Fair Value Accounting for Liabilities and Own Credit Risk

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1. Introduction

Credit risk measures reflect common, priced risk factors that influence both debt and equity returns. Higher credit risk levels are associated with higher expected equity returns (Vassalou and Xing, 2004). Unexpected increases in credit risk are associated with negative realized equity returns (Holthausen and Leftwich (1986). We refer to these established first-order effects as "direct." The objective of this study is to empirically test whether changes in equity value also reflect attenuating gains and losses associated with changes in debt value that arise from changes in credit risk. Merton (1974) establishes these second-order effects theoretically; however, empirical evidence is lacking.

Our research question is relevant to the use of fair value accounting for liabilities, which would include recognizing in income, what some view as anomalous effects on equity value of credit risk changes. In particular, we test whether increases (decreases) in credit risk are associated with incremental increases (decreases) in equity values, after controlling for the direct effects of risk changes on equity values. Because fair value accounting for liabilities, if adopted, would apply to all firms, we conduct our tests on a broad sample of primarily solvent firms.[1] We also calculate and provide descriptive evidence relating to the effects on firms' financial statements of recognizing changes in debt value.

Changes in credit risk may arise when either the value or the risk of the firm's assets changes.[2] Merton (1974) shows that changes in equity value occasioned by changes in asset value and changes in asset risk can be characterized into potentially countervailing direct and

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[1] For ease of exposition, we discuss *increases* in equity value associated with *decreases* in debt value arising from *increases* in risk. However, the same arguments, and our empirical tests, also apply to *decreases* in equity value associated with *increases* in debt value arising from *decreases* in risk. We use the term solvent to mean that the value of the firm's assets exceeds the book value of its debt.

[2] Changes in credit risk also can arise from changes in financing risk, i.e., leverage, that are unrelated to changes in the value of operating assets. Our analysis holds the face value of debt constant.

indirect effects. The direct effect of changes in asset value comprises the one-to-one mapping between asset value and equity value that exists in the absence of debt. The direct effect on equity value of increases in asset risk is negative or zero. It is negative if the risk is systematic and decreases asset value; it is zero if the risk is unsystematic and not priced. The indirect effects of changes in asset value and asset risk are countervailing and comprise the amount of any asset value change that is absorbed by debt holders, plus the change in debt value associated with changes in asset risk.

Merton (1974) predicts that debt value changes with asset value, despite the maintained assumption that debt has priority over equity. This prediction applies even to solvent firms because priority at liquidation of the debt does not imply that debt holders have first claim on asset value before liquidation. Thus, debt holders participate in changes in asset value, even when asset value is more than sufficient to liquidate the debt. Merton (1974) also predicts that debt value decreases with unanticipated increases in asset risk. Because equity value equals asset value minus debt value, decreases in debt value result in increases in equity value. Therefore, the indirect effect on equity value of increases in asset risk is positive. Figure 1 summarizes the direct and indirect effects of asset value and risk changes on equity. Figure 1 shows that debt in the capital structure attenuates both the effects of asset value changes and risk changes.

Although there is abundant evidence that debt and equity prices respond directly to changes in credit risk, we empirically test the second-order predictions of the Merton (1974) model because prior studies do not document gains (losses) to equity holders from decreases (increases) in debt values across a broad sample of solvent firms. Generalization of results from existing studies examining wealth transfers between debt and equity holders is limited by their small sample sizes and selective contexts. Analytically, Merton (1974) does not consider the effects of institutional features such as market inefficiencies or debt covenants, either of which could limit equity holders' ability to realize pre-liquidation gains from decreases in debt value in real markets. As well, because Merton (1974) shows that the indirect effect on equity value of risk increases decrease with solvency, the effect might be negligible for many firms. Thus, tests based on a broad sample of primarily solvent firms provide insight into the importance of the effect for most firms.

Understanding how changes in credit risk affect the values of debt and equity is critical to the debate about using fair value accounting for liabilities. The conceptual frameworks of the Financial Accounting Standards Board (FASB) and the International Accounting Standards Board (IASB) provide for income recognition of gains and losses arising from changes in the recognized amount of debt. Thus, if debt is recognized at fair value, firms will recognize gains (losses) when the fair value of debt decreases (increases). This is counterintuitive to some and has generated controversy relating to financial reporting for liabilities.[3] Also, assets and liabilities are accounted for using different conventions. To the extent that recognized decreases in debt value are not offset by recognized decreases in asset value, firms with deteriorating credit quality will recognize net gains. Concern about recognizing such gains is the primary reason the European Commission endorsed International Accounting Standard (IAS) 39 (IASB, 2003) for use by European firms only after deleting the option for firms to use fair value accounting for financial liabilities. The European Commission did not delete the corresponding option for financial assets.

[3] This effect also runs counter to the traditional financial statement analysis view that leverage exacerbates the effect on equity return of realized return on assets (ROA). A realized ROA higher (lower) than the cost of debt, increases (decreases) realized return on equity. However, this obtains unambiguously only if the cost of debt is not equal to the total return on debt (ie. the cost of debt excludes changes in the value of debt).

We focus our study on documenting empirically the indirect effect on equity value of increases in risk. Thus, we test the prediction that the decrease (increase) in equity value associated with an increase (decrease) in risk is mitigated to the extent of debt in the firm's capital structure, i.e., the firm's leverage. Specifically, our tests focus on the relation between annual equity returns and the interaction between risk changes and leverage. Our proxy for change in risk is change in estimated bond rating. Bond ratings reflect bond rating agencies' assessments of total credit risk; higher bond ratings reflect more risk. Risk changes interacted with leverage provides a link between equity returns and debt values. If equity market value changes are associated with debt value changes, the relation between equity returns and change in risk will depend on leverage.

Holthausen and Leftwich (1986) finds that equity returns are negatively associated with bond rating changes; we expect the same relation. However, we expect that equity value also reflects benefits associated with decreases in debt value. Thus, we predict that the interaction between leverage and change in credit risk is positive. We include earnings, change in earnings, and the level of leverage as control variables in our estimation equations. We expect equity returns to be positively related to earnings and changes in earnings; we do not predict the sign of the association with leverage.

Consistent with our predictions, we find that the association between change in equity value and change in risk is significantly less negative when leverage is higher. Because of potential nonlinearities, we also estimate the relation separately for firms with credit downgrades and upgrades. We find that downgraded firms have significant negative equity returns, after controlling for leverage, earnings, and changes in earnings. More importantly for our research question, we also find, as predicted, that returns are significantly less negative when leverage is higher. As predicted, we find the opposite for upgraded firms – although their equity returns are incrementally significantly positive, returns are significantly less positive when leverage is higher. We also permit the estimation relation to differ depending on whether the upgrade or downgrade is within investment grade, between investment grade and non investment grade, or within non investment grade. We find a significant positive relation between returns and change in credit risk interacted with leverage for each group, except for downgrades within investment grade.

Because change in credit rating reflects asset value changes as well as asset risk changes, we test separately whether changes in equity cost of capital and changes in expected future cash flows are attenuated by debt in the capital structure. This design allows us better to separate the effects of risk from the effects of asset value changes. Consistent with our primary results, we find that leverage interacted with change in risk attenuates the effects of asset value changes and of asset risk changes.

To provide a more direct link between changes in equity value and changes in debt value associated with changes in credit risk, we estimate the change in debt value incident to the change in firm's credit ratings and use it in our estimating equation in lieu of the risk change and leverage interaction variable. The change in debt value we calculate results from the change in market interest rate associated with the change in the firm's estimated bond rating over the maturity of the firm's debt. Consistent with our primary findings, we find that the gain or loss to equity holders from the calculated debt value changes is significantly positively associated with equity returns.

We supplement our primary analyses by providing descriptive evidence on the financial statement effects of fair value accounting for debt by using observed stock prices and volatility to invert the Merton (1974) model to obtain estimates firms' asset volatility, asset value, and debt value.[4] As expected, if only unrecognized changes in debt value are recognized, most upgrade firms would recognize lower net income and most downgrade firms would recognize higher net income than under current accounting rules. Yet, for most firms, the difference is not large enough to change the sign of net income. Also, our evidence indicates that for downgrade firms, asset write-downs recognized in accordance with present accounting standards are larger than unrecognized gains from decreases in debt value. These findings call into question concerns about anomalous income effects that are predicated on the assumption that debt value decreases exceed recognized contemporaneous asset value decreases.

The paper proceeds as follows. Section 2 elaborates on the background, motivation, and related research that underlie the study. Section 3 describes the basis for our prediction of the relation between equity returns and change in risk, and the research design we use to test it. Section 4 presents the primary findings, and section 5 presents results from additional analysis. Section 6 presents results relating to the financial statement effects of using fair value accounting for debt, and Section 7 offers concluding remarks.

2. Background, motivation, and related research

2.1. Risk, debt values, and equity values

Debt holders demand compensation commensurate with the level of risk they assume. Thus, changes in credit risk subsequent to debt contracting can affect the value of debt. The value of debt changes when the market interest rate commensurate with the new level of risk differs from the rate determined at the inception of the debt. A large body of finance literature

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[4] We validate these estimates by estimating the relation between equity returns and changes in estimated asset value and asset volatility, and the interaction between each of these and leverage. As expected, we find change in asset value is positively associated with equity returns. Consistent with our primary findings, we also find the relation

focuses on explaining changes in debt values, particularly variation in observed credit premiums across traded bonds with different default risk. However, little of this research addresses empirically the interrelation between debt and equity value changes. Thus, the empirical validity of Merton's (1974) predictions of equity gains from debt value decreases remains largely unexplored.

Structural debt valuation models are based on Merton's (1974) insight that equity can be viewed as a call option on the value of underlying assets with a strike price equal to the face amount of the outstanding debt. These models specify default risk and debt prices as a function of operating risk attributable to assets, financial risk attributable to leverage, and the term of the debt (e.g., Duffee, 1996, 1998; Duffie and Singleton, 1999; Huang and Huang, 2003; see Bohn, 2000, for a review of this literature).[5] Related to the effects on debt value of *changes* in default risk, Strong (1990) investigates changes in debt value associated with changes in bond rating for a sample of 190 firms in 1983. Strong (1990) seeks to distinguish changes in debt value associated with changes in firm risk from those associated with changes in market risk, and finds that both explain debt value changes. However, this literature does not attempt to link debt value changes and equity value changes.

The first-order effect on equity value of changes in default risk is well-established. Holthausen and Leftwich (1986) and Hand, Holthausen, and Leftwich (1992) investigate changes in equity value associated with announcements of bond rating changes. These studies find that

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between equity returns and change in asset value (asset volatility) is significantly less (more) positive when leverage is higher.

