



Estimation and empirical properties of a firm-year measure of accounting conservatism

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ABSTRACT

We estimate a *firm-year* measure of accounting conservatism, examine its empirical properties as a metric, and illustrate applications by testing new hypotheses that shed further light on the nature and effects of conservatism. The results are consistent with the measure, *C_Score*, capturing variation in conservatism and also predicting asymmetric earnings timeliness at horizons of up to 3 years ahead. Cross-sectional hypothesis tests suggest firms with longer investment cycles, higher idiosyncratic uncertainty and higher information asymmetry have higher accounting conservatism. Event studies suggest increased conservatism is a *response* to increases in information asymmetry and idiosyncratic uncertainty.

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1. Introduction

Accounting conservatism is the asymmetric verification threshold for gains versus losses: the verification threshold for gains is higher (Basu, 1997). This differential verification requirement *results in* asymmetric earnings timeliness with respect to gains versus losses, conservatism flow, that builds up a cumulative understatement of net assets, conservatism stock (Watts, 2003a). Conservatism has been an enduring qualitative characteristic of financial reporting for at least five centuries (Basu, 1997), and has been the subject of much academic research.¹

Empirical research on conservatism requires a metric or scale that can characterize both cross-sectional and time-series variation in conservatism. A number of measures of conservatism have been proposed (see Watts, 2003b, for a summary), with the Basu (1997) flow measure being the most widely used (Ryan, 2006). The Basu measure is estimated either for an *industry-year* using a cross-section of firms in the industry or for a *firm* using a time-series of firm-years. Both estimation methods have limitations. The industry-year measure obscures *cross-sectional variation* in the conservatism of individual firm financial reports by assuming all firms in the industry are homogeneous. The individual firm measure obscures the

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¹ For example, Ball et al. (2000), Givoly and Hayn (2000), and Holthausen and Watts (2001), among many others.

timing of changes in the conservatism of individual firm financial reports by assuming the firm's operating characteristics are stationary. Many changes affecting a firm's financial reporting conservatism are likely both time- and firm-specific. An example is a change in the information asymmetry between investors and the firm's managers caused by a firm-specific reduction in growth opportunities (LaFond and Watts, 2008).

Not surprisingly, researchers have expressed a demand for a *firm-level* measure of conservatism that can reflect the timing of conservatism changes and the variation of conservatism across firms within an industry. These expressions are both explicit (e.g., Ryan, 2006, p. 3),² and implicit (by researchers proposing such measures, e.g., Callen et al., 2008). Despite the demand, there is as yet no well-articulated *firm-year* conservatism flow measure. This paper's objective is to meet that demand. In the paper we:

- (i) estimate a firm-year conservatism measure;
- (ii) provide evidence consistent with the measure reflecting conservatism in a timely fashion; and
- (iii) illustrate the measure's application by testing previously untested conservatism hypotheses.

Estimation. Estimation of our firm-year measure, C_Score, is based on the Basu (1997) asymmetric earnings timeliness notion implied by accounting conservatism (e.g., Basu, 1997; Watts, 2003a; Roychowdhury and Watts, 2007). There is a large literature providing empirical evidence on both asymmetric earnings timeliness' existence (for a summary see Watts, 2003b), and its cross-sectional and inter-temporal variation as predicted by the theory of conservatism in Watts (2003a). Given this evidence, we assume asymmetric earnings timeliness represents a flow measure of accounting conservatism, and generate a firm-year measure of conservatism.

We estimate annual cross-sectional Basu (1997) regressions, specifying the asymmetric earnings timeliness coefficient (or Basu coefficient) as a linear function of firm-specific characteristics. These characteristics—size, market-to-book and leverage—are chosen because conservatism varies with them, both theoretically and empirically (e.g., LaFond and Watts, 2008). We limit the estimation to these three independent variables for reasons of parsimony. Using fewer variables in estimation makes more firm-years and hence larger samples available to researchers.³ The firm-year conservatism measure, C_Score, is calculated by substituting the firm's size, market-to-book and leverage into the estimation regression for that year. Section 2 provides details.

Empirical Properties. To assess C_Score's effectiveness in measuring conservatism, we examine whether its empirical properties are consistent with the accounting conservatism predictions that are empirically confirmed in the literature. We also examine whether C_Score can *predict* firms' future asymmetric earnings timeliness. In particular:

- (i) *Distributions of return on assets (ROA) and non-operating accruals (NOAcc).* Basu (1995), Givoly and Hayn (2000) and Watts (2003b) provide predictions for how the first, second and third moments of these distributions vary with accounting conservatism. Consistent with these predictions and with C_Score measuring conservatism, we find mean ROA is decreasing in C_Score deciles, while NOAcc variability is increasing in C_Score deciles. However, the other moments of these variables are not correlated with C_Score.
- (ii) *Accounting conservatism's variation with the firm's probability of litigation and with information asymmetry among the firm's investors.* Accounting conservatism is expected to increase with the firm's likelihood of litigation (Beaver, 1993; Watts, 1993, 2003a; Basu, 1997; Holthausen and Watts, 2001) and with information asymmetry among investors in the firm (Watts, 2003a, p. 209; LaFond and Watts, 2008). Variation of conservatism with legal liability across time and firms has been empirically demonstrated in several papers, including among others, Ball et al. (2000), Holthausen and Watts (2001) and Ryan and Zarowin (2003). LaFond and Watts (2008) present evidence that conservatism varies across firms and across time with information asymmetry. We find firm characteristics such as the probability of litigation and information asymmetry among investors are positively associated with C_Score.
- (iii) *Prediction of future asymmetric timeliness.* Givoly et al. (2007) and Ryan (2006) observe that firm level asymmetric timeliness estimates are not very stationary over time despite theory (e.g., Watts, 2003a) suggesting they would be stationary absent significant changes in the firm's characteristics. Since estimation of C_Score allows for changes in firm characteristics, we examine C_Score's ability to *predict* asymmetric earnings timeliness changes. The full sample results suggest C_Score discriminates between firms with varying degrees of asymmetric earnings timeliness up to 3 years ahead. This result also holds for a sample of firms with only positive returns in the estimation period. Since Basu conservatism measures cannot be estimated for firms that only have positive returns, this result implies C_Score can be used to increase sample size in future conservatism studies.

Hypothesis Tests. In the Empirical Properties section we examine whether C_Score can replicate the existing conservatism literature's empirical results. We also use C_Score to empirically test previously untested predictions and to conduct traditional event studies. The latter would not be possible absent a firm-year conservatism measure.

² Ryan (2006, p. 3) suggests that "(s)uch measures are currently not available and are desperately needed in order to address many research questions empirically."

³ The trade-off between parsimony and sample size is ultimately a matter to be settled by each researcher.

- (i) *Previously untested cross-sectional predictions.* We hypothesize that conservatism is decreasing in firm age and increasing in investment cycle length and firm-specific uncertainty. Younger firms tend to have a higher proportion of growth options relative to installed capital, and higher information asymmetry both between managers and investors and between managers and lenders. Since conservatism is an efficient governance and contracting mechanism for reducing agency costs generated by those information asymmetries (Watts, 1993, 2003a; Ball, 2001; Holthausen and Watts, 2001), we expect the older the firm, the less conservative the accounting.⁴ Information asymmetries are also expected to increase with the firm's *investment cycle length* and with its *firm-specific uncertainty*. The former captures investment uncertainty, which is a subset of the latter (total uncertainty). The uncertainty exacerbates information asymmetries, and the resulting moral hazard and adverse selection problems. This suggests the longer the investment cycle and the greater the firm-specific uncertainty, the more conservative the firm's accounting. Our empirical results are generally consistent with these cross-sectional hypotheses.
- (ii) *Event Studies.* LaFond and Watts (2008) predict that increases in information asymmetry between parties to the firm lead increases in conservatism, rather than conservatism leading information asymmetry.⁵ Our event study results are consistent with this argument. We also conduct event studies of conservatism changes around significant increases in the probability of litigation and stock return volatility and find that C_Score increases significantly in response to large changes in stock return volatility.

We contribute to the literature in a number of ways. First, we fill a gap in the literature by developing a simple methodology for estimating a firm-year measure of conservatism, and by providing evidence on its empirical properties as a metric. Second, we test new hypotheses about conservatism's variation with a firm's age, investment-cycle and idiosyncratic volatility. Third, we are the first to provide *event study* evidence on the increase in conservatism in response to significant increases in the probability of litigation, information asymmetry and idiosyncratic uncertainty.⁶

The rest of this paper proceeds as follows. Section 2 describes the estimation method. Section 3 describes the sample. Section 4 discusses the empirical properties of C_Score. Section 5 discusses the hypothesis tests. Section 6 presents further discussion and tests, and Section 7 concludes. The appendix presents variable definitions.

2. A firm-year measure of conservatism

In this section, we first provide the theoretical motivation for the variables used to generate the C_Score: the market-to-book ratio, firm size and firm leverage. Then we describe how these variables are used in the Basu model to estimate a firm-year conservatism measure.

2.1. Motivation for the firm-specific characteristics used in estimation

The theory of conservatism in Watts (2003a) suggests that conservatism varies with four factors: contracts (including debt and compensation contracts), litigation, taxation and regulation. All four factors vary with the firm's investment opportunity set (IOS). For example, firms with more growth options relative to assets-in-place are likely to have less debt (or fewer debt contracts) and fewer accounting-based compensation contracts (Smith and Watts, 1992), more likely to have a higher probability of litigation, more likely to have lower taxable earnings and more likely to be unregulated. Therefore, capturing variation in the IOS allows us to capture variation in these four factors and ultimately variation in conservatism. We thus choose a parsimonious set of firm characteristics—the market-to-book ratio (M/B), size and leverage—that are widely available and commonly used as proxies for the firm's IOS. Below we explain how M/B, size and leverage are related to conservatism through the four Watts (2003a) factors.

