpha_{2} \beta_{1}}{Z} \eta_{1,t} + \frac{\rho \alpha_{2}}{Z} \eta_{2,t}^{*} + \frac{\rho^{2} \alpha_{2} (1 - \rho \gamma)}{Z} \eta_{3,t}.
\] (B13)

Comparing earnings news for the market and the extreme conservative firm—Equations B5 and B12—gives
\[
N_{t}^{C} = N_{t}^{S} + \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{Z} \left( \eta_{2,t}^{*} - \eta_{2,t} \right) + \frac{\rho (1 - \rho \alpha_{1} - \rho \alpha_{2}) (1 - \rho \gamma)}{Z} \eta_{3,t}.
\] (B14)

Similarly, comparing expected return news for the market and the extreme conservative firm—Equations B6 and B13—gives
\[
N_{t}^{C} = N_{t}^{S} + \frac{\rho \alpha_{2}}{Z} \left( \eta_{2,t}^{*} - \eta_{2,t} \right) + \frac{\rho^{2} \alpha_{2} (1 - \rho \gamma)}{Z} \eta_{3,t}.
\] (B15)

Subtracting Equation B15 from Equation B14 yields
\[
N_{t}^{C} - N_{t}^{C} = \left[ r_{t} - E_{t-1} (r_{t}) \right] + \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{Z} \left( \eta_{2,t}^{*} - \eta_{2,t} \right) + \frac{\rho (1 - \rho \alpha_{1} - \rho \alpha_{2}) (1 - \rho \gamma)}{Z} \eta_{3,t}
\]
\[
= \left[ r_{t} - E_{t-1} (r_{t}) \right] + \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{Z} \left( \eta_{2,t}^{*} - E_{t-1} (\eta_{2,t}) \right) - \frac{\rho (1 - \rho \alpha_{1} - \rho \alpha_{2}) (1 - \rho \gamma)}{Z} \eta_{3,t}
\]
\[
= c_{0} + \left[ r_{t} - E_{t-1} (r_{t}) \right] + \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{Z} \left( \eta_{2,t}^{*} - \eta_{2,t} \right) + \frac{\rho (1 - \rho \alpha_{1} - \rho \alpha_{2}) (1 - \rho \gamma)}{Z} \eta_{3,t},
\] (B16)

where the second equality follows from the Vuolteenaho’s linear return decomposition \( r_{t} - E_{t-1} (r_{t}) = N_{t}^{C} - N_{t}^{S} \) and \( c_{0} = - \left[ (1 - \rho \alpha_{1} - \rho \alpha_{2}) / Z \right] E_{t-1} (\eta_{2,t}) \), a positive constant.

When \( \eta_{2,t} < 0 \), \( \eta_{2,t} = \eta_{2,t}^{*} \) and Equation B16 becomes
\[
N_{t}^{C} - N_{t}^{C} = c_{0} + \left[ r_{t} - E_{t-1} (r_{t}) \right] + u_{t},
\] (B17)

where \( u_{t} = \left[ \rho (1 - \rho \alpha_{1} - \rho \alpha_{2}) (1 - \rho \gamma) / Z \right] \eta_{3,t} \) is a mean-zero error term.

When \( \eta_{2,t} > 0 \), \( \eta_{2,t} = 0 \) and Equation B16 becomes
\[
N_{t}^{C} - N_{t}^{C} = c_{0} + \left[ r_{t} - E_{t-1} (r_{t}) \right] - \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{Z} \eta_{2,t} + u_{t}.
\] (B18)

It can be shown that
\[
r_{t} - E_{t-1} (r_{t}) = \left( \frac{1 - \rho \alpha_{1} - \rho \alpha_{2}}{1 - \rho \beta_{1} - \rho \beta_{2}} \right) \eta_{2,t},
\] (B19)

where, by stationarity, the numerator and denominator in the ratio of Equation B19 are necessarily positive.\(^{42}\) Thus, Equations B17 and B18 can be reformulated as follows:

When \( \left[ r_{t} - E_{t-1} (r_{t}) \right] \leq 0 \),
\[ Ne_t^C - N_r_t^C = c_0 + [r_t - E_{t-1}(r_t)] + u_t. \]  
(B20)