[5] We use the term "credit risk" to describe unobservable factors that determine the risk premium on debt at any point. Because we assume that contractual debt cash flows do not change prior to maturity, declines in debt value must derive from increases in credit risk. The terms "credit risk", "default risk', "firm risk", and "total risk" often are used interchangeably in the finance and accounting literatures that we cite. For the most part, these terms are consistent with our usage of "credit risk." One exception is term "default risk" which may be more narrowly construed. Specifically, although all firms have credit risk, some authors argue that only firms with non-zero debt have default risk (Dhaliwal, Lee and Fargher, 1991).

debt and equity returns decrease with bond rating downgrades, consistent with bond rating downgrade announcements conveying net negative information both to debt and equity markets. Dichev and Piotroski (2001) finds that negative abnormal equity returns persist for up to three years following bond rating downgrades and attributes this persistence to the market underreaction. However, Vassalou and Xing (2003) shows that these future abnormal returns largely disappear after taking account of serial downgrades and the variation in default risk around downgrades.

Relatedly, Ederington and Goh (1998) finds that analysts decrease earnings forecasts following downgrades and attributes this finding to information transfer from debt rating agencies to equity analysts. Consistent with credit risk comprising common factors that influence debt and equity returns, Vassalou and Xing (2004) shows that a large portion of default risk is systematic and, thus, priced in equity value. However, none of these studies examines the potential attenuating effects of debt value changes on equity value changes when common factors cause both to change.

A few studies examine the interrelation between change in debt value and change in equity value. In a unique institutional setting, Kliger and Sarig (KS, 2000) examines changes in stock and bond prices incident to Moody's 1982 adoption of finer rating partitions. KS finds significant decreases in bond prices for firms with implied downgrades, but does not consistently find significant increases for firms with implied upgrades. The significance of equity returns by rating change group depends on the specification; KS finds no positive abnormal equity returns to downgrades when basing expected returns on a market model. Hand, Hughes, and Sefcik (HHS, 1990) investigates whether bond holders gain at the expense of stock holders when firms defease debt in substance, but not legally, for a sample of 80 defeasances by 68 firms from 1981 to 1987. For a subsample of these firms with announcement data, HHS finds significant positive bond returns at the announcement of the defeasances and significant negative stock returns. However, the negative correlation between bond returns and stock returns is weak. After also investigating motivations for the defeasances, HHS concludes that the negative announcement stock returns are more likely attributable to information effects than to increases in debt values resulting from decreases in equity values. Each of these studies provides suggestive results, however the uniqueness of the settings and small sample sizes limit generalizability.

Another related stream of research examines whether debt attenuates the response of equity to earnings announcements. [6] Dhaliwal, Lee, and Fargher (1991) show that firms with higher leverage have lower earnings response coefficients (ERC) and posit that equity holders in more highly levered firms receive a smaller share of the change in firm value associated with unexpected earnings. Dhaliwal and Reynolds (1994) shows that ERCs are negatively related to default risk measured by bond rating level. Dhaliwal, Lee, and Fargher (1991) suggests that future research can enhance the tests relating to the effects on equity value of changes in asset value by using changes in default risk proxies, rather than levels. These studies establish the effect of risk level on equity's response to reported GAAP earnings; we examine the effect of leverage on equity's response to credit risk changes.

2.2. Fair value accounting for debt

The FASB has identified fair value as the most relevant measurement attribute for financial instruments and has indicated that recognition of all financial instruments at fair value

[6] Another stream of research links debt value and equity value by simulating the potential magnitude of agency costs arising from risk-taking incentives identified in Merton (1974), for example, Parrino and Weisbach (PW, 1999). Analytic analysis and simulations such as those in PW suggest that the agency costs can be substantial. However, PW assumes the Merton (1974) model when constructing simulated debt value, and, it cannot test the model's predictions. Empirically, Odders-White and Ready (OR, 2006) finds that firms with lower credit ratings have higher adverse selection components in their equity spreads, suggesting that agency costs are priced in expected equity as

is one of its long-term goals (FASB, 1999). Fair value measurement is permitted in US and International GAAP for many financial assets (e.g., Statement of Financial Accounting Standard (SFAS) No. 133 and IAS 39). However, fair value measurement of liabilities is not widespread. SFAS 133 and IAS 39 require derivative liabilities to be recognized at fair value, but require or permit firms to recognize at historical cost other liabilities, including long-term debt.

Fair value recognition of liabilities, particularly long-term debt, is a controversy currently facing standard setters. Many believe that recognition of liabilities at fair value is consistent with adoption of a fair value measurement basis for assets. A large body of research supports the notion that both reported income and its volatility better reflect market and other risks when financial firms recognize financial assets and liabilities at fair value (see, e.g., Barth, Landsman, and Wahlen, 1995; Hodder, Hopkins, and Wahlen, 2006).

However, others find the prospect of recognizing changes in debt fair value disturbing. They are particularly concerned about financial reporting implications if changes in debt value related to changes in the firm's own risk are recognized. For example, the European Central Bank has called the recognition of gains associated with increases in risk "counterintuitive" (European Central Bank, 2001). The European Commission's endorsement of IAS 39 for use by European firms eliminated the fair value recognition option for financial liabilities. The concern stems from the potential for net income to reflect poorly changes in the value of the firm's net assets if decreases in asset values are not recognized concurrently with decreases in debt values. For example, if some intangible assets are not recognized, troubled firms could report net income

well as debt. However, OR does not test the relation between changes in debt value and changes in equity value incident to unexpected increases in risk or decreases in asset value.

from recognized decreases in debt value during periods in which they experience decreases in equity value.[7]

Lipe (2002) demonstrates how accounting ratios might convey misleadingly positive signals when a firm approaching bankruptcy uses fair value accounting for liabilities. Lipe (2002) concludes that changes in debt value attributable to changes in credit quality should not be recognized. However, the adverse financial statement effects of Lipe's (2002) example primarily derive from incomplete recognition of assets and changes in asset values, not from the pro-forma recognition of changes in debt value.

Balance sheet and income statement recognition of risk effects at inception is not controversial. Both the carrying value of debt and recognized interest expense reflect debt's credit rating when issued. In contrast, fair value accounting measures and recognizes contemporaneously the effects of any changes in risk or market interest rates. Barth and Landsman (1995) notes that recognizing these changes is appropriate because debt holders have committed to an interest rate that is not commensurate with the ex post level of risk. Fair value accounting recognizes subsequent interest expense at the new rate, reflecting the change in the debt holders' required compensation. The promised stream of cash flows is unchanged and, cumulatively, only the characterization of income cash flows between gain or loss and interest expense changes. Fair value accounting ensures that periodic interest expense reflects the current cost of borrowing and excludes the benefits (costs) of below-market (above-market) borrowing resulting from prior-period debt transactions.

[7] When risk decreases, increases in asset values often are not recognized. Yet, if debt is recognized at fair value, increases in debt value would be recognized as losses. When risk increases, the opposite occurs. Recognized assets may be written down. However, not all assets are recognized and asset write-downs may not be complete or timely. Because debt values are less sensitive to decreases in risk than to increases, the latter problem is more troublesome to regulators than the former.

Although there is a substantial literature addressing the value-relevance of fair values for equity prices and returns, few of these studies examine fair values of liabilities in industries other than banking and insurance. Banking industry studies consistently demonstrate the value-relevance of asset fair values and to a lesser extent, deposit liabilities and long-term debt fair values. For example, Barth, Beaver, and Landsman (BBL, 1996) finds that unrealized gains and losses on bank long-term debt are significantly associated with the difference between equity market value and book value, although not in all model specifications and years. BBL finds no significant association between changes in unrecognized unrealized gains and losses on long-term debt and changes in the difference between equity market value and book value. Eccher, Ramesh, and Thiagarajan (1996) and Nelson (1996) find no association between equity value and long-term debt fair value. For a sample of non-financial firms, Simko (1999) finds that liability fair values are associated with equity values, but not consistently across industries and years. Barth, Landsman, and Rendleman (BLR, 1998) estimates debt values for a sample of non-financial firms and investigates the financial statement effects of fair value accounting for debt. BLR finds that financial statement amounts using fair value accounting for debt are potentially relevant to investors because financial statement amounts would be substantially different from those currently recognized. However, none of these studies investigates the effects of changes in credit risk on the value of the firm's debt and equity.

3. Basis for prediction and research design

3.1. Basis for prediction

We expect the effect on equity value of changes in credit risk to depend on the amount of debt in the capital structure. Merton (1974) shows that changes in equity value reflect two countervailing effects, a direct effect and an indirect effect. The direct effect is a function of changes in asset value; equity value decreases as asset value decreases. Changes in asset risk affect asset value only to the extent that the risk is systematic and the change is unanticipated. As such risk increases, asset value and, thus, equity value, decreases. Changes in unsystematic risk have no effect on asset value and, thus, have no direct effect on equity value. Thus, in the absence of debt, increases in risk have no positive direct effects on equity.

The indirect effect of risk on equity value is a function of factors that affect the value of debt, including leverage, asset value, and asset risk. Holding leverage constant, the indirect effect comprises the amount of asset value change that is absorbed by debt holders plus the change in debt value associated with changes in asset risk. Merton (1974) predicts that, despite assuming priority of debt over equity, debt value is increasing in asset value, even for solvent firms. Specifically, the value of levered equity is a convex function of asset value with a slope that approaches one only in the limit. This suggests that debt value varies with asset value, thereby mitigating the effect on equity value of changes in asset value. Merton (1974) also predicts that debt value decreases with increases in systematic and unsystematic asset risk. Because equity value equals asset value minus debt value, changes in debt value result in changes in equity value, even when asset value is unchanged.

The indirect effects are those that some view as counterintuitive. Thus, we test the prediction that the decrease (increase) in equity value associated with an increase (decrease) in credit risk is mitigated to the extent of debt in the firm's capital structure.

3.2. Research design: Returns and risk changes

We estimate in Eq. (1) the relation between equity returns and change in credit risk.

$$\begin{aligned} RET_t = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 EPS_t + \beta_5 \Delta EPS_t \\ + \beta_6 NEG_t + \beta_7 NEG_t \times EPS_t + \beta_8 NEG_t \times \Delta EPS_t + \varepsilon_{1t} \end{aligned} \qquad (1)$$

RET is annual size-adjusted stock return, inclusive of dividends. *DBTA* is the end-of-year ratio of book value of long-term debt to book value of total assets. *EPS* is earnings per share before extraordinary items, deflated by beginning-of-year stock price. *NEG* is an indicator variable that equals one if *EPS* is negative, and zero otherwise. Δ denotes change and t denotes year; we omit firm subscripts. We use only accounting-based explanatory variables in equation (1) to avoid endogeneity associated with changes in market values.