2.1.1. Market-to-book ratio

Firms with a high M/B ratio have more growth options relative to assets-in-place. Growth options are positively related to agency costs (e.g., Smith and Watts, 1992), and conservatism is an efficient corporate governance response to agency costs (e.g., Watts, 2003a), implying a positive relation between M/B and conservatism. High M/B firms are also likely to have more volatile stock returns because a greater proportion of their market value is due to risky growth options, and firms with more volatile stock returns are more likely to have very large losses that trigger lawsuits, suggesting a higher litigation demand for conservatism for high M/B firms. On the other hand, empirically firms with high M/B are less likely to be regulated, suggesting a lower regulation demand for conservatism from high M/B firms.

M/B is also *directly* related to conservatism because asymmetric verification requirements for gains versus losses build up a cumulative understatement of net assets (a conservative flow generates a conservative stock) relative to market

⁴ As firms mature, both the nature of their operations and their ownership structure are expected to change, and agency costs vary with these changes. This is another reason conservatism is expected to vary with firm age.

⁵ This contrasts with the FASB assertion (FASB, 2005) that conservatism *leads to* higher information asymmetry.

⁶ Basu (1997) and Holthausen and Watts (2001) examine how conservatism varies over time with the litigation regime, but do not conduct event studies or cross-sectional tests.

values. This understatement of net assets is reinforced by the immediate expensing of investment outlays (e.g., R&D, non-software development costs for software companies) under conservatism because of an inability to verify that the consequent asset has a positive value.⁷ Both the asymmetric verification requirements for gains versus losses and the immediate expensing of investment outlays imply a positive relation between conservatism and end-of-period M/B. Thus M/B is positively related to conservatism both because it is related to the four Watts (2003a) factors and because it is directly related to stock conservatism.

In some cases the direct positive relation between M/B and conservatism is not observed empirically due to the 'buffer problem' (Roychowdhury and Watts, 2007). The buffer problem is that over a short horizon beginning M/B is negatively correlated with conservatism flows due to prior unrecognized increases in asset values reducing the necessity to recognize asset value losses. Since ending M/B is a function of beginning M/B this induces a negative relation between ending M/B and conservatism at the annual horizon. Over longer horizons (3 years or more), the beginning M/B effect is reduced and ending M/B (in year t) is positively correlated with conservatism over years $t-3$ to t as shown in Roychowdhury and Watts (2007). Despite the fact that the relation's sign changes with horizon, the empirical evidence that conservatism varies with end-of-period M/B in a way consistent with the theory in Watts (2003a) justifies its use in C_Score.

2.1.2. Size

Larger firms are likely to be more mature and to have richer information environments (e.g., more analyst following), reducing both overall uncertainty and information asymmetries relating to the realizability of projected gains. While larger firms have more complex operations and more segments, which may increase information asymmetry, the empirical evidence in the literature is generally that the net effect is large firms have lower information asymmetry than small firms on average (e.g., Easley et al., 2002). This suggests a lower contracting demand for conservatism from larger firms. Larger firms with more divisions are also more likely to aggregate gains with losses across divisions, and have more accounts and funds through which to smooth (or defer) high earnings, thereby reducing the present value of their tax liability and lowering the taxation demand for conservatism.⁸ On the other hand, larger firms are also more likely to be sued because the expected recovery from them is higher and there are fixed costs of litigation, suggesting a higher litigation demand for conservatism from larger firms.

2.1.3. Leverage

Highly levered firms have agency conflicts between lenders and shareholders. Well-known agency problems between these two parties include excessive shareholder distributions, asset substitution, underinvestment and claim dilution.⁹ Conservatism results in 'hard' or verifiable lower bounds for accounting numbers used in debt contracts, thereby constraining opportunistic diversion of resources and triggering debt covenant violations in a timely fashion (Watts and Zimmerman, 1986, pp. 213–215; Watts, 1993, p. 2; 2003a; Ball, 2001). This suggests a higher contracting demand for conservatism from more levered firms. Financially distressed firms are more likely to be sued, and the likelihood of financial distress is increasing in leverage, suggesting a higher litigation demand for conservatism from more levered firms. In addition, highly levered firms are likely to be mature firms with higher taxable earnings, suggesting a higher taxation demand for conservatism from more levered firms.

We therefore use the three variables—M/B, size and leverage—as summary measures of the four Watts (2003a) factors (contracting, litigation, taxation and regulation) that drive conservatism. We do not try to separate out the individual effects of the four factors for two reasons. First, we do not think we can measure each individual conservatism factor reliably and parsimoniously. For example, statistical methods such as factor analysis could be used to comb through a variety of variables to provide a mechanical measure of each factor. However, this could over-fit the data and not be parsimonious. It would also remove the intuition generated by the theory in Watts (2003a) and by empirical evidence that suggests conservatism varies with market-to-book, size and leverage. Second, the greater the number of variables we use for our conservatism measure, the greater the limitations data availability imposes on sample size. Our results below indicate that C_Score as currently measured discriminates between firms with varying degrees of conservatism.

2.1.4. Other candidate variables

Some other variables have been used in the prior literature to capture variation in conservatism. Examples include credit ratings (Beatty et al., 2008), SIC code (Wittenberg-Moerman, 2008) and business cycles (suggested in Ryan, 2006). We do not use these variables for the following reasons. *Credit ratings changes* are not available for many firms, are not very timely, only partially adjust for the actual credit quality change (Altman and Rijken, 2006) and are not likely to capture the

⁷ Some researchers (e.g., Beaver and Ryan, 2005; Ryan, 2006) call this effect 'unconditional conservatism' because it is not necessarily related to negative stock returns or 'bad news'. However, the effect has the same source as what those researchers call 'conditional conservatism'. The *increase in assets values due to the investment expenditure* does not meet the verifiability standard for an increase in assets, just as the *increase in the value of existing assets (gains)* does not meet that verifiability standard. Labeling one as unconditional and the other as conditional emphasizes the mechanics used to identify conservatism, not the fundamental cause of the conservatism.

⁸ For example, larger firms are more likely to have loci in multiple tax jurisdictions—multiple states and countries—which affords greater flexibility in minimizing the overall tax liability through cross-jurisdiction transfers and allocations.

⁹ E.g., Jensen and Meckling (1976), Myers (1977), Smith and Warner (1979), and Barclay and Smith (1995).

effect on conservatism of non-debt-related agency costs, growth options and litigation.¹⁰ *SIC code or industry* is too broad. Even within industries, firms' investment opportunity sets, and consequently degrees of conservatism, vary. *Business cycles, or economic fluctuations* such as booms and busts affect the entire cross-section. They may help pick up time-series variation, but will not reflect cross-sectional variation in conservatism.

2.2. Estimation method

We draw on the Basu (1997) measure of asymmetric timeliness to estimate a firm-year measure of conservatism. The Basu (1997) cross-sectional regression is specified as

$$X_i = \beta_1 + \beta_2 D_i + \beta_3 R_i + \beta_4 D_i R_i + e_i \quad (1)$$

where i indexes the firm, X is earnings, R is returns (measuring news), D is a dummy variable equal to 1 when $R < 0$ and equal to 0 otherwise, and e is the residual. The good news timeliness measure is β_3 . The measure of incremental timeliness for bad news over good news, or conservatism, is β_4 and the total bad news timeliness is $\beta_3 + \beta_4$.

To estimate the timeliness with which accounting reflects both good news and conservatism at the firm-year level, we specify that both the timeliness of good news (which we refer to as G_Score) each year and the incremental timeliness of bad news (which we refer to as C_Score) each year are linear functions of firm-specific characteristics each year:

$$\text{G_Score} = \beta_3 = \mu_1 + \mu_1 \text{Size}_i + \mu_1 \text{M/B}_i + \mu_1 \text{Lev}_i \quad (2)$$

$$\text{C_Score} = \beta_4 = \lambda_1 + \lambda_2 \text{Size}_i + \lambda_3 \text{M/B}_i + \lambda_4 \text{Lev}_i \quad (3)$$

Empirical estimators of μ_i and λ_i , $i=1-4$, are constant across firms, but vary over time since they are estimated from annual cross-sectional regressions. Eqs. (2) and (3) are not regression models. Instead, we substitute them into regression Eq. (1), to obtain Eq. (4) below. C_Score is the firm-year measure of conservatism, or incremental bad news timeliness. The total bad news timeliness is the sum of G_Score and C_Score.

C_Score and G_Score vary across firms through cross-sectional variation in the firm-year characteristics (size, M/B and Lev), and over time through intertemporal variation in $\lambda_{i,t}$, $\mu_{i,t}$, and the firm-year characteristics. Conservatism is increasing in the C_Score.

The annual cross-sectional regression model used to estimate C_Score and G_Score is

$$X_i = \beta_1 + \beta_2 D_i + R_i(\mu_1 + \mu_2 \text{Size}_i + \mu_3 \text{M/B}_i + \mu_4 \text{Lev}_i) + D_i R_i(\lambda_1 + \lambda_2 \text{Size}_i + \lambda_3 \text{M/B}_i + \lambda_4 \text{Lev}_i) + (\delta_1 \text{Size}_i + \delta_2 \text{M/B}_i + \delta_3 \text{Lev}_i + \delta_4 D_i \text{Size}_i + \delta_5 D_i \text{M/B}_i + \delta_6 D_i \text{Lev}_i) + e_i \quad (4)$$

Eq. (4) results from substitution of Eqs. (2) and (3) into (1), including additional terms in the last parenthesis. The additional terms are needed because regression model (4) includes interaction terms between returns and firm characteristics, so we also control for the firm characteristics separately (the 'main effects').

3. Sample

We extract data from the intersection of CRSP and Compustat for the years 1962–2005. All data definitions are presented in the appendix. We delete firm years with missing data for any of the variables used in estimation, and firm years with negative total assets or book value of equity. Annual returns are obtained by cumulating monthly returns starting from the fourth month after the firm's fiscal year end (Hayn, 1995; Basu, 1997).