When \([r_t - E_{t-1}(r_t)] \geq 0\),

\[ Ne_t^C - N_r_t^C = c_0 + \frac{\rho \beta_1(1 - \rho \alpha_2) - \rho \alpha_1(1 - \rho \beta_2)}{Z} [r_t - E_{t-1}(r_t)] + u_t, \]  
(B21)

after substituting Equation B19 into Equation B18. Equations B20 and B21 can be combined into one equation of the form:

\[ Ne_t^C - N_r_t^C = c_0 + c_1[r_t - E_{t-1}(r_t)] + c_2 D \times [r_t - E_{t-1}(r_t)] + u_t, \]  
(B22)

where \( D = 1 \) when \([r_t - E_{t-1}(r_t)] \leq 0 \) and 0 otherwise, \( c_0 = -[(1 - \rho \alpha_1 - \rho \alpha_2)/Z] \)

\( E(\eta_{2t}) \), \( c_1 = [\rho \alpha_1(\rho \beta_2 - 1) - \rho \beta_1(\rho \alpha_2 - 1)]/Z \), and \( c_2 = (1 - \rho \beta_1 - \rho \beta_2)/Z \). Note that \( c_1 + c_2 = 1 \) and by stationarity \( c_1 < 1 \). Clearly, the impact of negative return shocks on earnings news, namely, \( c_1 + c_2 = 1 \) is greater than the impact of positive return shocks \( c_1 \).

**Proof of Proposition 2**

We assumed in the derivation of Proposition 1 that 0 is the truncation point for the (extreme) conservative firm. Consider instead a firm that is less conservative in that it only recognizes negative shocks below some \(-\gamma_t < 0 \) (\( \gamma_t \geq 0 \)). Let \( \eta_{2t}^R \) takes values of \( \eta_{2t} \) for values below \(-\gamma_t\) and 0 otherwise. We use the same approach as in the proof of Proposition 1 except that now \( \eta_{2t}^R = \eta_{2t}^R - E_{t-1}(\eta_{2t}^R) \). Define \( c_0 = -[(1 - \rho \alpha_1 - \rho \alpha_2)/Z] E_{t-1}(\eta_{2t}^R) \). By analogy to Equation B16, we obtain

\[ Ne_t^C - N_r_t^C = c_0 + [r_t - E_{t-1}(r_t)] + \frac{(1 - \rho \alpha_1 - \rho \alpha_2)}{Z} (\eta_{2t}^R - \eta_{2t}) + u_t. \]  
(B23)

Thus, when \( \eta_{2t} \leq -\gamma_t \), \( \eta_{2t}^R = \eta_{2t} \) so that Equation B23 yields

\[ Ne_t^C - N_r_t^C = c_0 + [r_t - E_{t-1}(r_t)] + u_t. \]  
(B24)

In contrast, when \( \eta_{2t} > -\gamma_t \), \( \eta_{2t}^R = 0 \) and Equation B23 becomes

\[ Ne_t^C - N_r_t^C = c_0 + [r_t - E_{t-1}(r_t)] - \frac{(1 - \rho \alpha_1 - \rho \alpha_2)}{Z} \eta_{2t} + u_t. \]  
(B25)

Substituting \([r_t - E_{t-1}(r_t)]\) for \( \eta_{2t} \), and using Equation B19, allows us to rewrite Equations B24 and B25 and the associated inequalities as

\[ Ne_t^C - N_r_t^C = c_0 + [r_t - E_{t-1}(r_t)] + u_t, \]  
(B26)

when \( r_t - E_{t-1}(r_t) \leq -\gamma_t(1 - \rho \alpha_1 - \rho \alpha_2)/(1 - \rho \beta_1 - \rho \beta_2) \) and

\[ Ne_t^C - N_r_t^C = c_0 + \frac{[\rho \beta_1(1 - \rho \alpha_2) - \rho \alpha_1(1 - \rho \beta_2)]}{Z} [r_t - E_{t-1}(r_t)] + u_t, \]  
(B27)

when \( r_t - E_{t-1}(r_t) > -\gamma_t(1 - \rho \alpha_1 - \rho \alpha_2)/(1 - \rho \beta_1 - \rho \beta_2) \). Combining Equations B26 and B27 into one equation gives
\[ Ne_t^C - Nr_t^C = c_0 + c_1 [r_t - E_t-1(r_t)] + c_2 D \times [r_t - E_t-1(r_t)] + u_t, \]  
(B28)

where \( D = 1 \) if \( r_t - E_t-1(r_t) \leq -\gamma_t(1 - \rho \alpha_1 - \rho \alpha_2)/(1 - \rho \beta_1 - \rho \beta_2) \) and 0 otherwise, \( c_0 = -[(1 - \rho \alpha_1 - \rho \alpha_2)/Z]E(n_{t-1}^R), c_1 = [\rho \beta_1(1 - \rho \alpha_2) - \rho \alpha_1(1 - \rho \beta_2)]/Z, \) and \( c_2 = (1 - \rho \beta_1 - \rho \beta_2)/Z. \) Again, \( c_1 + c_2 = 1 > c_1. \)