ΔCR is the annual change in our proxy for credit risk, *CR*, where *CR* is a categorical variable that ranges from 1 denoting low risk to 4 denoting high risk. Thus, ΔCR is positive (negative) when credit risk increases (decreases). *CR* is the firm's bond rating, which we estimate based on the relation between actual bond ratings for firms with rated debt and accounting variables. The appendix explains how we follow prior research to do this. We use actual bond ratings to develop *CR* because bond ratings reflect the credit agency's assessment of the firm's risk, where that assessment is based on publicly available and private information (Jorion, Liu, and Shi, 2004). For consistency, we use estimated bond ratings to construct *CR* for all firms. Using estimated bond ratings permits us to expand our sample beyond firms with rated debt, thereby enhancing the generalizability of our inferences. Also, bond ratings, especially upgrades, are revised with a lag (e.g., Pinches and Singleton, 1978), which adds noise when observed bond rating changes are used as proxies for changes in risk.[8]

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[8] Our inferences about the interaction between credit risk and leverage are unaffected by the use of alternative measures of credit risk changes, including actual bond rating changes. See table 5 and footnote 24. Hillegeist, Keating, Cram, and Lundstedt (HKCL, 2004) estimates probability of default using asset value and asset risk estimates obtained from inverting the Merton (1974) model. Because their model uses stock prices as inputs, the HKCL probability of default estimates are endogeneous in Eq. (1). Thus, we do not use them in our tests. In section 6.2, we present findings from estimating a relation analogous to Eq. (1) using asset value and asset risk estimates obtained from the Merton (1974) model. Our inferences from that specification are the same as those we obtain from Eq. (1).

For our research question, the key variable in Eq. (1) is $\Delta CR \times DBTA$. Including it in Eq. (1) permits us to establish a link between leverage and increases (decreases) in equity value associated with increases (decreases) in credit risk. Credit risk comprises factors giving rise to the risk premium on debt. Prior research (Dhaliwal, Lee and Fargher, 1991) uses leverage to proxy for default risk. In our analysis, we include credit risk explicitly, and use leverage to measure the quantity of debt outstanding. Therefore, $\Delta CR \times DBTA$ proxies for the change in debt value incident to the bond rating change.[9] We predict that its coefficient, β_2, is positive because the more debt in the firm's capital structure, the greater the change in debt value and the less equity holders lose when asset value decreases or asset risk increases (the less equity holders gain when asset value increases or asset risk decreases).

Based on prior research (e.g., Holthausen and Leftwich, 1986), we predict β_1 is negative. We do not predict the sign of β_3; we include leverage in Eq. (1) because we interact it with *DBTA*.[10] We include *EPS* and ΔEPS in Eq. (1) because of the extensive research documenting a positive relation between returns and earnings and change in earnings; we predict β_4 and β_5 are positive. Including *NEG*, $NEG \times EPS$, and $NEG \times \Delta EPS$ in Eq. (1) permits the relation to differ for firms with negative earnings (Hayn, 1995; Barth, Beaver, and Landsman, 1998); we predict β_7 and β_8 are negative. Note that each control variable likely comprises part of the information set leading to credit risk changes and can be interpreted as a proxy for change in asset value or

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[9] As noted above, we use *DBTA* as our leverage measure because it is based on the book values of debt and assets and, thus, is largely unaffected by changes in debt and asset values Consistent with this, untabulated findings reveal that our inferences are unaffected by using $DBTA_{t-1}$ in place of $DBTA_t$ in Eq. (1).

[10] Returns may be correlated with change in leverage. However, change in *DBTA* is reflected in ΔCR through estimation of Eq. (A1). Also, untabulated statistics reveal that changes in *DBTA* are close to zero for most firms – the upper (lower) decile of $\Delta DBTA$ is 0.09 (–0.07). Inferences from an untabulated estimation of Eq. (1) eliminating observations with the highest and lowest 1% $\Delta DBTA$ are the same as those from the results we tabulate.

risk. Thus, including these variables in Eq. (1) enhances our interpretation of $\Delta CR \times DBTA$ as capturing changes in returns associated with changes in debt value.

We estimate Eq. (1) pooling all firms with year and industry fixed effects, defining industries following Barth, Beaver, and Landsman (1998). To mitigate the effects of influential observations, we estimate Eq. (1) using Huber-M estimation, which minimizes a less rapidly increasing function of the regression residuals than OLS.[11]

Merton (1974) predicts that the sensitivity of equity value of asset value changes decreases as asset value increases. Therefore, we also estimate Eq. (1) separately for firms with credit upgrades and downgrades. To investigate the potential for additional nonlinearities, we further partition firms based on whether the upgrade or downgrade is within investment grade, between investment grade and non investment grade, or within non investment grade. This effectively controls for the initial bond rating, as well as clientele effects.[12]

4. Data and findings for relation between changes in risk and equity returns

4.1. Data and sample

Fair value accounting for liabilities would apply to all firms, regardless of financial condition. Thus, we construct our sample to comprise a broad cross-section of primarily solvent firms. In particular, we begin with all firms with available data on Compustat for 1986-2003.[13] We eliminate firms in the utilities, financial services, and real estate industries because their capital structures markedly differ from those of other firms. To mitigate the effects of outliers, we eliminate firms for which the absolute value of EPS_t, EPS_{t-1}, or ΔEPS_t is greater than 1.5

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[11] Our inferences are unaffected if we use OLS estimation. We also obtain similar inferences if we base our test statistics on standard errors that are clustered by firm, which controls for heteroskedasticity and intertemporal firm-specific dependence in regression residuals.

[12] Results are qualitatively similar when initial bond rating is used in lieu of investment grade.

[13] The sample period begins in 1986 because Compustat does not include bond ratings before 1985, and two years are necessary to calculate change in risk.

(Easton and Harris, 1991) and firms with *RET* in the extreme 1 percentile of the observations (Kothari and Zimmerman, 1995; Collins, Maydew, and Weiss, 1997; Fama and French, 1998; Barth, Beaver, Hand, and Landsman, 1999; among others). To mitigate undue effects of very small firms, we also eliminate firms with total assets or sales less than $10 million, or share price less than $1.[14] The final sample comprises 50,297 firm-year observations, of which 11,799 have Compustat bond ratings. Data limitations reduce the sample size for some additional analyses.

We obtain all data from Compustat, except for stock market data, which we obtain from CRSP. The bond ratings on Compustat are Standard & Poors' Issuer Credit Rating.[15] *RET* is each firm's size-adjusted annual buy-and-hold return, computed as the firm's return compounded over twelve months minus the corresponding compounded size decile return associated with the firm's market value of equity at the beginning of the year.[16]

4.2. Descriptive statistics

Table 1 presents descriptive statistics for the variables in Eq. (1). Panel A presents distributional statistics, panel B presents correlations between the variables, and panel C presents the industry composition of the sample. Panel A reveals that sample firms have negative (positive) mean and median *RET* (*EPS* and *ΔEPS*). Although the median risk change, *ΔCR*, is zero, the mean is positive, indicating that, on average, risk increases. Table 1, panel A, also shows that the mean long-term debt-to-total asset ratio, *DBTA*, is 19% and that 25% of the sample firms have negative *EPS*.

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[14] Our inferences are unaffected if we include all firms in our tests.

[15] Beginning September 1, 1998, Standard & Poor (S&P) bond ratings reflect the firm's overall creditworthiness, apart from its ability to repay individual obligations. It focuses on the firm's capacity and willingness to meet its financial commitments of more than one year as they come due. Prior to this date, the rating is the firm's senior debt rating. It is an assessment of the creditworthiness with respect to long-term debt not subordinate to any other long-term debt. Typically, the rating is for the firm's highest senior issue. If a firm does not have senior debt, it is an implied senior rating. Our inferences are the same before and after this change.

[16] Consistent with Fama and French (1992) and Jegadeesh (1992), our inferences are unaffected by using beta-adjusted returns. However, using beta-adjusted returns noticeably reduces our sample size.

Panel B of table 1 reveals that *RET* is negatively correlated with *ΔCR* (Pearson correlation is –0.20 and Spearman correlation is –0.21), which is consistent with prior research and with *ΔCR* reflecting changes in asset value. As expected based on prior research, *RET* is positively related to *EPS* and *ΔEPS*. *RET* is negatively related to *DBTA*. Other correlations in panel B also are consistent with expectations. For example, the correlations between *EPS* and *ΔEPS* are positive, and those between *ΔCR* and *EPS* and *ΔEPS* are negative. The negative association between *ΔCR* and *EPS* (*ΔEPS*) is equivalent to a positive association between changes in asset value and *EPS* (*ΔEPS*), which is consistent with current earnings reflecting at least a portion of asset value changes. The correlations between *ΔCR* and *DBTA* are significantly positive, consistent with downgrade firms having higher leverage.[17] *NEG* is negatively correlated with *RET*, *EPS*, and *ΔEPS*, and positively correlated with *ΔCR* and *DBTA*. All tabulated correlations other than the Spearman correlation between *EPS* and *DBTA* are significantly different from zero. However, we base our inferences on the multivariate relations in Eq. (1) and focus on the interaction between *ΔCR* and *DBTA*.

Table 1, panel C, reveals that Durable Manufacturers is the most represented industry, comprising 29.37% of the sample. Retail and Computers are the second and third most represented, comprising 14.54% and 14.33% of the sample. These percentages reflect the industry composition of the Compustat population. Untabulated statistics reveal that the industry composition of firms with rated debt is similar to that in panel C.

4.3. Primary findings

Table 2 presents regression summary statistics from estimating Eq. (1). As predicted, it reveals that the relation between change in risk and equity returns is less negative for firms with

[17] We use the term significance to denote statistical significance at less than the 0.05 level, based on a one-sided test

more leverage. In particular, the first set of columns in panel A reveals that the coefficient on *ΔCR*×*DBTA* is significantly positive (coef. = 0.17, t = 9.21). This indicates that changes in debt value are oppositely associated with changes in equity value. In particular, when risk increases, equity value increases by an amount that depends on the extent of debt in the capital structure. Also as predicted, the coefficient on *ΔCR* is significantly negative (coef. = –0.10, t = –18.74), those on *EPS* and *ΔEPS* are significantly positive (coefs. = 1.90 and 0.42, t = 72.79 and 25.91), and those on *NEG*, *NEG*×*EPS*, and *NEG*×*ΔEPS* are significantly negative (coefs. = –0.12, –1.81, and –0.27, t = –23.90, –57.68, and –12.69).