We delete firm years with price per share less than \$1, and firms in the top and bottom 1% of earnings, returns, size, market-to-book ratio, leverage and depreciation each year (e.g., Ball et al., 2000). These filters result in a sample of 115,516 firm-years from 1963 to 2005 (1962 is lost due to the need for lagged market value of equity in deflating net income).¹¹

Table 1 shows descriptive statistics for the full sample. The mean, standard deviation, median, and first and third quartiles are reported. The distributions are similar to those reported in the prior literature (e.g. Roychowdhury and Watts, 2007).

Table 2 shows the correlation matrix for variables used in the study, over the period 1963–2005. The upper (lower) right triangle reports the Pearson (Spearman) correlations. We estimate cross-sectional correlations annually, and then report the mean across all years. The Pearson (Spearman) correlation between leverage and M/B is -0.270 (-0.467), consistent with the contracting, size and progressive tax hypotheses in Myers (1977) and Smith and Watts (1992). The probability of litigation, ProbLit, has a positive rank correlation with size (0.245), consistent with the idea that larger firms are more likely to be sued because the expected recovery from them is high enough to offset the fixed costs of litigation. However, the Pearson correlation between ProbLit and size is negative (-0.034) but small, suggesting a nonlinear relation between the two variables. Larger firms have lower volatility and bid-ask spreads, consistent with larger firms having, on average, more liquid stocks, less information asymmetry and less idiosyncratic uncertainty.

¹⁰ Credit rating agencies balance the need for ratings timeliness with the important but conflicting needs for rating stability and performance in predicting defaults (see Altman and Rijken, 2006).

¹¹ Results are generally robust when these filters are not imposed.

Table 1
Descriptive statistics.

	Mean	StdDev	Q1	Median	Q3
Earnings	0.054	0.154	0.023	0.069	0.117
Returns	0.157	0.540	−0.166	0.081	0.368
Size	4.765	2.052	3.216	4.601	6.218
M/B	2.121	2.234	0.932	1.486	2.437
Lev	0.764	1.133	0.125	0.385	0.936
Volatility	0.031	0.019	0.019	0.026	0.038
NOAcc	−0.013	0.054	−0.023	−0.007	0.002
CFOA	0.069	0.152	0.025	0.082	0.137
Inv. Cycle	0.045	0.031	0.026	0.040	0.059
Probit	0.025	0.119	0.001	0.002	0.005
PIN	0.202	0.076	0.148	0.190	0.241
Bid/ask	0.042	0.040	0.021	0.031	0.051
Age	11.715	8.891	5.000	9.000	17.000

This table shows descriptive statistics for 115,516 firm-years between 1963 and 2005. The mean, standard deviation (StdDev), median and first (Q1) and third (Q3) quartiles are reported. Earnings is net income before extraordinary items, scaled by lagged market value of equity. Returns are annual returns. Size is the natural log of market value of equity. M/B is the market-to-book ratio. Lev is leverage, defined as long-term and short-term debt deflated by market value of equity. Volatility is the standard deviation of daily firm-level returns. NOAcc is non-operating accruals, scaled by lagged assets. CFOA is cash flow from operations, deflated by lagged assets. Inv. Cycle is a decreasing measure of the length of the investment cycle. Probit is the probability of litigation from Shu (2000). PIN is the probability of informed trading from Easley et al. (2002). Bid–Ask is the bid–ask spread, scaled by the midpoint of the spread. Age is firm age, in years.

Table 2
Correlation matrix (Pearson top and Spearman bottom).

	Earnings	Size	M/B	Lev	Volatility	NOAcc	CFOA	Inv.Cyc	Probit	PIN	bid/ask	Age
Earnings												
Size	0.093											
M/B	−0.151	0.339										
Lev	0.064	−0.135	−0.467									
Volatility	−0.267	−0.533	−0.008	−0.064								
NOAcc	0.046	−0.066	−0.106	0.020	−0.019							
CFOA	0.326	0.280	0.188	−0.240	−0.248	−0.204						
Inv.Cyc.	−0.068	0.075	0.113	−0.138	0.086	−0.110	0.309					
Probit	0.103	0.245	−0.212	0.636	−0.059	−0.019	−0.151	−0.143				
PIN	−0.034	−0.664	−0.244	0.068	0.243	0.025	−0.164	−0.067	−0.250			
Bid/ask	−0.249	−0.483	−0.005	−0.052	0.765	−0.016	−0.230	0.086	−0.050	0.015		
Age	0.114	0.316	−0.100	0.094	−0.280	0.038	0.082	−0.025	0.139	−0.258	−0.344	

This table shows means of annual cross-sectional correlations for 115,516 firm-years between 1963 and 2005. The upper (lower) right triangle of the matrix shows Pearson (Spearman) correlations. Earnings is net income before extraordinary items, scaled by lagged market value of equity. Size is the natural log of market value of equity. M/B is the market-to-book ratio. Lev is leverage, defined as long-term and short-term debt deflated by market value of equity. Volatility is the standard deviation of daily firm-level returns. NOAcc is non-operating accruals, scaled by lagged assets. CFOA is cash flow from operations, deflated by lagged assets. Inv.Cyc. is a decreasing measure of the length of the investment cycle. Probit is the probability of litigation from Shu (2000). PIN is the probability of informed trading from Easley et al. (2002). Bid–Ask is the bid–ask spread, scaled by the midpoint of the spread. Age is firm age, in years.

4. Empirical properties of C_Score

4.1. Estimation results

Table 3 shows the coefficients from estimation of the regression in Eq. (4). We estimate the regressions annually to allow the coefficients to vary annually, and report the mean coefficients over the 43 years in Table 3. The *t*-statistics are based on the standard error of the 43 coefficients (Fama and Macbeth, 1973). We calculate the C_Score for a firm-year as given in Eq. (3), using the parameter estimates for each year, and calculate the G_Score as given in Eq. (2).

Table 3 shows the relation between earnings and returns (as represented by the coefficients of Ret and $D \times \text{Ret}$) is significantly positive as expected, and the significantly positive coefficient of $D \times \text{Ret}$ (the asymmetric timeliness coefficient) suggests firms are conservative on average. The coefficient of Ret \times Size is significantly positive as predicted, consistent with larger firms having higher good news timeliness. The coefficient of $D \times \text{Ret} \times \text{Size}$ is significantly negative as predicted, consistent with larger firms having lower asymmetric timeliness. LaFond and Watts (2008) suggest less conservative firms have higher good news timeliness and lower asymmetric earnings timeliness.

Also in Table 3, the coefficient of Ret \times M/B is significantly negative as predicted, consistent with growth firms having lower good news timeliness (or being more conservative). The coefficient of $D \times \text{Ret} \times \text{M/B}$ is insignificant, likely due to the

Table 3

Mean coefficients from estimation regressions (dependent variable is earnings scaled by lagged price).

Indep. variable	Pred. sign	Coeff.	t-stat.
Intercept		0.083	7.53
<i>D</i>		−0.024	−3.56
Ret	+	0.031	1.84
Ret × Size	+	0.005	2.25
Ret × M/B	−	−0.006	−2.00
Ret × Lev	−	0.005	0.77
<i>D</i> × Ret	+	0.237	10.78
<i>D</i> × Ret × Size	−	−0.033	−7.42
<i>D</i> × Ret × M/B	+	−0.007	−0.93
<i>D</i> × Ret × Lev	+	0.033	1.86
Size		0.005	4.83
M/B		−0.017	−7.93
Lev		−0.008	−3.61
<i>D</i> × Size		0.003	3.45
<i>D</i> × M/B		−0.001	−0.42
<i>D</i> × Lev		−0.002	−0.88
Adj. Rsq.		0.24	

This table shows mean coefficients from annual cross-sectional (Fama–Macbeth) regressions of earnings on the variables listed, on a sample of 115,516 firm-years from 1963 to 2005. *D* is a dummy variable equal to 1 if returns (Ret) are negative, and 0 if returns are positive. “×” is the multiplication operator. Size is the natural log of market value of equity. M/B is the market-to-book ratio. Lev is leverage, defined as long-term and short-term debt deflated by market value of equity. Adj. Rsq. is the average of the adjusted R^2 from the 43 annual regressions. The parameter estimates in the table are used to calculate the C_Score and G_Score as described in the text.

Table 4

	Mean	StdDev	Q1	Median	Q3
<i>Panel A: Descriptive statistics of C_Score and G_Score</i>					
C_Score	0.105	0.139	0.022	0.097	0.180
G_Score	0.048	0.055	0.019	0.044	0.067
<i>Panel B: Correlations (Pearson top triangle and Spearman bottom triangle)</i>					
	C_Score		G_Score		
C_Score			−0.310 ^c		
G_Score	−0.275 ^c				

This table shows descriptive statistics and correlations of C_Score and G_Score. The mean, standard deviation (StdDev), median, first quartile (Q1), third quartile (Q3), and the Pearson and Spearman correlations are reported. C_Score is calculated using parameter estimates from Table 3, as described in the text. The sample consists of 115,516 firm-years between 1963 and 2005. A superscript of “c” indicates two-tailed statistical significance at less than 1%.

buffer problem discussed in Section 2. The coefficient of Ret × Lev is insignificant, but the coefficient of *D* × Ret × Lev is significantly positive as predicted, suggesting more levered firms have higher asymmetric earnings timeliness.

Table 4, Panel A, reports full sample descriptive statistics of C_Score and G_Score. C_Score (G_Score) has a mean of 0.105 (0.048) and median of 0.097 (0.044), suggesting the C_Score and G_Score distributions are not skewed. The first quartile (Q1) of C_Score is positive, suggesting conservatism is a widespread feature of financial reporting. Panel B of Table 4 shows the Pearson (top) and rank (bottom) correlations between C_Score and G_Score are negative. This is consistent with higher asymmetric timeliness (incremental timeliness of bad news over good news) stemming partially from lower good news timeliness (e.g., Roychowdhury and Watts, 2007; LaFond and Watts, 2008).