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**Notes**

1. Such a model must necessarily focus on the dynamics of earnings and/or accruals. Examples of theoretical papers analyzing earnings dynamics include Feltham and Ohlson (1999), G. Zhang (2000), and X. Zhang (2000). However, all these studies focus on the relationship between conservatism and equilibrium pricing rather than derive implications that can be used to generate empirical proxies. Pope and Walker (1999) is an exception. Unfortunately, price in their model is determined without reference to recognized earnings or to the impact of conservatism on the time series properties of recognized earnings so that the relation that they derive between recognized earnings and returns is ad hoc.

2. The basic accounting rules relating to conservatism may be a function of the loss function faced by auditors (see Antle & Lambert, 1988; Gigler, Kanodia, Sapra, & Venugopalan, 2009). Although elegant, these articles do not provide any immediate empirical proxies.

3. On intuitive grounds, Basu (1997) measures the degree of conservatism by the relative regression coefficients on the return variables which, as we show further below, is not generally correct.

4. The nonlinear relation that they derive intuitively is the same as the one we derive formally in this article. However, they did not specify the exact form of the coefficients nor the proper form of the return truncation dummy variable. The latter is crucial for deriving a model-based measure of the degree of conditional conservatism. Furthermore, their measure of the degree of conservatism is unrelated to the model-driven measure derived in this study.

5. A number of empirical studies (e.g., Khan & Watts, 2009; Lara, Osma, & Penalva, 2009, 2011; Qiang, 2007) have tested Watts’s determinants of conditional conservatism using Basu (1997) and Basu-like measures of conditional conservatism. These studies do not address the endogeneity criticisms of the Basu metric by Dietrich, Muller, and Riedl (2007), nor other criticisms of the Basu measure by Givoly, Hayn, and Natarajan (2007) and Patatoukas and Thomas (2011). These other criticisms tend to be specific to Basu and irrelevant to this study. For example, the appropriate deflator in the Basu regression is not an issue in this study because our deflators are model determined.

6. We certainly make no exclusivity claims. Many other rigorous definitions of conditional conservatism are possible. What makes our definition interesting is that it yields a proxy for the degree of conservatism that can be estimated and which takes into account the fact that positive shocks to earnings not recognized this period because of conservatism are recognized in a future period. The ability to rigorously relate our proxy to Basu’s is also an important factor.
7. Beaver and Ryan (2005) argue in contrast that as a measure of unconditional conservatism, the market-to-book ratio should be inversely related to conditional conservatism.

8. We refer to earnings news in this study rather than cash flow news because Vuolteenaho (2002) models earnings processes (not cash flow processes) although, in the finance literature tradition, he calls his news item “cash flow news.”

9. This assumption is implicit in Vuolteenaho’s (2002) derivation of his decomposition.

10. It is best to conceptualize a vector autoregressive (VAR) process as a set of reduced form (rather than structural) equations such that all variables are endogenously determined. There are a number of early empirical studies that model the time series of firm-level earnings as part of VAR processes, including Bar-Yosef, Callen, and Livnat (1987, 1996) and Finger (1994). More recent empirical work includes Morel (1999), Callen and Segal (2004), Callen, Hope, and Segal (2005) and Callen, Livnat and Segal (2006). To the best of our knowledge, Garman and Ohlson (1980) is the first theoretical accounting study to analyze earnings within a VAR framework.

11. To simplify the discussion and the proofs, we assume the minimal VAR form possible. The proofs go through for more general VAR systems. In particular, we could embed an “other information” variable into the VAR to allow for value relevant nonaccounting information without any loss of generality. Empirically, following Vuolteenaho (2002), we estimate a parsimonious three-variable VAR, including returns, deflated earnings (roe), and the book-to-market ratio, which can be conceptualized as an “other information” variable.