To compare the magnitudes of the effects of risk changes and leverage, the second set of columns in panel A presents summary statistics from estimating a version of Eq. (1) using a ranked *DBTA* variable. The *DBTA* variable is the decile rank of *DBTA*, scaled to be between zero and one. Specifically, we place firms in portfolios 0 to 9 with portfolio 9 comprising firms with the largest *DBTA*, and divide these portfolio ranks by nine. This permits us to interpret β_1 as the magnitude of the relation between change in risk and equity returns for firms with lowest *DBTA*. The sum of β_1 and β_2 is the magnitude for firms with highest *DBTA*.

Results of the rank regression in the second set of columns in panel A are consistent with predictions and those in the first set of columns. Most importantly, the coefficient on *ΔCR*×*DBTA* is 0.10 and is significantly different from zero (t = 9.04). Of note is that the sum of β_1 and β_2 is –0.02 (–0.12 + 0.10), which significantly differs from zero. This indicates that for highly levered firms, the increase in equity value associated with a decrease in debt value offsets most but not all of the decrease in equity value resulting from a decrease in asset value.

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when we have signed predictions and a two-sided test otherwise.

Our primary findings are based on pooled estimates of Eq. (1) with year and industry fixed effects, and the relations could exhibit differences across years and industries that are not captured by mean effects. However, untabulated findings reveal that this is not the case. Separate-year estimation results in coefficients on *ΔCR×DBTA* that are positive in all 18 years; the Z1 and Z2 statistics are 9.75 and 7.46. Separate-industry estimation results in coefficients on *ΔCR×DBTA* that are positive in all 11 industries; the Z1 and Z2 statistics are 7.00 and 3.85.[18] All other results are consistent with those in table 2.[19]

To investigate whether our findings differ for firms with credit upgrades and downgrades, we estimate Eq. (1) permitting the coefficients on *ΔCR* and *ΔCR×DBTA* to vary with the sign of the risk change. Consistent with the findings in table 2, panel A, the findings in the first set of columns in table 2, panel B, reveal that *ΔCR* is significantly negatively related to *RET* for credit downgrades, *DN×ΔCR*, and upgrades, *UP×ΔCR*, (coef. = –0.08; t = –10.09 for downgrades; coef. = –0.13; t = –15.46 for upgrades). Thus, downgrades (upgrades) have significant negative (positive) incremental returns. More importantly for our research question, the first set of columns in panel B also reveals that the relation between credit downgrades (upgrades) and returns is less negative (positive) for firms with more leverage. In particular, the coefficient on *ΔCR×DBTA* is significantly positive for firms with credit downgrades, *DN×ΔCR×DBTA*, and upgrades, *UP×ΔCR×DBTA*, (coef. = 0.15; t = 6.40 for downgrades; coef. = 0.18; t = 4.98 for

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[18] Z1 equals $(1/\sqrt{G})\sum_{j=1}^{G}(t_j/\sqrt{k_j/(k_j-2)})$, where G is the number of groups, t_j is the t-statistic on the estimated coefficient for firm j, and k_j is the degrees of freedom for firm j. Z2 equals (mean t) / (std deviation t / $\sqrt{(G-1)}$) (see White, 1980; Bernard, 1987).

[19] Our inferences also are unchanged when we measure leverage as the ratio of total liabilities to assets rather than as the ratio of long-term debt to assets and when we eliminate observations with negative book value of equity. Our tabulated findings include firms with zero debt because these firms have credit risk associated with their asset value and asset risk. However, our inferences are unchanged when we eliminate firms with zero debt.

upgrades). Untabulated findings based on the ranked *DBTA* specification reveal the same inferences.[20]

Findings from estimating Eq. (1) further partitioning firms based on the type of risk change are in the second set of columns in table 2, panel B. As the appendix notes, bond rating groups 1, 2, 3, and 4 comprise firms with ratings of AAA to A–, BBB+ to BBB–, BB+ to BB–, B+ to D, respectively. The first two groups comprise investment grade debt; the second two comprise non investment grade. In table 2, panel B, DN^{INV} equals one for firms that are downgraded from the highest credit group, $CR = 1$, to the second highest, $CR = 2$, and zero otherwise. Thus, firms with $DN^{INV} = 1$ are downgraded within investment grade. DN^{ACR} equals one for firms that are downgraded from group 1 or 2 to group 3 or 4, and zero otherwise. Thus, firms with $DN^{ACR} = 1$ are downgraded from investment grade to non investment grade. DN^{NINV} equals one for firms that are downgraded from group 3 to group 4, and zero otherwise. Thus, firms with $DN^{NINV} = 1$ are downgraded within non investment grade. UP^{INV}, UP^{ACR}, and UP^{NINV} are analogously defined. $UP^{INV} = 1$ for firms are those that are upgraded within investment grade, $UP^{ACR} = 1$ for firms are those that are upgraded from non investment grade to investment grade, and $UP^{NINV} = 1$ for firms are those that are upgraded, within non investment grade.

The second set of columns in table 2, panel B, reveals that our inferences extend to almost all levels of credit risk change. The coefficients on $\Delta CR \times DBTA$ interacted with DN^{ACR}, DN^{NINV}, UP^{INV}, UP^{ACR}, and UP^{NINV} are significantly positive, as predicted (t ranges from 1.66 to 5.27). The coefficient on $DN^{INV} \times \Delta CR \times DBTA$ is positive, as predicted, but not significantly so (t = 0.39). These findings indicate that all levels of risk changes, except downgrades within

[20] That the tabulated coefficient for downgrades (0.15) is smaller than that for upgrades (0.18) appears inconsistent with predictions from Merton (1974). However, the untabulated coefficient for downgrades from the ranked *DBTA* specification, 0.10, is larger than for upgrades, 0.06.

investment grade, are significantly related to equity value changes associated with debt value changes.[21]

5. Additional analyses

5.1. Estimates of changes in long-term debt fair values based on changes in interest rates

The findings in table 2 reveal that the relation between returns and credit risk changes depends on leverage. To investigate whether the effect associated with leverage is attributable to decreases in debt value rather than other effects, we calculate the gain or loss on the firm's debt attributable to a change in the firm's risk. This analysis also permits us to test our relation without relying directly on estimated bond ratings. We then evaluate the relation between this calculated gain or loss and equity return.

We estimate the debt gain or loss attributable to the change in risk using Eq. (2).

$$GL\_ACC = \sum_{t=1}^{5} DEBTt \times (1-\Delta R)^{t} + DEBT6^{+} \times (1-\Delta R)^{10} \qquad (2)$$

DEBTt is debt maturing in each of the next five years and $DEBT6^{+}$ is debt maturing in six years and beyond. We obtain debt maturities from financial statement footnotes. ΔR is the interest rate change indicated by the firm's change in risk. That is, $\Delta R = (1 + R_{beg})/ (1 + R_{end})$ where R_{beg} (R_{end}) is the interest rate associated with the firm's risk, *CR*, at the beginning (end) of the year. The interest rate we associate with each risk group is the average interest rate for that group's associated bond rating over the sample period. Using the average avoids introducing into our analysis confounding temporal effects. The average also helps insulate *GL_ACC* from effects

[21] When we limit the sample to firms without rated debt, our inferences are the same as those for the full sample using estimated bond ratings. When we use actual bond ratings for firms with rated debt and estimated bond ratings for firms without rated debt, our inferences are the same, except that the coefficients on $UP^{INV}\times\Delta CR\times DBTA$ and $UP^{ACR}\times\Delta CR\times DBTA$ are not significantly different from zero (t = 0.65 and 0.21). The insignificance of these coefficients is consistent with lags in actual bond rating upgrades.

associated with changes in market interest rates between the beginning and end of the year. Thus, *GL_ACC* reflects primarily the effects of changes in the firm's risk.

For comparison, we calculate the debt gain or loss implied by the parameters estimated in Eq. (1). The market-implied gain or loss on long-term debt, *GL_MKT*, is equal to $0.17 \times \Delta CR \times DBTA$. We use 0.17 because it is the estimate of β_2 in table 2, panel A. *GL_ACC* and *GL_MKT* are per share, deflated by beginning of year stock price.

Table 3 presents descriptive statistics and results. Panel A reveals that the means (standard deviations) of *GL_ACC* and *GL_MKT* are 0.00 and 0.00 (0.07 and 0.04). Panel B reveals that *GL_ACC* and *GL_MKT* are significantly positively correlated. The Spearman correlation is 0.99, although the Pearson correlation is 0.25, which is consistent with uncorrelated estimation error in one or both of the variables. Consistent with this, correlations between *GL_ACC* and *RET* and between *GL_MKT* and *RET* are similar.

Table 3, panel C, presents summary statistics from estimating Eq. (1) with *GL_ACC* instead of $\Delta CR \times DBTA$. Inferences are the same as those we obtain from table 2. In particular, the amount we calculate for gain or loss on debt attributable to changes in credit risk attenuates the gain or loss reflected in ΔCR. The coefficient on *GL_ACC* is 0.25, with a t-statistic of 7.17. All other results are similar to those in table 2.

5.2. Changes in operating risk and asset value

Credit risk increases with total equity risk, which prior research separates into operating risk and financing risk (see, e.g., Beaver, Kettler, and Scholes, 1970). Operating risk derives from the systematic risk of operating assets. Financing risk results from leverage. As explained in section 3.1, the existence of debt can mitigate the negative effects on equity value of decreases in asset value if debt holders absorb some of the asset value decrease. Beyond this loss sharing, increases in operating risk may result in a wealth transfer from debt holders to equity holders.