4.2. Other empirical properties

To assess the effectiveness of C_Score as a metric of conservatism, we examine whether its empirical properties are consistent with predictions of conservatism and with associations documented in the prior literature using other conservatism measures. We begin by sorting firms on their C_Score and place them in C_Score deciles each year. Examining the properties of C_Score deciles allows non-parametric tests of unconditional (univariate) predictions, and circumvents issues of potential non-linearities in the relations examined. In particular, we examine three sets of properties described below:

- We estimate the standard (Basu, 1997) regression on the pooled (cross-sectional and time-series) data within each C_Score decile, and examine whether the Basu incremental timeliness coefficients from those regressions (Basu

Table 5

Coefficients from basic Basu regressions by C_Score decile.

C_Score decile	Intercept	D	Ret	Ret × D
Lo	0.083	−0.018	−0.025	0.147
2	0.089	−0.017	−0.008	0.127
3	0.091	−0.016	−0.007	0.140
4	0.094	−0.022	0.000	0.139
5	0.098	−0.022	−0.004	0.172
6	0.097	−0.022	−0.001	0.196
7	0.087	−0.009	0.014	0.214
8	0.088	−0.016	0.010	0.236
9	0.083	−0.026	−0.002	0.263
Hi	0.062	−0.037	−0.015	0.337
Rank Corr.			0.382	0.915 ^c
Hi–Lo (predicted sign)			0.010 (−)	0.191 ^c (+)

This table shows coefficients from basic Basu regressions estimated by C_Score decile. The sample consists of 115,516 firm-years between 1963 and 2005. Firms are sorted annually into deciles by C_Score, and then the following pooled regression is estimated for each decile:

$$X_{i,t} = \beta_1 + \beta_2 D_{i,t} + \beta_3 R_{i,t} + \beta_4 D_{i,t} R_{i,t} + e_{i,t}$$

X is earnings scaled by lagged price, D is a dummy variable equal to 1 if returns (Ret) are negative, and 0 if returns are positive. The columns show the intercept, the dummy (D), the good news timeliness (Ret) and the Basu asymmetric timeliness (Ret × D) coefficients. Conservatism is increasing in the C_Score. Rank Corr. is the rank correlation between the C_Score decile and the coefficient ranking, and is a measure of the monotonicity of the ranking in the table. Hi–Lo is the difference between the coefficients for the high and low C_Score deciles. A superscript of 'c' indicates two-tailed statistical significance at less than 1%.

coefficients) increase monotonically across the C_Score deciles. Note that we are comparing a *firm-year* index of conservatism (the C_Score) with a *non-firm-year* index (Basu coefficient).

Table 5 shows the results. The Basu asymmetric timeliness measure is increasing nearly monotonically with the C_Score decile. The difference between the Basu asymmetric timeliness for the high and low C_Score deciles is significantly positive at 0.191. The rank correlation between the C_Score decile ranking and the Basu asymmetric timeliness ranking is significantly positive 0.915. The Basu good news timeliness is uncorrelated with the C_Score decile rank. This result suggests that a firm with low good news timeliness for example is not necessarily conservative if it also has very low bad news timeliness (i.e., if the firm generally has low news timeliness, and negative asymmetric timeliness of bad news). On the other hand, a firm with high good news timeliness is not necessarily less conservative if it also has very high bad news timeliness (i.e., if the firm generally has high news timeliness, and positive asymmetric timeliness of bad news).

Overall, Table 5 suggests C_Score is effective in distinguishing between firms with varying degrees of flow conservatism (Basu asymmetric timeliness), consistent with C_Score measuring conservatism. To see that this result is useful consider an alternative hypothesis described in Section 7 suggesting C_Score is really capturing risk and not conservatism. However, the alternative hypothesis does not predict a relation between risk and the Basu coefficient, and therefore does not explain the result described above. The result above helps discriminate between competing hypotheses and is therefore useful.

- (ii) We examine the distributions of ROA and non-operating accruals by C_Score decile. Basu (1995), Givoly and Hayn (2000) and Watts (2003b) suggest the mean, variability and negative skewness of ROA and non-operating accruals are measures of conservatism. Conservative firms' large write-offs tend to manifest themselves as large spikes in the distribution of these variables. This implies ROA and non-operating accruals are expected to be more variable for conservative firms and more negatively skewed. In addition, conservative firms are expected to have more negative periodic non-operating accruals.

Table 6 shows the results. The bottom row shows the rank correlation between the C_Score decile and the moments of the distribution of each variable. Consistent with the arguments in Givoly and Hayn (2000) and Watts (2003b), the mean of ROA is negative for the most conservative firms, and mean ROA is monotonically decreasing in C_Score with a significant rank correlation of −1. The variability of NOAcc is increasing in C_Score as predicted, with a significant rank correlation of 0.939. However, the skewness of ROA and NOAcc, the variability of ROA and the mean of NOAcc are not significantly correlated with C_Score, which is inconsistent with our prediction.

- (iii) We examine whether the probability of litigation and information asymmetry are associated with C_Score, consistent with results in the prior literature using other conservatism measures. This set of empirical properties of C_Score differs from those in (ii) above in that the predictions from the prior literature examined here relate only to the levels of characteristics rather than to their higher order moments as well.

- (a) *Probability of litigation.* Firms are more likely to be sued for actual losses rather than for potential profits foregone (Kellogg, 1984) because the latter are not verifiable in a court of law. In other words, a firm that overstates its

Table 6

Distributions of ROA and non-operating accruals, by C_Score decile.

C_Score Decile	ROA			NOAcc		
	Mean	StdDev	Skew	Mean	StdDev	Skew
1	0.071	0.153	−5.423	−0.013	0.047	−1.241
2	0.064	0.122	−6.227	−0.013	0.046	−1.002
3	0.052	0.151	−11.861	−0.014	0.048	−1.474
4	0.043	0.137	−6.138	−0.014	0.051	−1.776
5	0.031	0.152	−6.750	−0.014	0.056	−1.675
6	0.021	0.156	−7.092	−0.013	0.056	−1.357
7	0.010	0.179	−12.343	−0.013	0.056	−1.759
8	0.004	0.149	−5.569	−0.013	0.060	−1.542
9	−0.003	0.132	−6.982	−0.012	0.058	−1.376
10	−0.015	0.103	−4.755	−0.010	0.059	−1.462
Rank Corr.	−1 ^c	−0.248	0.030	0.539	0.939 ^c	−0.273
(Predicted sign)	(−)	(+)	(−)	(−)	(+)	(−)

This table shows the mean, standard deviation (StdDev) and skewness (Skew) of ROA and NOAcc, by C_Score decile. The sample consists of 115,516 firm-years between 1963 and 2005. Firms are sorted annually into deciles by C_Score, and then the first, second and third moments of ROA and NOAcc are calculated for each decile. ROA is earnings before extraordinary items, deflated by lagged assets. NOAcc is non-operating accruals, deflated by lagged assets. Rank Corr. is the rank correlation between the C_Score decile and the column ranking, and is a measure of the monotonicity of the ranking in the table. A superscript of 'c' indicates two-tailed statistical significance at less than 1%.

Table 7

Means of selected characteristics of C_Score deciles.

C_Score Decile	C_Score	G_Score	M/B	Size	Lev	Inv.Cyc.	PIN	Bid/ask	Volatility	ProbLit	Age
1	−0.088	0.063	4.003	7.457	0.298	0.050	0.143	0.029	0.023	0.008	15.638
2	−0.010	0.059	2.743	6.549	0.368	0.049	0.165	0.029	0.024	0.008	14.550
3	0.029	0.056	2.425	5.844	0.398	0.048	0.181	0.032	0.026	0.008	12.856
4	0.060	0.053	2.200	5.294	0.433	0.047	0.199	0.034	0.027	0.009	11.862
5	0.088	0.051	1.999	4.808	0.497	0.046	0.213	0.037	0.029	0.010	11.247
6	0.115	0.048	1.847	4.370	0.560	0.045	0.228	0.040	0.031	0.011	10.689
7	0.143	0.045	1.711	3.957	0.659	0.044	0.236	0.044	0.033	0.012	10.267
8	0.174	0.041	1.595	3.539	0.808	0.044	0.251	0.050	0.036	0.016	10.161
9	0.216	0.037	1.436	3.140	1.114	0.042	0.264	0.057	0.038	0.024	9.964
10	0.325	0.026	1.258	2.694	2.503	0.040	0.268	0.069	0.042	0.146	9.922
Rank Corr.	−0.975 ^c	−0.908 ^c	−0.991 ^c	0.777 ^c	−0.981 ^c	0.992 ^c	0.951 ^c	0.987 ^c	0.603 ^a	−0.929 ^c	
Hi–Lo	0.412 ^c	−0.037 ^c	−2.745 ^c	−4.763 ^c	2.205 ^c	−0.010 ^c	0.125 ^c	0.041 ^c	0.019 ^c	0.138 ^c	−5.716 ^c
(Predicted sign)	(+)	(−)	(−/+)	(−)	(+)	(−)	(+)	(+)	(+)	(+)	(−)

This table shows means of selected characteristics of C_Score deciles. The sample consists of 115,516 firm-years between 1963 and 2005. Firms are sorted annually into deciles by C_Score, and then the mean of the reported firm characteristics is calculated by decile. Conservatism is increasing in the C_Score. G_Score is the good news timeliness, as given by Eq. (2) in the text. M/B is the market-to-book ratio. Size is the natural log of market value of equity. Lev is leverage, defined as long-term and short-term debt deflated by market value of equity. Inv.Cyc. is a decreasing measure of the length of the investment cycle. PIN is the probability of informed trading from [Easley et al. \(2002\)](#). Bid-Ask is the bid-ask spread, scaled by the midpoint of the spread. Volatility is the standard deviation of daily firm-level returns. ProbLit is the probability of litigation from [Shu \(2000\)](#). Firm age is the age of the firm in a given year. Rank Corr is the rank correlation between the C_Score decile and the sample mean of the variable, and is a measure of the monotonicity of the ranking in the table. Hi–Lo is the difference between the values of the variable for the high and low C_Score deciles. A superscript of 'c' [a] indicates two-tailed statistical significance at less than 1% [10%].

earnings and book values, and then subsequently suffers a loss in the value of its stock when the overstatement is discovered, is more likely to be sued than a firm with understated earnings and book values whose stock price subsequently rises when the understatement is discovered. This implies that high litigation risk firms are more likely to understate rather than overstate earnings and book values, so we expect the C_Score to be positively associated with the probability of litigation ([Beaver, 1993](#); [Watts, 1993, 2003a](#); [Basu, 1997](#)). We use the [Shu \(2000\)](#) measure of the probability of litigation.