12. The definitions of \( r_t \) and \( \text{roe}_t \) are not arbitrary. They are a consequence of the structure of the Vuolteenaho (2002) model. Note that our definitions differ slightly from his. In particular, Vuolteenaho defines \( r_t \) as the excess return net of the risk-free rate so that the risk free has to be subtracted from \( \text{roe}_t \) in his Equations 3 and 4. To simplify the notation, and without loss of generality, we define \( r_t \) to be gross of the risk-free rate, obviating the need to subtract the risk-free rate from \( \text{roe}_t \). We subtract the risk-free rate from these variables in the empirical analysis, however.

13. To simplify the notation, the “as if” data are denoted by a superscript to indicate whether the data are “generated” by the symmetric accounting system (\( \text{roe}^S_t \)) or by the conservative accounting system (\( r^C_t \)). Actual data (\( \text{roe}_t, r_t \)) are denoted without superscripts.

14. Although the return dynamic does not appear to be a direct function of the earnings surprise, nevertheless, returns are necessarily a function of the earnings surprise as returns are a function of earnings news and the earnings surprise is a component of earnings news (see Vuolteenaho’s Equation 3 for the formal relation).

15. In particular, we assume in the theoretical analysis that the VAR coefficients (but of course not the decompositions) for the two systems are identical and that all of the “action” is in the earnings definitions and in the error (shock) terms.

16. In other words, \( \eta_{2,t}^L(\eta_{2,t}) \) is a right (left)-truncated version of \( \eta_{2,t} \) where the truncation point is zero.

17. Of course, positive shocks not recognized in past earnings could be recognized in future earnings over a number of periods. However, because the underlying system of equations in this model is (log) AR(1), we assume that positive shocks in period \( t - 1 \) are deferred to period \( t \) only. Allowing for more time periods in the model, for example, AR(\( k \)), \( k > 1 \), would allow us to assume that past positive shocks are deferred up to \( k - 1 \) periods ahead. Parsimony and modeling simplicity motivate the AR(1) assumption.

18. Note that for linguistic simplicity, we refer to \( \eta_{2,t-1}^+ \) as a shock even though, by period \( t \), it is no longer stochastic. Furthermore, because the time series of past (nonstochastic) positive earnings shocks could provide information about future positive earnings shocks, the system of Equations 3 and 4 is an incomplete description of a conservative accounting system. We account for this formally in the proofs by assuming that expected future positive shocks are related to past positive shocks by an AR(1) process—see Equation B11. Thus, the conservative accounting system
comprises three equations. For simplicity, we finesse this issue in the text and relegate it to the proofs in Appendix B.

19. Earnings news encompasses not only the current earnings surprise but also the impact of the shock on future discounted earnings. The importance of extending earnings shocks to future periods in “value relevance” studies has been emphasized by Gonedes (1978); Antle, Demski, and Ryan (1994); and more recently by Callen (2009).

20. Note that the summation begins at 0 for earnings news and at 1 for discount rate news (see Callen & Segal, 2010).

21. The superscript \( S \) denotes the symmetric accounting (market) system. The Vuolteenaho return decomposition is an approximation. Formulating the return decomposition relation 
\[ r_t = E_{t-1}(r_t) = N e^S_t - N r^S_t \]
as an assumption in the proposition is just another way of saying that the Vuolteenaho approximation error is negligible. For empirical evidence that the approximation error is in fact negligible, see Vuolteenaho (2002).

22. It is worth noting that error term \( u_t \) is not imposed on the model for econometric reasons but is a natural outcome of the model as demonstrated in Appendix B.

23. A maintained assumption in this article is that the market can estimate the true pattern of cash flows even if the latter is not provided by conservative financial statements. In other words, we assume that investors incorporate information beyond financial statements when determining equity prices either from the broader aspects of the accounting system or from sources outside of the accounting system altogether. This assumption is not overly restrictive because the firm’s information environment is richer than just the financial statements. For example, firms have to report material events in 8K Form (such as entry into material agreements and positive or negative clinical trials), even if these events affect accounting statements in subsequent periods. In addition, investors can observe positive shocks to prices based on trade, industry, or macro-sources. Hence, the market is subject to positive shocks (as well as negative shocks reported by the conservative accounting system) even if the effects of such shocks are not yet reflected in the financial statements. Consequently, the VAR equations of the Vuolteenaho Types 1 and 2 (or 3 and 4) are plausible even under imperfect accounting systems.

24. While Basu (1997) scales earnings by the prior-period price, we scale by the book value of equity as prescribed by the model.