To investigate the effect of wealth transfers attributable to increases in operating asset risk, we estimate Eq. (3). To investigate the effect from loss sharing attributable to decreases in operating asset values, we estimate Eq. (4).

$$\Delta ECC_t^* = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 \Delta r_t + \varepsilon_{3t} \quad (3)$$

$$FR_t^* = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 \Delta r_t + \varepsilon_{4t} \quad (4)$$

Eq. (3) relates change in equity cost of capital, ΔECC, and credit risk change, ΔCR, and the interaction between leverage and risk change, $\Delta CR \times DBTA$. We predict β_1 is positive; changes in credit risk are positively associated with changes in equity cost of capital. We expect β_2 is negative to the extent debt mitigates the effect on equity value of increases in operating risk. Eq. (4) is the same relation with analyst earnings forecast revisions, *FR*, as the dependent variable. *FR* is a proxy for the change in expected cash flows incident to the credit risk change. We predict β_1 is negative; changes in risk are negatively associated with analysts' forecast revisions. In Eq. (4), $\Delta CR \times DBTA$ captures the extent to which debt holders share in unrealized gains and losses in asset value. We expect β_2 is positive to the extent debt in the capital structure mitigates the effect on equity value of decreases in asset value. Leverage, *DBTA*, and changes in the risk-free interest rate, Δr, are control variables. Because we aim to consider separately risk and cash flow effects associated with risk changes, ΔECC^* (FR^*) is the residual from a regression of ΔECC (*FR*) on *FR* (ΔECC).[22]

We estimate equity cost of capital following Claus and Thomas (2001), Gebhardt, Lee, and Swaminathan (2001), Gode and Mohanram (2003), and Easton (2004). Each study's estimate is based on the residual income model, after specifying a relation between equity cost of capital, equity market value, equity book value, and forecasted earnings and dividends. We use the assumptions in Dhaliwal, Heitzman, and Li (2005). Following Hail and Leuz (2004) and Dhaliwal, Heitzman, and Li (2005), *ECC* is the mean of these four cost of equity estimates.[23] To mitigate the effects of error associated with estimating *ECC*, we eliminate observations for which *ECC* < 0% or *ECC* > 50%. *FR* is the consensus one-year-ahead forecast of annual earnings per share in June of year *t*, minus the consensus two-year-ahead forecast of annual earnings per share in June of year *t* – 1. We exclude observations in the extreme 1% of the *FR* distribution.

Table 4 presents the findings. Panel A presents descriptive statistics and reveals that the mean and median change in equity cost of capital, *ΔECC*, and change in the risk-free interest rate, *Δr*, are 0.00. The mean (median) revision to analysts earnings forecast, *FR*, is –0.26 (–0.09), which is consistent with analysts "walking down" their forecasts over time (Richardson, Teoh, and Wysocki, 2004). The distributional statistics for *ΔCR* and *DBTA* are similar to those in table 1, panel A. Panel B reveals that *ΔECC* and *FR* are significantly negatively correlated, which indicates that increases in expected earnings are associated with decreases in equity cost of capital, partially motivating our use of *ΔECC** and *FR** as the dependent variables. Panel B also reveals that *ΔECC* (*FR*) is significantly positively (negatively) correlated with *ΔCR.* These correlations indicate that increases in equity cost of capital and decreases in expected earnings are associated with increases in risk.

Panels C and D present regression summary statistics from Eqs. (3) and (4). Panel C reveals that, as expected, changes in equity cost of capital not associated with changes in analyst forecast revisions, *ΔECC**, are significantly positively associated with changes in risk, *ΔCR* (t =

[22] Our inferences are unaffected when we use *ΔECC* and *FR* as the dependent variables.

15.92). More importantly for our research question, panel C also reveals that the relation is less positive for firms with more leverage; the coefficient on $\Delta CR \times DBTA$ is significantly negative (t = –2.53). Similarly, panel D reveals that, also as expected, analyst earnings forecast revisions not associated with changes in equity cost of capital, *FR**, are significantly negatively associated with changes in risk, ΔCR (t = –17.79). More importantly, it also reveals that the relation is less negative for firms with more leverage; the coefficient on $\Delta CR \times DBTA$ is significantly positive (t = 4.84). All other inferences are the same as in table 2. These findings indicate that our table 2 findings are attributable to changes in risk, as captured by ΔECC, as well as changes in expected future cash flows, as captured by *FR*.

5.3. Debt covenants

Debt holders may protect the value of their debt from increases in risk by including covenants in debt contracts. Doing so should mitigate the effects on debt value and, thus, on equity value of increases in risk (Core and Schrand, 1999). To investigate this possibility, we estimate Eq. (1) including ΔBR and $\Delta BR \times DBTA$ interacted with an indicator variable, *COV*, that equals one if more than one-half of the firm's debt issues have covenants, and zero otherwise. We obtain debt covenant data from the Fixed Income Securities Database. The mean of *COV* for our sample is 0.54. Because *COV* is available only for firms with rated debt, we use actual bond ratings, *BR*, in this analysis. However, this results in a substantially smaller sample than that used in our primary analysis. We predict a negative coefficient on $\Delta BR \times DBTA \times COV$. We do not predict the sign of the coefficient on $\Delta BR \times COV$. Table 5 presents the findings. As

[23] Inferences based on each cost of capital measure are consistent with those from the results we tabulate.

predicted, *ΔBR×DBTA×COV*'s coefficient is significantly negative (t = –2.24). This indicates that covenants in debt contracts mitigate the effect on equity value of changes in risk.[24]

6. Financial statement effects of debt fair value recognition

6.1. Estimating asset and debt values and asset volatility

Merton (1974) provides a mechanism for decomposing equity value into the values of assets and liabilities. This permits us to estimate the financial statement effects of recognizing debt fair value. Specifically, given observed equity value and historical stock volatility, we invert the Merton (1974) model to obtain estimates of asset value and its volatility. Equity value is fiscal year end share price times the number of shares outstanding. Following Hillegeist, Keating, Cram, and Lundstedt (HKCL; 2004), we estimate the volatility of equity using daily stock returns, and require at least 80% of the returns to be non-missing in the estimation period.

Our estimation procedure follows HKCL, except that we estimate the remaining term of the debt, rather than assuming it equals one year. Compustat provides the amount of debt due in each of the next 1 through 5 years. Thus, we calculate the weighted average remaining term of the firm's debt by summing the percentage of total debt outstanding in each maturity category times the number of years in that category. We assume that the firm's remaining long-term debt is due in the 10th year. The Merton (1974) model assumes zero-coupon debt. Thus, if there are amounts due before maturity, we increase the amounts due by the amount of net interest paid in year *t*, as reported in the statement of cash flows. We also differ from HKCL in that we focus on long-term debt rather than total liabilities, and we include in assets all other liabilities. We define the fair value of debt as the estimated value of the firm's assets minus its market value of

[24] Untabulated statistics reveal *COV* and *DBTA* are significantly positively correlated, although the correlation is small, 0.10. To control for this, in an untabulated analysis we use *COV** in place of *COV*, where *COV** is the residual from a regression of *COV* on *DBTA*. Our inferences relating to covenants are unaffected.

equity. For the risk-free rate, we use the annual one-year Treasury rate published on www.federalreserve.gov. To mitigate the effects of estimation errors, we eliminate the top and bottom 1% of observations of each variable, except for the remaining term of the debt, the risk-free interest rate, and *DBTA*. These data requirements result in a sample of 19,133 observations.

Panel A of table 6 presents descriptive statistics for inputs to and outputs from the Merton (1974) model. The mean (median) ratio of market value of equity, *MVE*, to book value of equity, *BVE*, is 2.10 (1.65), consistent with sample firms having unrecognized net assets. The average remaining maturity on long-term debt is 4.89 years, the average risk-free interest rate over the sample period is 5%, and the average volatility of equity returns is 49%. Consistent with leverage increasing the volatility of equity, our calculated volatility of asset value, σ_V, is 38%. We calculate a mean (median) ratio of fair value of assets to book value of assets (*MVA*/*BVA*) of 1.74 (1.43). The mean (median) ratio of fair value of debt, *MVD*, to book value of debt, *BVD* is 1.17 (1.10). Untabulated statistics confirm that our sample comprises primarily solvent firms. In particular, for only 1.6% of the sample firms is the value of assets less than the book value of debt.

6.2. Internal validity check of model estimates

Before turning to estimates of the financial statement effects of recognizing changes in debt values, we investigate the internal validity of our model estimates. We do this by estimating a version of Eq. (1) in which we include the change in asset value and change in asset volatility, both estimated using the Merton model, in lieu of credit rating change and earnings. Recall that Eq. (1) includes credit rating change and earnings as proxies for changes in asset value and risk. We interact both variables with leverage. If validly implemented, the model results in the equity value effects of changes in asset value and asset risk being moderated by the extent of debt in the capital structure. We primarily view this as an internal validity check because the firm's stock price and volatility are inputs to the model – thus, the dependent variable is used indirectly to estimate the explanatory variables.

Table 6, panel B, presents the findings, which are consistent with our primary results. It reveals that equity returns are positively and significantly associated with change in asset value, ΔMVA, (t = 70.79). Because we include directly the change in asset value, which reflects changes in systematic risk, the coefficient on change in asset risk should reflect only the effects of change in unsystematic risk and, thus, be zero. Otherwise, it should be negative. Consistent with this, the coefficient is not significantly different from zero (t = –0.73). More importantly for our research question, consistent with the Merton (1974) model and the table 2 findings, the effect on equity returns of increases in asset value (asset risk) is less (more) positive when leverage is higher. In particular, the coefficient (t-statistic) on $\Delta MVA \times DBTA$ is –0.35 (–24.68) and that on $\Delta\sigma_V \times DBTA$ is 0.43 (4.01).

6.3. Estimates of financial statement effects

As noted in section 2, opponents of fair value debt recognition are concerned that net income would become less reflective of the net change in the economic value of the firm's net assets. To investigate this possibility, table 7 presents descriptive statistics relating to various forms of reported net income, *NI*, and unrecognized changes in estimated asset and debt values, ΔUA and ΔUD. All variables are deflated by beginning of year *MVE*. Because of the estimation error likely inherent in ΔUA and ΔUD, these statistics should be interpreted with caution. Nonetheless, they provide some indication of the potential financial statement effects of recognizing changes in debt values.

Table 7 presents statistics separately for firms with credit upgrades, no change in credit standing, and credit downgrades. Relating to firms with upgrades, table 7 reveals that, on average, these firms have positive net income in year t and year $t-1$, and positive change in net income from year $t-1$ to year t. The means for NI_t, NI_{t-1}, and ΔNI are 0.10, 0.02, and 0.09. It also reveals that the change in unrecognized assets, ΔUA, is positive for most of these firms. On average, ΔUD is positive, 0.02. As a result, had these firms recognized ΔUD, their net income would have been lower. On average, $NI_t–\Delta UD_t$ also is positive; the mean (median) is 0.09 (0.08). Thus, most upgrade firms would have positive net income even if the increase in the value of their debt were recognized. Untabulated statistics reveal that whereas NI_t is positive for 95% of upgrade firms, $NI_t–\Delta UD_t$ is positive for 80%. Thus, recognizing ΔUD would result in approximately 15% more upgrade firms reporting negative rather than positive net income.