Table 7 shows means of selected characteristics by C_Score decile. The probability of litigation, ProbLit, is significantly increasing in C_Score, and the highest decile of C_Score has significantly higher ProbLit than the lowest decile of C_Score, as predicted.

- (b) *Information asymmetry.* [Watts \(2003a, p. 209\)](#) suggests conservatism is a means of addressing agency problems stemming from information asymmetries between contracting parties. For example, requiring asymmetric earnings timeliness deters artificial inflation of the pool of earnings available for distribution to shareholders at the expense of lenders, constraining excessive distributions. Similarly, asymmetric verification requirements for

unrealized gains versus losses reduce the managers' ability to overstate earnings and be over-compensated under accounting-based compensation plans. These restrictions reduce managers' dysfunctional efforts to transfer wealth to themselves instead of increasing the total wealth available to all claimholders on the firm (i.e., they reduce agency costs).

We use the bid-ask spread and the PIN metric of Easley et al. (2002) to proxy for information asymmetry. The bid-ask spread is a proxy for the degree of information asymmetry (e.g., Welker, 1995) because it represents one way that market-makers protect themselves from expected losses in trading with more informed traders. PIN is an order imbalance statistic that has been proposed as a measure of information asymmetry across traders, and has been used in several prior papers (e.g., LaFond and Watts, 2008; Mohanram and Rajgopal, 2009). We expect C_Score to be positively associated with the bid-ask spread and the PIN score.¹² Table 7 shows information asymmetry as measured by both PIN and the bid-ask spread is significantly increasing in C_Score, and the highest C_Score decile has significantly higher information asymmetry than the lowest C_Score decile, as predicted.

Table 7 also shows that sorting on C_Score (asymmetric timeliness) induces a reverse sort on G_Score (good news timeliness), consistent with the argument in LaFond and Watts (2008) that more conservative firms have lower good news timeliness. In addition, size is decreasing, and leverage is increasing, in the C_Score decile as predicted. The rank correlation between the C_Score decile and the M/B ratio in Table 7 is significantly negative. As discussed in Section 2, the empirical relation between ending M/B and conservatism over 1-year intervals is complicated by the buffer problem. Overall, the associations in Table 7 between C_Score and various firm characteristics are consistent with C_Score measuring conservatism.

4.3. Predictive ability

We examine whether the C_Score can predict asymmetric earnings timeliness up to 3 years ahead. Firms are first sorted into deciles annually based on their C_Score in year $t-3$, or $t-2$, or $t-1$, and then a Basu regression using year t data is estimated within each decile.

Panel A of Table 8 shows the results for the 69,767 firm-years with both positive and negative returns and C_Score available for all years from $t-3$ to t . The table shows the Basu coefficient by C_Score decile, and the rank correlation between the C_Score ranking and the Basu coefficient. C_Score ($t-1$) predicts the Basu coefficient at t well, with a significant rank correlation of 0.99. The predictive ability of C_Score ($t-2$) for the Basu coefficient at t is also high, with a significant rank correlation of 0.98. C_Score ($t-3$) also strongly predicts the Basu coefficient at t , with a significant rank correlation of 0.89.

We repeat the predictive tests above for a sub-sample of firms with only positive returns in each of the last 3 years (years $t-3$ to $t-1$). These firms may have positive or negative returns in the current year (year t). The Basu conservatism measure is not estimable for this sub-sample in any of the years $t-3$ to $t-1$ (but is estimable in year t) since the Basu regression also requires firm-years with negative returns. For this sub-sample in particular, it is of interest to predict which firms will be more or less conservative when they eventually receive bad news in the future.

Table 8, Panel B shows the results for the 16,059 firm-years with positive returns in each of years $t-3$, $t-2$ and $t-1$. The rank correlation between the Basu coefficient at t and the C_Score ($t-1$) [$t-2$] [$t-3$] ranking is (0.82) [0.79] [0.79] and highly statistically significant.

Overall, Table 8 suggests the C_Score has predictive ability for the Basu coefficient up to 3 years ahead, and this C_Score property holds even for sub-samples of firm-years where the Basu coefficient is not estimable due to an absence of negative returns.

5. Hypothesis tests

To illustrate applications of the C_Score we develop and test new hypotheses to shed further light on the nature of conservatism. The hypotheses are classified as cross-sectional and event-time hypotheses.

5.1. Cross-sectional hypotheses

Firm age. We expect conservatism to decrease with firm age because younger firms tend to have more growth options relative to assets-in-place than older firms. Information asymmetry between managers and investors increases with growth options because the future cash flows from growth options are typically unverifiable, producing more agency costs

¹² The hypotheses relate to information asymmetry between managers and shareholders, while the bid-ask spread more directly measures information asymmetries among shareholders (or traders). The justification for using the bid-ask spread is as follows. Information asymmetry between managers and shareholders is likely to generate greater private information search, since private information is more valuable in this environment. This will lead to groups of shareholders or traders who are privately informed, relative to other shareholders. As such, the information asymmetry between managers and shareholders will also generate information asymmetries among shareholders (or traders), which is captured by the bid-ask spread.

Table 8

Predictive ability of C_Score for Basu coefficient.

Decile of C_Score In year $t-1$	Basu coeff. In year t	Decile of C_Score In year $t-2$	Basu coeff. In year t	Decile of C_Score In year $t-3$	Basu coeff. In year t
<i>Panel A: Full sample (both positive and negative returns for years $t-3$ to $t-1$)¹</i>					
1	0.098	1	0.121	1	0.142
2	0.126	2	0.144	2	0.161
3	0.126	3	0.181	3	0.249
4	0.152	4	0.198	4	0.237
5	0.184	5	0.244	5	0.214
6	0.244	6	0.275	6	0.274
7	0.278	7	0.294	7	0.255
8	0.332	8	0.287	8	0.298
9	0.351	9	0.350	9	0.270
10	0.405	10	0.300	10	0.324
Rank Corr.	0.99 ^c	Rank Corr.	0.98 ^c	Rank Corr.	0.89 ^c
<i>Panel B: Positive returns from $t-3$ to $t-1$ sample²</i>					
1	0.063	1	0.058	1	0.083
2	0.049	2	0.087	2	0.061
3	0.087	3	0.079	3	0.074
4	0.087	4	0.105	4	0.086
5	0.062	5	0.055	5	0.075
6	0.073	6	0.132	6	0.075
7	0.120	7	0.100	7	0.137
8	0.120	8	0.129	8	0.136
9	0.170	9	0.140	9	0.172
10	0.261	10	0.230	10	0.194
Rank Corr.	0.82 ^c	Rank Corr.	0.79 ^c	Rank Corr.	0.79 ^c

This table shows Basu coefficients estimated in year t , for firms ranked on their C_Score in year $t-3$ (or $t-2$ or $t-1$). The following pooled regression is then estimated in year t for each decile:

$$X_{i,t} = \beta_1 + \beta_2 D_{i,t} + \beta_3 R_{i,t} + \beta_4 D_{i,t} R_{i,t} + e_{i,t}$$

where X is earnings scaled by lagged price, D is a dummy variable equal to 1 if returns (Ret) are negative, and 0 if returns are positive. The columns show the Basu asymmetric timeliness coefficient, β_4 , for each decile. Conservatism is increasing in the C_Score. Rank Corr is the rank correlation between the C_Score decile ranking and the Basu coefficient, and is a measure of the predictive ability of the C_Score for the Basu coefficient.

¹ The sample consists of 69,767 firm-years with returns and C_Scores in each of years $t-3$, $t-2$ and $t-1$. A superscript of 'c' indicates two-tailed statistical significance at less than 1%.

² The sample consists of 16,059 firm-years with only positive returns in each of years $t-3$, $t-2$ and $t-1$. A superscript of 'c' indicates two-tailed statistical significance at less than 1%.

that lead to more conservatism (see LaFond and Watts, 2008). Assets-in-place associated with existing business are more verifiable and so lead to less conservatism.

Firm-specific uncertainty, and the length of the investment cycle. We expect conservatism to be positively associated with both firm-specific uncertainty and investment cycle length, as agency costs are increasing in these variables. The distinction between the variables is that the length of the investment cycle captures investment uncertainty, which is one subset of total firm-specific uncertainty. We hypothesize that firms with high uncertainty and long investment cycles:

- (i) have future gains that are less verifiable ex ante and more susceptible to gaming, generating a higher contracting and governance demand for conservatism;
- (ii) are relatively more likely to face adverse outcomes from investments than are firms with low uncertainty. High uncertainty and long investment cycles increase the difficulty in forecasting the magnitudes and timing of future cash flows, which will lead to larger losses ex post. While these losses may be balanced out over a long period by larger gains, lenders are more concerned about the left tail of the earnings distribution and the attendant agency problems such as excessive shareholder distributions, asset substitution, and underinvestment. This generates a higher demand for conservatism; and
- (iii) have higher potential shareholder losses, increasing the likelihood of litigation and generating a higher litigation demand for conservatism.

Our proxy for firm-specific uncertainty is stock return volatility, while the length of the investment cycle is measured as depreciation divided by lagged assets (which is decreasing in investment cycle length).