25. Generally, \( N e^C_t = r o e_t - E_{t-1}(r o e_t) + \Delta E_t \sum_{j=1}^{\infty} p^j r o e_{t+j} \). Thus, given the first condition of the corollary, \( N e^C_t = r o e_t \). Under the second condition, \( N r^C_t = 0 \), where \( E_{t-1}(r o e_t) \) is subsumed by the constant \( c_0 \).

26. The theory developed in this article can be extended somewhat to account for positive shocks. Nevertheless, as conservatism in the face of positive news is a marginal phenomenon in U.S. generally accepted accounting principles (GAAP), we prefer not to further complicate the model and the empirical work.

27. On estimating a switching regression of the unknown sample separation variety by simultaneous maximum likelihood, see Dickens and Lang (1985); Garcia, Lusardi, and Ng (1997); and Hu and Schiantarelli (1998).

28. As one can only estimate \( \psi/\sigma_e \) and not \( \psi \) and \( \sigma_e^2 \) separately, we normalize \( \sigma_e^2 \) to equal 1 (in the matrix).

29. These results obtain even though we use the direct (rather than the residual) method to estimate both news items, thereby finessing the criticism of Chen and Zhao (2009) regarding the residual method.

30. Indeed, one limitation of our study is that we cannot measure the DCON for firm-years with positive revisions to returns.

31. The endogeneity of returns with respect to earnings (as opposed to earnings news) has been downplayed by Ball, Kothari, and Nikolaev (2010) in the context of Basu (1997) and more generally by Ball and Shivakumar (2008). The latter articles are irrelevant for this study because returns are far more likely to be a function of earnings news than earnings and also because
endogeneity of the switch point is an issue even if returns are not an endogenous function of earnings news.

32. Because the regression includes a dummy variable for high litigation, one should interpret these standardized coefficients with caution.

33. Formally, \( r_C^t = \delta_0 + \delta_1 r_t + \zeta_t \) where \( \delta_1 \) are parameters and \( \zeta_t \) is a mean-zero error term. Clearly, this assumption is not only unsatisfying but also unavoidable.

34. The book-to-market ratio is included in the parsimonious VAR because our model is generated from this ratio. Vuolteenaho (2002) similarly includes the book-to-market ratio in his VAR specifications. It also controls for the firm’s growth prospects.

35. We estimate the VAR in mean-adjusted form to preempt potential estimation complexities due to the assumed truncated error term in the earnings (roe) regression arising out of conservatism. Specifically, consistent with the proofs in Appendix B, mean adjustment transforms the error term to be mean-zero so that weighted least squares estimation yields consistent parameter estimates.

36. Industry subscripts are suppressed in the above equations.

37. Using ordinary least squares (OLS) gives similar results.

38. Following Vuolteenaho (2002), Callen and Segal (2004), Callen, Hope, and Segal (2005) and Callen, Livnat and Segal (2006), we assume that \( r = .967 \). The results are not sensitive to this assumption for reasonable values of \( r \).

39. All formulae in this study and our empirical work are based on Vuolteenaho’s (2002) direct valuation approach that does not a priori force linearity by construction. Thus, earnings news equals \( e^t = \eta_{1,t}^t \) and discount rate news equals \( r^t = \eta_{2,t}^t \) in terms of Vuolteenaho’s nomenclature. Vuolteenaho’s indirect or residual formulation has come under significant attack by Chen and Zhao (2009).

40. We could also add a period \( t \) mean-zero error term to reflect general uncertainty and also to account for positive and negative cash flow shocks that both occur and are realized in period \( t \). As the analysis is not affected by this additional error term, we do not include it formally.

41. Based on Equations B9, B10, and B11, the VAR coefficient matrix of the conservative firm takes the form: 
\[
\begin{pmatrix}
\alpha_1 & \alpha_2 \\
\beta_1 & \beta_2
\end{pmatrix}
\]
This is contrast to the symmetric accounting VAR coefficient matrix that takes the form: 
\[
\begin{pmatrix}
\alpha_1 & \alpha_2 \\
\beta_1 & \beta_2
\end{pmatrix}
\]
42. To prove Equation (B19), substitute Equations B5 and B6 into the Vuolteenaho linear return decomposition 
\[
\eta_{1,t}^t = Ne_t^S - Ne_t^L = \frac{\alpha_1 - \alpha_2 (1 - \rho_1 - \rho_2)}{\rho_1 (1 - \rho_2)} \eta_{2,t}^t.
\]
Noting further that \( r_t - E_{t-1}(r_t) = \eta_{1,t}^t \) from Equation B3 and substituting yields the desired result.

References