Relating to downgrade firms, table 7 reveals statistics that generally are of the opposite sign to those for upgrade firms. In particular, although these firms have positive net income in year $t-1$, they have negative net income in year t caused by a negative change in net income from year $t-1$ to year t. The means for NI_t, NI_{t-1}, and ΔNI are –0.05, 0.05, and –0.10. It also reveals that for most of these firms change in unrecognized assets, ΔUA, is negative. On average, ΔUD is negative; the mean (median) is –0.04 (–0.07). Thus, had these firms recognized ΔUD, their net income would have been higher. However, untabulated statistics reveal that both the mean and median $NI_t–\Delta UD_t$ are insignificantly different from zero. Thus, the difference is not large enough to turn losses into profits in most cases. Untabulated statistics reveal that whereas NI_t is negative for 55% of downgrade firms, $NI_t–\Delta UD_t$ is negative for 45%. Thus, recognizing ΔUD would result in approximately 10% more downgrade firms reporting positive rather than negative net income.

Table 7 also presents statistics for $\Delta NI–\Delta UD$. This is a proxy for the effect on net income of the firm's change in year t circumstances, including changes in assets and liabilities. This is particularly relevant for downgrade firms because asset impairment write-downs are required, but asset write-ups generally are not permitted. When assessing the effect on net income of recognizing the change in unrecognized debt, one would like to compare it to the amount of asset impairments, which is not available to us. Under the assumption that $NI_{t–1}$ is a good proxy for income before the firm's downturn, ΔNI is a proxy for asset write-downs recognized in year t. For downgrade firms, the mean (median) $\Delta NI–\Delta UD$ is –0.06 (–0.05). These statistics indicate that for most downgrade firms, recognized asset write-downs are larger than unrecognized decreases in debt values. Thus, although downgrade firms would recognize higher net income if debt value changes were recognized, for most firms the net effect of decreases in recognized asset value and increases in debt value is negative.

Also contributing to the concern about potential anomalous income statement effects arising from fair value accounting for debt is the fact that not all concurrent asset value changes are recognized. The statistics in table 7 indicate that for most upgrade (downgrade) firms the net change in unrecognized asset and liability values, $\Delta UA_t–\Delta UD_t$, is positive (negative). Table 7 also reveals that for all firms $\Delta UA_t–\Delta UD_t$ is greater in magnitude than $\Delta NI–\Delta UD$. These statistics are consistent with the existence of unrecognized assets for all groups of firms and, thus, changes in the values of those assets, increases or decreases, not recognized.

Relating to firms with no change in bond rating, the statistics in table 7 are as expected. That is, the mean (median) change in net income, ΔNI, and change in unrecognized debt value, ΔUD, are small, 0.00 (0.01) and 0.01 (0.00). Thus, recognizing unrecognized changes in debt value have little effect on net income for these firms.

7. Conclusion

This study tests whether equity value reflects gains and losses associated with changes in the value of debt, consistent with predictions of Merton (1974). This not only contributes to the extant debt and equity valuation literature, but also is critical to the debate about using fair value accounting for liabilities. Because increases in credit risk result in decreases in debt value, a firm suffering from deteriorating credit quality would recognize gains with respect to its outstanding debt. This outcome is counterintuitive to some and has generated considerable controversy relating to fair value accounting for liabilities.

Consistent with prior research, we find that equity returns are significantly negatively related to increases in credit risk as reflected in change in estimated bond ratings. More importantly for our research question, we find that the relation between risk changes and equity returns is significantly less negative when leverage is higher. We also find that equity returns for firms with downgrades are significantly less negative when leverage is higher; we find the opposite for firms with upgrades. Our findings hold for all risk groups, except for firms downgraded within investment grade. Thus, equity increases associated with increases in risk are evident for a broad cross-section of firms, including quite solvent firms.

To provide a more direct link between changes in debt values and changes in equity values, we calculate the change in debt value arising from the change in market interest rate associated with the change in the firm's risk, and use this estimate of the change in debt value in our estimating equation in lieu of the risk change and leverage interaction variable. Consistent with our primary findings, we find that the calculated debt gain or loss is incrementally significantly positively associated with returns. We also provide evidence that the effect we document is associated with change in asset risk, as reflected in equity cost of capital, and change in expected future cash flows, as reflected in revisions of analyst earnings forecasts.

Our findings link and empirically document the existence of two countervailing equity value effects associated with increases in credit risk: (i) decreases in equity value, presumably arising from decreases in asset value or increases in systematic asset risk, and (ii) increases in equity value attributable to decreases in debt value, presumably arising from decreases in asset value or increases in systematic or unsystematic asset risk.

We also provide descriptive evidence on how recognition of changes in debt value would affect firms' financial statements. We do this by using observed stock prices and volatility to invert the Merton (1974) model to obtain an estimate of each firm's asset and debt value and asset volatility. As expected, we find that most upgrade firms would recognize higher net income than they do under current accounting rules if all changes in debt and asset value are included in income. Most downgrade firms would recognize lower net income. If only unrecognized changes in debt value were recognized, most upgrade firms would recognize lower net income and most downgrade firms would recognize higher net income. Yet, for most firms, the difference is not large enough to change the sign of net income. Also as expected, we find evidence of changes in value of unrecognized assets. However, for downgrade firms, it appears that recognized asset write-downs are larger than unrecognized gains from decreases in debt value. These findings call into question concerns about anomalous income effects, particularly relating to the recognition of gains associated with debt value decreases.

Appendix
Risk Estimation

A.1 Estimation equation

We estimate the relation between bond ratings and financial statement variables, using the subsample of firms with rated debt (Barth, Beaver, and Landsman, 1998; Ashbaugh, Collins, and LaFond, 2004; Larcker, Richardson, and Tuna, 2004). We set *CR*, our proxy for risk, equal to the predicted value from equation (A1) for firms with and without rated debt. ΔCR in Eq. (1) is the annual change in *CR*.

$$BR_t = a_0 + a_1 TA_t + a_2 ROA_t + a_3 DBTA_t + a_4 DIV_t + a_5 SUBDBT_t + a_6 NEG_t + \upsilon_t \qquad \text{(A1)}$$

BR_t is bond rating at the end of year *t*, *TA* is the log of end-of-year total assets, *ROA* is income before extraordinary items divided by total assets, *DIV* is an indicator variable that equals one if the firm paid a cash dividend in year *t*, and zero otherwise, *SUBDBT* is an indicator variable that equals one if the firm has subordinated debt in year *t*, and zero otherwise, and *NEG* is an indicator variable the equals one if *ROA* is negative in year *t*, and zero otherwise.[25] Estimating Eq. (A1) using annual data to calculate *CR* and then calculating annual changes in *CR* for use in our tests mitigates the effects of bond ratings being revised with a lag (Pinches and Singleton, 1978).[26]

We estimate Eq. (A1) with year and industry fixed effects. *BR* takes on values ranging from 1 to 4, where larger *BR* corresponds to higher risk. Specifically, groups 1, 2, 3, and 4

[25] Ashbaugh, Collins, and LaFond (2004) and Larcker, Richardson, and Tuna (2004) also include in Eq. (A1) interest coverage and capital intensity. We do not include these variables because doing so noticeably reduces our sample size. However, our inferences are unchanged if we include these variables and conduct our tests using the resulting *CR* for the reduced sample. Also, Eq. (A1) does not include variables related to debt covenants. Thus, our estimated bond ratings might not capture all aspects of debt relevant to its value. Implicitly, our design assumes that unrated debt have covenants similar to those rated debt. To the extent that this assumption is not valid, our tests could be biased. The direction of the bias is not obvious. However, table 5 reports results when we control for the existence of covenants. Our inferences are unchanged.

include firms with ratings of AAA to A–, BBB+ to BBB–, BB+ to BB–, B+ to D, respectively.[27] Because *BR* takes on values ranging from 1 to 4, we use maximum likelihood estimation and an ordered probit model. We predict that α_1, α_2, and α_4 are negative, and that α_3, α_5, and α_6 are positive. We have no prediction for α_0.

A.2 Empirical estimates

Table A1, panel A, presents regression summary statistics from estimating Eq. (A1) for the 11,799 observations for firms with rated debt. Consistent with prior research, bond ratings, *BR*, are significantly negatively related to *TA*, *ROA*, and *DIV*, and significantly positively related to *DBTA*, *SUBDBT*, and *NEG*. The pseudo R^2 from the estimation is 0.65, indicating that these variables explain a substantial portion of the variation in bond ratings.[28]

Table A1, panel B, presents the distributions of actual bond rating levels and changes and the distributions of estimated bond rating levels and changes. It reveals that the distributions are similar. However, in bond rating group 1 there are fewer firms with estimated ratings (10.38%) than with actual ratings (29.48%). The opposite is true for bond rating group 4, which comprises 39.97% of firms with estimated ratings, but only 19.49% of firms with actual ratings. Panel B also reveals that changes in actual ratings are concentrated in the 0, 1, and –1 change groups, whereas changes in estimated ratings are more widely distributed. Distributional differences between firms with and without rated debt are not unexpected because the explanatory variables

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[26] Our inferences are unchanged if we estimate Eq. (1) using two-year returns for our primary results and those based on only firms with rated debt.
[27] Prior studies partition group 4 into two groups, one for bond ratings of B+ to B– and one for bond ratings CCC+ to D. We combine these two groups because the CCC+ to D group has very few observations; these two groups combined have fewer observations than do the other three bond rating groups.
[28] Because *CR* is the estimated, rather than actual, bond rating, the standard errors from Eq. (1) are biased downward. To correct for the additional variance in *CR*, as a robustness check, we add a component to the estimated variance of the parameters estimated in Eq. (1). We obtain the added component from bootstrapping Eq. (A1). Specifically, following Petrin and Train (2002, footnote 11), we repeatedly estimate Eqs. (A1) and (1) with bootstrapped samples. The added component is the variance in Eq. (1) parameter estimates obtained over the bootstrapped samples. Our inferences are unaffected by using this procedure.

reflect systematic differences between the two groups of firms. For example, firms with rated debt tend to have larger total assets.[29]

As an internal validity check, we compare actual and estimated bond ratings for firms with rated debt. Because for these firms *CR* is the predicted value for an observation included when estimating Eq. (A1), the comparisons should be interpreted cautiously. However, untabulated statistics reveal that the distributions of actual and estimated bond ratings are similar. For actual ratings, the rating groups 1 through 4 are 31%, 27%, 24%, and 18% of the observations; for estimated ratings the percentages are 33%, 26%, 23%, and 17%. The statistics also reveal that Eq. (A1) correctly predicts 62% of actual ratings, and results in prediction errors of more than one bond rating group only 2% of the time.