Another reason to expect that return volatility is positively correlated with conservatism is that volatility is negatively correlated with returns (e.g., Black, 1976; Christie, 1982; Campbell and Hentschel, 1992). Specifically, conservative firms will write off assets sooner when there is bad news (some of which is reflected in negative returns), and return volatility is

Table 9
Cross-sectional hypothesis tests.

Ind. variable	Predicted sign	Dependent variable is C_Score Coefficient	t-statistic
Intercept		0.056	3.79 ^c
Volatility	+	1.651	7.29 ^c
Investment cycle	–	–0.569	–7.81 ^c
Age	–	–0.000	–0.97
Bid/ask spread	+	0.651	5.99 ^c
R ²		0.13	

This table shows coefficients and *t*-statistics from Panel (pooled cross-sectional and time-series) regressions of C_Score on stock return volatility, the bid/ask spread, firm age and the length of the investment cycle. The sample consists of 115,516 firm-years between 1963 and 2005. Volatility is the standard deviation of daily stock returns. Investment Cycle, defined as depreciation expense deflated by lagged assets, is a decreasing measure of the length of the investment cycle. Age is the age of the firm in a given year. bid/ask spread is the bid–ask spread scaled by the midpoint of the spread. The *t*-statistics are based on standard errors clustered by firm and year (double-clustered). A superscript of 'c' indicates two-tailed statistical significance at less than 1%.

likely to be higher around bad news times.¹³ Therefore, in this case too, we predict a positive relation between volatility and C_Score.

Consistent with the above hypotheses, Table 7 shows that firms in the lowest C_Score decile are more than 5 years older than firms in the highest C_Score decile (*p*-value < 1%), and the relation between C_Score and age is monotonic. Table 7 also shows that idiosyncratic uncertainty (return volatility)¹⁴ increases monotonically with the C_Score decile, as predicted. The rank correlation between the C_Score decile and the mean idiosyncratic uncertainty is 0.987 (*p*-value < 1%), which indicates the monotonicity of the rank relation in the table. In addition, as indicated by the values in the row labeled “Hi-Lo,” firms in the most conservative decile have significantly higher return volatility than firms in the least conservative decile. Further, Table 7 shows that the length of the investment cycle is increasing in the C_Score decile, and that the most conservative firms have significantly longer investment cycles than the least conservative firms, as predicted.

Finally, Table 9 presents results from multiple regression tests of the cross-sectional hypotheses. The table shows coefficients and *t*-statistics from Panel (pooled cross-sectional and time-series) regressions of C_Score on age, volatility, bid–ask spread and the length of the investment cycle. The *t*-statistics are based on standard errors double-clustered by year and firm to control for cross-sectional and time-series correlation (Petersen, 2009; Gow et al., 2009). All variables, with the exception of firm age, load significantly in the predicted direction. Overall, the results in Tables 7 and 9 are generally consistent with our cross-sectional hypotheses.

5.2. Event-time hypotheses

We conduct event studies of conservatism changes around significant increases in the probability of litigation, idiosyncratic uncertainty and information asymmetry. For each of the three events, we define a significant increase in the relevant variable (probability of litigation, idiosyncratic uncertainty or information asymmetry) as one above the 95th percentile of the full-sample distribution of changes in that variable. In other words, the increase is significant in the statistical sense that it occurs less than 5% of the time.

- (i) *significant increases in the probability of litigation (ProLit)*. Based on the litigation demand for conservatism, we expect firms to *respond* by increasing conservatism in the subsequent year, event year +1.
- (ii) *significant increases in idiosyncratic uncertainty*. Based on Section 5.1 arguments, we expect firms to *respond* by increasing conservatism in the subsequent year, event year +1.
- (iii) *significant increases in the bid–ask spread*. Based on Section 4 arguments, we expect firms to *respond* by increasing conservatism in the subsequent year, event year +1. This hypothesis has previously been tested in LaFond and Watts (2008) using the PIN score as a measure of information asymmetry. Because they did not have available a firm-year measure of conservatism, LaFond and Watts had to use three separate Basu-type regressions for the relation between PIN changes and conservatism. One specified a lagged relation, one a contemporaneous relation and one a leading relation. Evidence on this hypothesis is important not only because it provides evidence on the theory of conservatism in LaFond and Watts (2008), but also because the hypothesis is counter to the Financial Accounting Standards Board's (FASB, 2005) assertion that conservatism *leads* to higher information asymmetry.

For all three events, we expect conservatism increases in the event year (year 0) and the subsequent year (year +1). Since the event does not necessarily occur on the last day of the period we expect some of the increase in conservatism to be

¹³ Conservatism does not cause the increase in volatility. Rather, the two variables are contemporaneously associated for the reason described above.

¹⁴ Since idiosyncratic uncertainty is more precisely measured by idiosyncratic return volatility, we confirm our results are robust to using idiosyncratic rather than total return volatility.

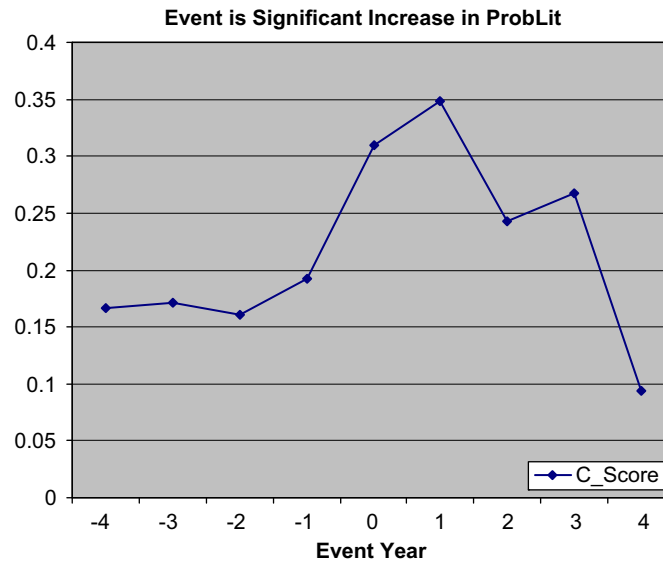


Fig. 1. Event study—conservatism and the probability of litigation.

contemporaneous with the event. However, given that conservatism is a response to information asymmetry and the probability of litigation, we expect a significant amount of the conservatism response to occur in year +1. Note that if conservatism were not a response to information asymmetry or litigation probability, but merely contemporaneously correlated with those variables, and if large changes in those variables were mechanically mean reverting, selection bias would cause the maximum conservatism to be observed in the event year (year 0), rather than in year +1 as we predict.

To illustrate how the increase in conservatism associated with an increase in the probability of litigation surfaces in C_Score, consider the following. An increase in the probability of litigation is likely associated with negative returns. As conservative firms write down assets in response to market value declines, firm size decreases. Leverage increases through a decrease in the denominator of the debt to assets or equity ratio because the firm does not instantaneously adjust capital structures (Ball et al., 1976). Both the decrease in size and increase in leverage increase C_Score via Eq. (3), thereby correctly signaling the increase in conservatism. There are similar explanations for the relation between changes in idiosyncratic uncertainty or the bid-ask spread¹⁵ and C_Score.

Figs. 1–3 show the results of the event studies. In each graph, the vertical axis shows the mean C_Score, while the horizontal axis shows the event year.¹⁶ The figures do not impose any survivorship requirement on firms. However, the relations they depict remain intact when we require firms to survive 2 years after the event.

In Fig. 1 the conservatism response to an increase in litigation probability comes essentially contemporaneously and peaks in the subsequent year, consistent with our hypotheses. In Figs. 2 and 3 where the shock is in bid-ask spread and volatility, respectively, the C_Score response is essentially concentrated in the subsequent year, consistent with the proposition that conservatism responds to information asymmetry changes.

Figs. 1–3 also show a large drop in conservatism in year 2. We interpret this as reflecting that the year t and year $t+1$ increases in conservatism are not permanent. They are a response to the year t shock in the relevant variable (ProbLit, bid/ask spread or volatility), and these shocks to ProbLit, bid/ask spread and volatility themselves are not permanent. For example, an increase in the likelihood of litigation occurs when the firm experiences large negative returns, but large negative returns are unlikely to persist. In unreported tests we confirm empirically that the significant increases in ProbLit, bid/ask spread and volatility (the “events” in Figs. 1–3) are all temporary changes, and that ProbLit, bid/ask spread and volatility all revert after year 0.¹⁷

Table 10, Panels A–C, provide evidence from Panel (pooled cross-sectional and time-series) regressions on the magnitude and significance of the C_Score response to each event. The table shows the incremental change in the C_Score, for event firm-years compared to non-event firm-years, from year -2 to year -1 (regression coefficient b_1), from year -1 to year 0 (regression coefficient b_2), and then from year 0 to year +1 (regression coefficient b_3). The t -statistics are calculated

¹⁵ We use the bid/ask spread rather than PIN because PIN data is only available from 1983 to 2001.

¹⁶ In conducting each event study, we first estimate the C-score parameters over non-event firm-years, to prevent the event from tainting the parameter estimates. We then use these non-event parameter estimates to calculate the C-Score for the event years. Further, we ensure that, for a given firm, there is only one event in the event window ($t=-4$ to $t+4$) that we examine.

¹⁷ This result is not mechanical. We construct our event sample to exclude significant increases in any year from $t-4$ to $t+4$, excepting year t . However, this does not imply that the level of litigation probability (or bid/ask spread or return volatility) should decrease in year $t+1$ (it can remain at the elevated level) unless the shock is temporary.