[29] Note that the validity of *CR* as a proxy for credit risk does not depend on consistent levels of the prediction variables between firms with and without rated debt. Rather, its validity depends on consistency of the parameters associated with the explanatory variables between the two groups of firms. Unfortunately, we are unable to determine this because bond ratings are not observable for firms without rated debt. However, as table 5 reports, our inferences are unaffected by estimating Eq. (1) using only firms with rated debt.

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Figure 1: Effects of Changes in Asset Value and Asset Risk on Realized Equity Values

	Change in Asset Value	Change in Asset Risk
Direct Effects	positive	non-positive
Indirect Effects*	negative	positive

**Indirect effects exist only in the presence of debt and reflect 1) the extent to which debt holders absorb asset value changes prior to liquidation and 2) wealth transfers between debt and equity holders that arise from changes in asset risk.*

Table 1: Summary Statistics for Regression Variables (*N* = 50,297)

Panel A: Descriptive Statistics

Variable	Mean	Median	Std. Dev.
RET	–0.01	–0.07	0.54
ΔCR	0.01	0.00	0.42
DBTA	0.19	0.15	0.19
EPS	0.02	0.05	0.18
ΔEPS	0.01	0.01	0.19
NEG	0.25		

Panel B: Pearson (above the diagonal) and Spearman (below the diagonal) Correlations

	RET	*ΔCR*	*DBTA*	*EPS*	*ΔEPS*	*NEG*
RET		–0.20	–0.05	0.27	0.25	–0.25
ΔCR	–0.21		0.07	–0.20	–0.28	0.26
DBTA	–0.03	0.07		–0.09	–0.03	0.10
EPS	0.43	–0.26	0.00		0.52	–0.65
ΔEPS	0.39	–0.37	–0.03	0.50		–0.29
NEG	–0.32	0.26	0.04	–0.75	–0.38	

Table 1 (continued): Summary Statistics for Regression Variables (*N* = 50,297)

Panel C: Industry Composition of Sample

Industry	SIC codes	*N*	Percent
Mining and construction	1000-1999, except 1300-1399	1,512	3.01
Food	2000-2111	1,569	3.12
Textiles, printing, and publishing	2200-2799	3,900	7.75
Chemicals	2800-2824, and 2840-2899	1,690	3.36
Pharmaceuticals	2830-2836	1,595	3.17
Extractive industries	2900-2999, and 1300-1399	2,213	4.40
Durable manufacturers	3000-3999, except 3570-3579, 3670-3679	14,770	29.37
Computers	7370-7379, 3570-3579, and 3670-3679	7,206	14.33
Transportation	4000-4899	3,271	6.50
Retail	5000-5999	7,312	14.54
Services	7000-8999, except 7370-7379	5,259	10.46
		50,297	100.00

RET = size-adjusted fiscal-year stock return (including dividends), *CR* = risk group (4 groups, 1 = highest to 4 = lowest), *DBTA* = long-term debt to total assets, *EPS* = earnings per share before extraordinary items, deflated by beginning of year stock price, *NEG* = indicator for negative *EPS*, Δ denotes annual change. All correlations in panel B are significantly different from zero, except the Spearman correlation between *EPS* and *DBTA*. Sample of 7,646 Compustat firms from 1986-2003.

Table 2: Summary Statistics for Returns Regressions (*N* = 50,297)

$$RET_t = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 EPS_t + \beta_5 \Delta EPS_t + \beta_6 NEG_t + \beta_7 NEG_t \times EPS_t + \beta_8 NEG_t \times \Delta EPS_t + \varepsilon_t$$

Panel A: Regression Summary Statistics

				DBTA ranks	
	Pred.	Coef.	t-statistic	Coef.	t-statistic
ΔCR	−	–0.10	–18.74	–0.12	–17.29
ΔCR×DBTA	+	0.17	9.21	0.10	9.04
DBTA	?	–0.05	–5.25	–0.03	–4.88
EPS	+	1.90	72.79	1.90	72.88
ΔEPS	+	0.42	25.91	0.42	25.92
NEG	−	–0.12	–23.90	–0.13	–24.03
NEG×EPS	−	–1.81	–57.68	–1.80	–57.70
NEG×ΔEPS	−	–0.27	–12.69	–0.27	–12.79
Adj. R^2		0.16		0.16	

Table 2 (continued): Summary Statistics for Returns Regressions (*N* = 50,297)

Panel B: Regression Summary Statistics from Panel A Regression with Separate Effects for Downgrades and Upgrades

	Pred.	Coef.	t-statistic	Coef.	t-statistic
$DN \times \Delta CR$	−	–0.08	–10.09		
$DN^{INV} \times \Delta CR$	−			0.00	0.13
$DN^{ACR} \times \Delta CR$	−			–0.03	–2.74
$DN^{NINV} \times \Delta CR$	−			–0.13	–11.89
$DN \times \Delta CR \times DBTA$	+	0.15	6.40		
$DN^{INV} \times \Delta CR \times DBTA$	+			0.04	0.39
$DN^{ACR} \times \Delta CR \times DBTA$	+			0.11	3.34
$DN^{NINV} \times \Delta CR \times DBTA$	+			0.18	5.27
$UP \times \Delta CR$	−	–0.13	–15.46		
$UP^{INV} \times \Delta CR$	−			–0.08	–3.16
$UP^{ACR} \times \Delta CR$	−			–0.11	–8.27
$UP^{NINV} \times \Delta CR$	−			–0.15	–14.20
$UP \times \Delta CR \times DBTA$	+	0.18	4.98		
$UP^{INV} \times \Delta CR \times DBTA$	+			0.22	1.66
$UP^{ACR} \times \Delta CR \times DBTA$	+			0.13	1.98
$UP^{NINV} \times \Delta CR \times DBTA$	+			0.20	4.41
DBTA	?	–0.04	–4.57	–0.05	–4.65
EPS	+	1.90	72.84	1.89	73.24
ΔEPS	+	0.41	25.25	0.42	25.11
NEG	−	–0.13	–24.16	–0.12	–23.37
$NEG \times EPS$	−	–1.81	–57.93	–1.80	–58.18
$NEG \times \Delta EPS$	−	–0.25	–11.73	–0.27	–11.96
Adj. R^2		0.17		0.17	

RET = size-adjusted fiscal-year stock return (including dividends), *CR* = risk group (4 groups, 1 = highest to 4 = lowest), *DBTA* = ratio of long-term debt to total assets, *DBTA* ranks = decile rank of *DBTA*, scaled between 0 and 1, *EPS* = earnings per share before extraordinary items, deflated by beginning of year price, *NEG* = indicator for negative net income before extraordinary items, *DN* (*UP*) = indicator for credit downgrade (upgrade), DN^{INV} (UP^{INV}) = indicator for credit downgrade (upgrade) within investment grade,

DN^{NINV} (UP^{NINV}) = indicator for credit downgrade (upgrade) within non investment grade, DN^{ACR} (UP^{ACR}) = indicator for credit downgrade (upgrade) across grades, Δ denotes annual change. Huber M-estimates are presented, with year and industry fixed effects untabulated. Sample of 7,646 Compustat firms from 1986-2003. See table 1 for industry composition.

Table 3: Summary Statistics for Debt Gain Regression (*N* = 29,758)

Panel A: Descriptive Statistics

Variable	Mean	Median	Std. Dev.
RET	–0.01	–0.07	0.53
GL_ACC	0.00	0.00	0.07
GL_MKT	0.00	0.00	0.04

Panel B: Pearson (above the diagonal) and Spearman (below the diagonal) Correlations

	RET	*GL_ACC*	*GL_MKT*
RET		–0.07	–0.03
GL_ACC	–0.20		0.25
GL_MKT	–0.20	0.99	

Panel C: Regression Summary Statistics from

$$RET_t = \beta_0 + \beta_1 \Delta CR_t + \beta_2 GL\_ACC_t + \beta_3 DBTA_t + \beta_4 EPS_t + \beta_5 \Delta EPS_t + \beta_6 NEG_t + \beta_7 NEG_t \times EPS_t + \beta_8 NEG_t \times \Delta EPS_t + \varepsilon_t$$

	Pred.	Coef.	t-statistic
ΔCR	−	–0.07	–12.20
GL_ACC	+	0.25	7.17
DBTA	?	–0.06	–4.71
EPS	+	1.85	55.25
ΔEPS	+	0.47	22.24
NEG	−	–0.12	–17.88
NEG×EPS	−	–1.78	–44.02
NEG×ΔEPS	−	–0.30	–10.65
Adj. R^2		0.17	

$$GL\_ACC = \frac{1}{P_{t-1}} \sum_{t=1}^{5} DEBTt \times (1 - \Delta R)^{t} + DEBT6^{+} \times (1 - \Delta R)^{10}$$

, where *R* is interest rate associated with the firm's risk group, averaged over 1986 to 2003, *DEBTt* is debt maturing in each of the next one to five years, and $DEBT6^{+}$ is debt maturing in six years and beyond. *GL_MKT* = $\beta \times \Delta CR \times DBTA$, where $\beta = 0.17$ from table 2, panel A. *GL_ACC* and *GL_MKT* are deflated by beginning of period market value. *RET* = size-adjusted fiscal-year stock return (including dividends), *CR* = risk group (4 groups, 1 = highest to 4 = lowest), *DBTA* = ratio of long-term debt to total assets, *EPS* = earnings per share before extraordinary items, deflated by beginning of year stock price, *NEG* = indicator for negative net income before extraordinary items, *Δ* denotes annual change. All correlations in panel B are significantly different from zero. Huber M-estimates are presented in panel C, with year and industry fixed effects untabulated. Sample of 5,669 Compustat firms from 1986-2003.