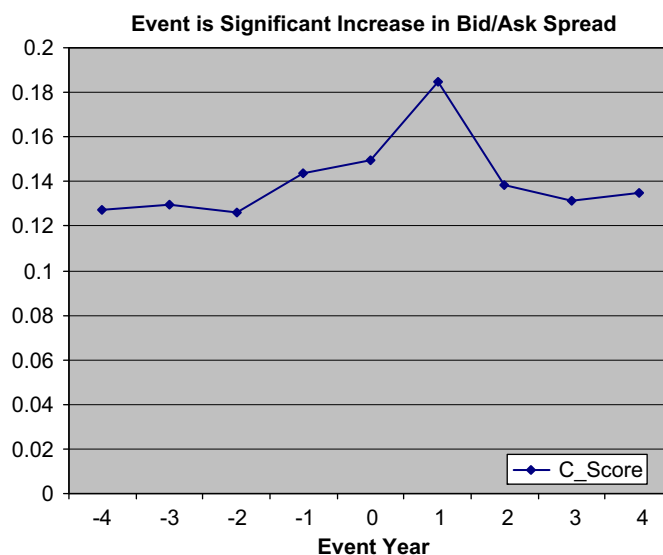


Fig. 2. Event study—conservatism and the bid/ask spread.

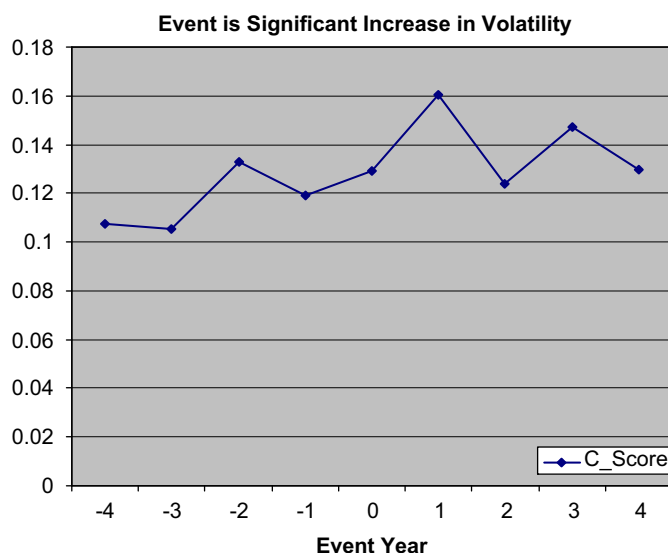


Fig. 3. Event study—conservatism and idiosyncratic return volatility.

based on standard errors double-clustered by time and firm to control for cross-sectional and time-series correlation. The coefficient b_3 is significantly positive as predicted in Panels B and C, but insignificant in Panel A, consistent with conservatism increasing in response to significant increases in information asymmetry and idiosyncratic uncertainty. The contemporaneous correlation b_2 is significantly positive in Panel A, but insignificantly positive otherwise. This suggests firms increase conservatism more quickly (contemporaneously rather than with a lag) in response to changes in litigation probability, than in response to changes in information asymmetry and idiosyncratic uncertainty. In sum, the event studies provide evidence generally consistent with our predictions.

6. Further tests and discussion

6.1. Alternative explanation

An alternative explanation for some of our results is that C_Score may simply be capturing systematic risk as opposed to conservatism because C_Score is negatively correlated with ROA and positively correlated with the probability of litigation

Table 10

Event study significance tests.

$$\Delta C_Score = a_1 + b_1 D(t-1) + b_2 D(t) + b_3 D(t+1) + u$$

	Intercept	$D(t-1)$	$D(t)$	$D(t+1)$
<i>Panel A: Event is significant increase in the probability of litigation</i>				
Coeff	0.001	0.012	0.114	0.119
t-stat	0.06	0.45	2.23 ^b	1.09
<i>Panel B: Event is significant increase in the bid/ask spread</i>				
Coeff	0.000	0.009	0.005	0.051
t-stat	0.02	0.58	0.23	1.75 ^b
<i>Panel C: Event is significant increase in return volatility</i>				
Coeff	0.001	−0.020	0.009	0.044
t-stat	0.08	−1.22	0.42	1.63 ^a

This table shows coefficients and *t*-statistics from three separate Panel (pooled cross-sectional and time-series) regressions, estimated on the sample of 115,516 firm-years between 1963 and 2005. ΔC_Score is the change in *C_Score* over the prior year. $D(t-1)$ ($D(t)$, $D(t+1)$) is a dummy that equals 1 in the year before (year, year after) the firm experiences an event, and 0 otherwise. The events examined are significant increases in the probability of litigation (Panel A), the bid/ask spread (Panel B) and stock return volatility (Panel C). A significant increase in a variable is defined as a change that is larger than the 95th percentile of the distribution of changes in that variable. The *t*-statistics are based on standard errors clustered by firm and time (double-clustered). A superscript of 'b' [a] indicates one-tailed statistical significance at less than 5% [10%].

and return volatility. This argument suggests (i) systematic risk should be positively correlated with *C_Score*, and (ii) ranking firm-years into deciles of systematic risk should yield similar correlations in sign, magnitude and significance.

We use the CAPM beta to measure systematic risk. The beta is estimated for every firm-year using daily data.¹⁸ We find that:

- (i) the correlation between beta and *C_Score* is −0.256. The sign of the correlation is the opposite of that predicted;
- (ii) when we sort firm-years into deciles of beta and calculate the mean ROA, ProbLit and Volatility for each decile, the rank correlation of the beta decile with mean ROA is 0.248, with mean ProbLit is −0.042, and with mean Volatility is 0.56 (*p*-value < 10%). In contrast to the *C_Score* results in Tables 6 and 7, the rank correlations between beta and ROA and ProbLit are insignificant, while the correlation with Volatility is marginally significant. The point estimates are lower in magnitude, and the signs of the ROA and ProbLit coefficients are not as predicted.

Overall, we interpret the collective evidence as providing support for our hypothesis that *C_Score* captures conservatism rather than the alternative argument that *C_Score* captures risk.

6.2. Out-of-sample tests

We estimate *C_Score* parameters on half the firm-years selected randomly (estimation sample), and then use these to estimate *C_Score* for the remaining half of firm-years (holdout sample). We then sort firms in the holdout sample into *C_Score* deciles and estimate the Basu coefficient by decile. In this holdout sample, the rank correlation between the *C_Score* ranking and the Basu coefficient is 0.87 and is significant at less than 1%. This suggests *C_Score* has out-of-sample predictive ability for the Basu coefficient.

6.3. Alternative definition of investment cycle length

The results discussed earlier in the paper measure investment cycle length as (the inverse of) depreciation scaled by lagged assets, rather than depreciation scaled by lagged gross property, plant and equipment (PPE). To see why, we can write $\text{Dep}/\text{Assets} = \text{Dep}/\text{PPE} \times \text{PPE}/\text{Assets}$. PPE/Assets measures the firm's relative proportion of fixed or long-term assets. We predict a positive relation between conservatism and investment cycle length, but this relation may not be observed if the firm has a relatively low proportion of fixed assets. Our hypothesis more precisely therefore is that the positive relation between investment cycle length and conservatism is increasing in the proportion of fixed assets, and Dep/Assets measures the interaction of investment cycle length (Dep/PPE) and the proportion of fixed assets (PPE/Assets).

To examine whether our result is robust to simply using Dep/PPE we re-do the analyses in Table 7 (univariate results) and Table 9 (multiple regression results) using this alternative definition of investment cycle length. Investment cycle length is decreasing in Dep/PPE , so we predict a negative relation between *C_Score* and Dep/PPE .

¹⁸ Specifically, this is the beta from a regression of firm excess returns on an intercept and the contemporaneous market excess return.

We find the correlation between Dep/PPE and C_Score is significantly positive, inconsistent with our prediction. However, this is a univariate result. In the multiple regression tests of Table 9 we include Dep/PPE as well as Dep/PPE \times PPE/Assets as independent variables and find that the marginal effect of Dep/PPE on C_Score is negative as predicted. This clarifies that investment cycle length increases conservatism for firms with a high proportion of fixed assets.

Finally, neither Dep/PPE nor Dep/Assets accurately captures the investment cycle length of intangible assets. This could potentially create an errors-in-variables problem in Table 9 if noise in our investment cycle length proxy is correlated with the regression error term.

6.4. Comparison with other conservatism metrics

We compare C_Score with other measures of conservatism in two ways: (i) contemporaneous association with the Basu coefficient, as illustrated in Table 5; and (ii) predictive ability for the Basu coefficient at horizons of 1, 2 and 3 years, as illustrated in Table 8.

We identify five contenders: (i) C_Score estimated from a rolling 5-year panel, as opposed to annual cross-sectional estimation, and denoted PC_Score; (ii) firm size; (iii) leverage; (iv) the market-to-book ratio, M/B; and (v) the ratio of change in earnings to change in returns, which can be seen as the slope coefficient from an earnings-returns regression using two annual data points. The ratio of change in earnings to change in returns is defined in three different ways as described in the notes to Table 11.

For each contender, we rank firm-years into deciles based on the value of the contender in year t , or $t-1$, or $t-2$ or $t-3$. We then estimate the Basu regression for each decile using year t data, and examine the rank correlation between the contender ranking and the Basu coefficient as was done in Tables 5 and 8. The rank correlations are presented in Table 11.

As the table shows, all three versions of the earnings-returns ratio have very weak contemporaneous association with, and predictive ability for, the Basu coefficient. PC_Score has very strong contemporaneous association with, and predictive ability at all three horizons for, the Basu coefficient. C_Score is almost as good as PC_Score. Size has as strong a contemporaneous association with the Basu coefficient as does PC_Score, but it has weaker predictive ability. Leverage does not have the strongest contemporaneous association or predictive ability. The market-to-book ratio has no significant contemporaneous association with the Basu coefficient, but it has strong predictive ability. Overall, PC_Score appears to have the most stable and strong association with the Basu coefficient at all horizons.

Another firm-year conservatism metric that has been proposed is the Callen et al. (CSH, 2008) conservatism ratio. The CSH metric's contemporaneous association with, and predictive ability for, the Basu coefficient is not known. Hence we are unable to compare the empirical performance of their metric with ours.

Table 11
Rank correlations with the Basu coefficient in year t .

Ranking variable	Ranking year			
	t	$t-1$	$t-2$	$t-3$
PC_Score	0.99 ^c	0.98 ^c	0.95 ^c	0.96 ^c
C_Score	0.95 ^c	0.99 ^c	0.98 ^c	0.89 ^c
Size	-0.99 ^c	-0.95 ^c	-0.89 ^c	-0.81 ^c
Lev	0.65 ^b	0.94 ^c	0.78 ^c	0.84 ^c
M/B	-0.38	-1 ^c	-0.93 ^c	-0.98 ^c
$\Delta\text{Earn}/\Delta\text{Ret}$ (1)	0.15	0.28	-0.02	0.45 ^a
$\Delta\text{Earn}/\Delta\text{Ret}$ (2)	-0.58 ^b	0.45 ^a	-0.09	0.03
$\Delta\text{Earn}/\Delta\text{Ret}$ (3)	-0.09	0.77 ^c	-0.21	0.39

This table shows rank correlations between the decile of the ranking variable and the Basu coefficients for those deciles. The sample consists of 69,767 firm-years with all available data for each year from $t-3$ through t . A superscript of 'c' (b) [a] indicates statistical significance at 1% (5%) [10%]. For example, the first row shows the rank correlations when the ranking variable is PC_Score. The first column entry in this row shows the rank correlation when all firm-years are ranked into deciles of PC_Score _{t} , where PC_Score _{t} is the value of PC_Score in year t . We then run the Basu regression separately for each decile using year t data and report the rank correlation between the PC_Score _{t} decile and the Basu coefficients for those deciles, which is 0.96 in this case. This rank correlation is a measure of the contemporaneous association between the Basu coefficient and PC_Score. The procedure in this case is identical to that used in Table 5 of the paper. The second column entry in the first row shows the rank correlation when all firm-years are ranked into deciles of PC_Score _{$t-1$} , where PC_Score _{$t-1$} is the value of PC_Score in year $t-1$. We then run the Basu regression separately for each decile using year t data and report the rank correlation between the PC_Score _{$t-1$} decile and the Basu coefficient, which is 0.79 in this case. This rank correlation is a measure of the predictive ability of PC_Score in year $t-1$ for the Basu coefficient in year t . The procedure in this case is identical to that in Table 8, Panel A, of the paper. PC_Score is C_Score estimated using rolling 5-year panel regressions, rather than the annual cross-sectional regressions used to estimate C_Score. Size is the natural log of market value of equity. Lev is leverage, defined as long-term and short-term debt deflated by market value of equity. M/B is the market-to-book ratio. $\Delta\text{Earn}/\Delta\text{Ret}$ (1) is the change in earnings divided by change in returns, where change in earnings is $\Delta(\text{Earnings}/\text{lagged market value of equity})$. $\Delta\text{Earn}/\Delta\text{Ret}$ (2) is calculated using $(\Delta\text{Earnings})/\text{lagged earnings}$, or the percent change in earnings, in the numerator. $\Delta\text{Earn}/\Delta\text{Ret}$ (3) is calculated using earnings minus lagged earnings (all unscaled) in the numerator.

6.5. Probability of litigation event study

The Shu (2000) measure of the probability of litigation is a composite of several variables, including two variables, size and leverage, that are also used in estimating C_Score. While it is possible that the event study result on the relation between conservatism and the probability of litigation is mechanical, a number of reasons suggest that this is unlikely to be the case: (i) as shown in Table 8, the C_Score predicts Basu asymmetric timeliness, suggesting C_Score is capturing conservatism; (ii) the fact that the C_Score peaks in the year following the significant increase in ProbLit, rather than peaking contemporaneously, mitigates the likelihood of a mechanical relation; (iii) the Pearson correlation between C_Score and ProbLit is 0.27, while the rank correlation is 0.08. The fact that these correlations are low diminishes the likelihood that the event study result obtains by construction; (iv) the event study results for the bid/ask spread and return volatility are consistent with our hypotheses, even though neither of these variables is used in estimating the C_Score. Overall, we believe it is unlikely that the event study results above are purely mechanical.

6.6. Using C_Score and controlling for inputs to C_Score

Some empirical research on conservatism using C_Score as a dependent or independent variable in a regression may also require controlling for M/B, leverage or size, variables that are also inputs to the C_Score. Failing to control for M/B, size or leverage may result in finding an association between conservatism (measured by C_Score) and the variable of interest where there is no association.

We suggest three options for the researcher. One option is to directly control for size, M/B and leverage as in Louis et al. (2009) where C_Score loads after controlling for these variables. A second option is to use instruments for M/B, leverage or size. For example, if M/B is used to capture the firm's investment opportunity set the researcher could consider using stock return volatility instead, since firms with significant growth options relative to assets in place have more volatile stock returns. Firm age could be used in place of leverage as a control, since older firms have more fixed assets and so are likely to have more debt than younger firms. Book value of assets rather than market value of equity, or even stock return volatility or firm age, could be used in place of size. However, researchers should be mindful that we do not provide evidence on the effectiveness of using such instruments in addressing the problem in question. A third option is to use other conservatism measures in place of C_Score to verify the robustness of the association between conservatism and the variable of interest.

In summary, researchers should be mindful of naive applications of C_Score, and of correlated omitted variable and errors-in-variables problems that may result.

7. Conclusion

We estimate a firm-year measure of financial reporting conservatism, C_Score, provide evidence on its empirical properties as a metric and its predictive ability for future asymmetric timeliness, and illustrate its applications by developing and testing new hypotheses.

Results suggest the C_Score predicts flow conservatism (the Basu asymmetric timeliness coefficient) at horizons of up to 3 years ahead. This predictive ability holds even for samples of firms with positive returns in the year the prediction is made and in the intervening years before the year for which conservatism is predicted. This is an important attribute because the Basu asymmetric timeliness measure cannot be estimated for samples of firms with only positive returns.

The results further suggest that firm-years with higher C_Scores have higher Basu (1997) asymmetric timeliness, more negative ROA and more variable non-operating accruals. Finally, firms with higher C_Scores have the characteristics associated with conservatism, such as higher information asymmetry and probability of litigation, that are predicted by the prior literature.

Cross-sectional hypothesis tests suggest firms with longer investment cycles, higher idiosyncratic uncertainty and higher information asymmetry are more conservative. Event studies suggest conservatism increases contemporaneously with, and subsequent to, large changes in the probability of litigation, information uncertainty and stock return volatility. These results are consistent with conservatism being a response to information asymmetry and litigation, rather than a factor inducing those attributes.

It is important to note some caveats to avoid the mechanical use of C_Score. First, there may a correlated omitted variable problem if C_Score is an independent variable in a multiple regression, and the regression has an important omitted variable that is correlated with C_Score. Second, since C_Score has not been developed here by solving for equilibrium conditions in an analytical model, it is not necessarily the optimal measure of conservatism. Third, since C_Score is motivated from the four Watts (2003a) determinants of conservatism in the US, it may not be an appropriate conservatism measure in studies using data from countries where the institutional features differ from US institutional features in important ways. For example, C_Score may not be an appropriate measure for countries with a weak legal enforcement regime, where contracts are more easily vitiated and litigation (and litigation liabilities) more easily circumvented.

Overall, this paper contributes to the literature by presenting a simple methodology for estimating a firm-year measure of conservatism, and by providing new insights into the nature and effects of conservatism.

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Appendix A. Variable definitions

Earnings is net income before extraordinary items (Compustat data18), scaled by lagged market value of equity ($\text{data25} \times \text{data199}$).

Returns, from CRSP, are annual returns compounded from monthly returns beginning the fourth month after fiscal year end.

Size is the natural log of market value of equity.

M/B is the ratio of market value of equity to book value of equity (data60) at the end of the year.

Lev is leverage, defined as long-term debt (data9) plus short term debt (data34) deflated by market value of equity.

Volatility is the standard deviation of daily stock returns.

NOAcc is non-operating accruals, scaled by lagged assets (data6). Non-operating accruals are measured as net income before extraordinary items, plus depreciation (data14), minus cash flow from operations (CFOA), minus operating accruals, all deflated by lagged total assets (e.g., Givoly and Hayn, 2000). Operating accruals are measured as change in non-cash current assets (data4 minus data1), minus change in current liabilities excluding short-term debt (data4 minus data34), deflated by lagged assets.

CFOA is cash flow from operations, deflated by lagged assets. CFOA is obtained from the statement of cash flows (data308) after 1987, and prior to that is measured as funds from operations (data110) minus operating accruals (e.g., Givoly and Hayn, 2000).

Inv. Cycle is a decreasing measure of the length of the investment cycle, and is defined as depreciation expense deflated by lagged assets.

Problit is the probability of litigation, fitted using the parameters and variables in Table 3 of Shu (2000). Specifically, it is the inverse logit of $\{-10.049 + 0.276(\text{Size}) + 1.153(\text{Inventory}) + 2.075(\text{Receivables}) + 1.251(\text{ROA}) - 0.088(\text{Current Ratio}) + 1.501(\text{Lev}) + 0.301(\text{Sales growth}) - 0.371(\text{stock return}) - 2.309(\text{stock volatility}) + 0.235(\text{beta}) + 1.464(\text{stock turnover}) + 1.060(\text{Delist dummy}) + 0.928(\text{Technology dummy}) + 0.463(\text{Qualified opinion dummy})\}$.

PIN is the probability of informed trading from Easley et al. (2002), obtained from the website of Soeren Hvidkjaer (<http://www.smith.umd.edu/faculty/hvidkjaer/data.htm>).

Bid-Ask is the bid-ask spread scaled by the midpoint of the spread, obtained from CRSP. The bid-ask spread for a firm-year is the average of the daily spreads for that firm-year.

Age is the age of the firm in a given year, measured as the number of years with return history on CRSP.

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