Table 4: Summary Statistics for Equity Cost of Capital and Analyst Earnings Forecast Revision Regression Variables (*N* = 24,036)

Panel A: Descriptive Statistics

Variable	Mean	Median	Std. Dev.
ΔECC	–0.00	–0.00	0.03
FR	–0.26	–0.09	0.54
ΔCR	0.02	0.00	0.47
DBTA	0.18	0.16	0.17
Δr	–0.00	–0.00	0.01

Panel B: Pearson (above the diagonal) Spearman (below the diagonal) Correlations

	ΔECC	*FR*	*ΔCR*	*DBTA*	*Δr*
ΔECC		–0.11	0.15	0.03	0.17
FR	–0.11		–0.19	–0.10	0.06
ΔCR	0.15	–0.19		0.08	–0.01
DBTA	0.03	–0.09	0.07		0.01
Δr	0.18	0.06	0.00	0.02	

Table 4 (continued): Summary Statistics for Equity Cost of Capital and Analyst Earnings Forecast Revision Regression Variables (*N* = 24,036)

Panel C: Regression Summary Statistics from

$$\Delta ECC_t^* = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 \Delta r_t + \varepsilon_{3t}$$

	Pred.	Coef.	t-statistic
ΔCR	+	0.01	15.92
ΔCR×DBTA	−	–0.01	–2.53
DBTA	?	0.00	2.04
Δr	+	0.60	33.82
Adj. R^2		0.04	

Panel D: Regression Summary Statistics from

$$FR_t^* = \beta_0 + \beta_1 \Delta CR_t + \beta_2 \Delta CR_t \times DBTA_t + \beta_3 DBTA_t + \beta_4 \Delta r_t + \varepsilon_{4t}$$

	Pred.	Coef.	t-statistic
ΔCR	−	–0.11	–17.79
ΔCR×DBTA	+	0.12	4.84
DBTA	?	–0.16	–12.51
Δr	+	3.56	14.84
Adj. R^2		0.02	

ECC = the mean of the equity cost of capital estimates from the Gebhardt et al. (2001), Claus and Thomas (2001), Gode and Mohanram (2003), and Easton (2004) models. We calculate equity cost of capital at the end of June for each year. *CR* = risk group (4 groups, 1 = highest to 4 = lowest), *FR* = revision in analysts' consensus earnings per share forecast, from June of prior year to June of current year, *ΔECC** (*FR**) = the portion of *ΔECC* (*FR*) that is orthogonal to *FR* (*ΔECC*). *DBTA* = ratio of long-term debt to total assets, *r* = the yield on a 10-year Treasury note, *Δ* denotes annual change. All correlations in panel B are significantly different from zero, except the Pearson correlation between *DBTA* and *Δr* and the Spearman correlation between *ΔCR* and *Δr*. Huber M-estimates are presented, with year and industry fixed effects untabulated. Sample of 4,488 Compustat firms from 1986–2003.

Table 5: Summary Statistics for Returns Regressions using Firms with Rated Debt (*N* = 11,799)

Regression Summary Statistics from

$$RET_t = \beta_0 + \beta_1 \Delta BR_t + \beta_2 \Delta BR_t \times COV_t + \beta_3 \Delta BR_t \times DBTA_t + \beta_4 \Delta BR_t \times DBTA_t \times COV_t + \beta_3 DBTA_t + \beta_4 EPS_t + \beta_5 \Delta EPS_t + \beta_6 NEG_t + \beta_7 NEG_t \times EPS_t + \beta_8 NEG_t \times \Delta EPS_t + \varepsilon_t$$

	Pred.	Coef.	t-statistic
ΔBR	−	–0.11	–4.91
ΔBR×COV	?	0.00	0.03
ΔBR×DBTA	+	0.14	3.01
ΔBR×DBTA×COV	−	–0.18	–2.24
DBTA	?	–0.11	–6.71
EPS	+	0.86	18.70
ΔEPS	+	0.44	14.82
NEG	−	–0.12	–12.15
NEG×EPS	−	–0.71	–12.65
NEG×ΔEPS	−	–0.24	–5.98
Adj. R^2		0.16	

RET = size-adjusted fiscal-year stock return (including dividends), *BR* = bond rating group (4 groups, 1 = highest to 4 = lowest), *DBTA* = ratio of long-term debt to total assets, *EPS* = earnings per share before extraordinary items, deflated by beginning of year stock price, *NEG* = indicator for negative net income before extraordinary items, *COV* = indicator whether at least half of the outstanding debt issues have covenants, *Δ* denotes annual change. Huber M-estimates are presented, with year and industry fixed effects untabulated. Sample of 1,888 Compustat firms from 1986-2003.

Table 6: Summary Statistics using Merton Model Estimates (N = 19,133)

Panel A: Descriptive Statistics for Merton Model Estimation Inputs and Outputs

Variable	Mean	Median	Std. Dev.
MVE / *BVE*	2.10	1.65	1.68
MVA / *BVA*	1.74	1.43	1.11
MVD / *BVD*	1.17	1.10	0.54
Term remaining on debt	4.89	5.00	1.80
Risk-free interest rate	0.05	0.05	0.02
σ_E	0.49	0.44	0.23
σ_V	0.38	0.33	0.21
ΔMVA	0.00	0.01	0.95
DBTA	0.22	0.20	0.16

Panel B: Regression Summary Statistics from

$$RET_t = \beta_0 + \beta_1 \Delta MVA_t + \beta_2 MVA_t \times DBTA_t + \beta_1 \Delta \sigma_{V\,t} + \beta_2 \Delta \sigma_{V\,t} \times DBTA_t + \beta_3 DBTA_t + \varepsilon_t$$

	Pred.	Coef.	t-statistic
ΔMVA	+	0.33	70.79
$\Delta MVA \times DBTA$	−	–0.35	–24.68
$\Delta\sigma_V$	0/–	–0.02	–0.73
$\Delta\sigma_V \times DBTA$	+	0.43	4.01
DBTA	?	–0.29	–17.92
Adj. R^2		0.22	

RET = size-adjusted fiscal-year stock return (including dividends), *MVE* (*BVE*) is market value (book value) of equity, *MVA* is market value of assets estimated using the Merton (1974) model. *MVD* = *MVA* – *MVE*, *BVA* = book value of assets – book value of liabilities other than long-term debt, *BVD* = book value of long-term debt, σ_E is volatility of equity values estimated using monthly stock returns over a period equal to the term remaining on debt, σ_V is volatility of asset values estimated using the Merton (1974) model, *DBTA* = ratio of long-term debt to total assets, Δ denotes annual change. ΔMVA is deflated by MVE_{t-1}. Huber M-estimates are presented, with year and industry fixed effects untabulated. Sample of 4,000 Compustat firms from 1986-2003.

Table 7: Summary Statistics using Merton Model Estimates (N = 19,133)

Upgrades (N = 1,344)	Mean	Q1	Median	Q3
NI_t	0.10	0.06	0.09	0.14
NI_{t-1}	0.02	–0.01	0.04	0.08
ΔNI_t	0.09	0.02	0.04	0.11
ΔUD_t	0.02	–0.03	0.00	0.05
ΔUA_t	0.16	–0.28	0.12	0.57
$NI_t – \Delta UD_t$	0.09	0.02	0.08	0.16
$\Delta NI_t – \Delta UD_t$	0.07	–0.01	0.04	0.14
$\Delta UA_t – \Delta UD_t$	0.14	–0.26	0.10	0.51

No Change (N = 16,327)	Mean	Q1	Median	Q3
NI_t	0.04	0.02	0.06	0.09
NI_{t-1}	0.04	0.02	0.06	0.08
ΔNI_t	0.00	–0.02	0.01	0.03
ΔUD_t	0.01	–0.03	0.00	0.04
ΔUA_t	–0.02	–0.33	–0.03	0.28
$NI_t – \Delta UD_t$	0.03	–0.02	0.05	0.11
$\Delta NI_t – \Delta UD_t$	–0.00	–0.06	0.00	0.06
$\Delta UA_t – \Delta UD_t$	–0.03	–0.32	–0.03	0.25

Downgrades (N = 1,462)	Mean	Q1	Median	Q3
NI_t	–0.05	–0.09	–0.01	0.05
NI_{t-1}	0.05	0.03	0.06	0.09
ΔNI_t	–0.10	–0.14	–0.06	–0.01
ΔUD_t	–0.04	–0.07	–0.00	0.03
ΔUA_t	–0.17	–0.47	–0.16	0.16
$NI_t – \Delta UD_t$	–0.01	–0.10	–0.00	0.09
$\Delta NI_t – \Delta UD_t$	–0.06	–0.16	–0.05	0.03
$\Delta UA_t – \Delta UD_t$	–0.13	–0.40	–0.13	0.15

NI = income before extraordinary items, unrecognized assets (UA) = market value of net assets – book value of net assets, and unrecognized debt (UD) = market value of long-term debt – book value of long-term debt. The market values of net assets and debt are estimated using the Merton (1974) model. Each is deflated by beginning of period market value of equity. All panel A means and medians are significantly different from zero, using a t-test for means or signed rank test for medians, except the median $\Delta NI_t – \Delta UD_t$ for firms without risk changes, and the mean and median $NI_t – \Delta UD_t$ for downgrade firms. Sample of 4,000 Compustat firms from 1986-2003.

Table A1: Risk Estimation

Panel A: Regression Summary Statistics from

$$BR_t = a_0 + a_1 TA_t + a_2 ROA_t + a_3 DBTA_t + a_4 DIV_t + a_5 SUBDBT_t + a_4 NEG_t + \upsilon_t$$

	Pred.	Coef.	t-statistic
TA	–	–0.56	–58.49
ROA	–	–4.31	–19.61
DBTA	+	2.17	31.47
DIV	–	–1.01	–39.87
SUBDBT	+	0.35	13.92
NEG	+	0.32	9.07
Pseudo R^2		0.65	

Panel B: Distributions of Actual and Estimated Bond Rating Groups

Bond Rating Group		Actual *N*	Actual Percent	Estimated *N*	Estimated Percent
AAA to A–	1	3,841	29.43	5,198	10.33
BBB+ to BBB–	2	3,380	25.89	8,898	17.69
BB+ to BB–	3	3,286	25.17	16,123	32.06
B+ to D	4	2,546	19.51	20,078	39.92

Change in Bond Rating Group		Actual *N*	Actual Percent	Estimated *N*	Estimated Percent
Upgrades	–3			4	0.01
	–2	7	0.06	74	0.15
	–1	396	3.36	4,293	8.54
No change	0	10,760	91.19	42,958	81.43
Downgrades	1	600	5.09	4,852	9.65
	2	31	0.26	105	0.21
	3	5	0.04	11	0.02

Panel A is based on an ordered probit estimation using the 11,799 observations for firms with rated debt. The model is estimated with year and industry fixed effects (untabulated). Estimated bond rating groups in panel B are predicted values from the panel A regression. *BR* = bond rating group (4 groups, 1 = highest to 4 = lowest), *TA* = natural log of total assets, in $ millions, *ROA* = return on assets; net income before extraordinary items divided by total assets, *DBTA* = long-term debt to total assets, *DIV* = one if the firm paid a dividend in year t and 0 otherwise, *SUBDBT* = one if the firm has subordinated debt and 0 otherwise, *NEG* = 1 if *ROA* is negative and 0 otherwise. Sample of Compustat firms from 1986-2003.