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What Can We Learn About Capital Structure From Bond Credit Spreads?[1]

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ABSTRACT

Bond credit spreads have been shown to reflect the issuing firm's default probability. In an efficient market, spreads will reflect both the firm's current risk and investors' expectations about how that risk level might change in the future. Collin-Dufresne and Goldstein (2001) show analytically that the expected future behavior of a firm's leverage importantly influences the appropriate credit spread on long-term bonds. We implement this insight empirically, by using current information to proxy for investors' expectations about future leverage changes. We find that expected future leverage affects bond credit spreads, and that expectations formed under the trade-off and pecking-order theories of capital structure both enjoy empirical support. However, separate estimations by firm leverage, firm size, bond credit-ratings and direction of leverage change reveal a relatively wider applicability of the trade-off theory.

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I. Introduction

As credit risk modeling has become more formalized, researchers have focused increasing attention on the information content of bond credit spreads. Financial theory indicates that any change in a firm's default risk should be reflected in the prices of its debt claims. Merton (1974) specifies bond credit spreads in terms of a firm's asset volatility, initial leverage, and term to maturity. Subsequent empirical studies have sought to explain credit spreads using (among other things) firm leverage and a variety of proxies for asset volatility (e.g. Collin-Dufresne *et al.* (2001), Krishnan *et al*. (2005), Avramov *et al.* (2005), Campbell and Taksler (2003)). Researchers agree that default risk accounts for at least part of a corporate bond rate's spread over Treasury. Some studies conclude that the spread is entirely caused by default risk (Longstaff *et al.* (2005)) while others assert that taxes (Elton *et al.* (2001)) and liquidity (Chen, Lesmond, and Wei (2005)) also contribute.

The Merton (1974) model generally implies implausibly small asset volatilities when taken to the data. Collin-Dufresne and Goldstein (2001) argue that one likely reason is the Merton model's failure to consider that a firm might change its debt level in the future. Merton (1974) assumes that a firm will maintain its current debt level until the debt matures. Because expected asset returns are positive, this implies an expected decline in leverage over time, which generates relatively low expected default losses. Collin-Dufresne and Goldstein (2001) recognize that a firm may change its outstanding debt over time, with potentially important effects on the riskiness of multi-period debt obligations. By modeling leverage as mean-reverting, they simulate credit spreads that conform much more closely to those observed in the market. They conclude that "the appropriate credit spread for a corporate bond [reflects]… both the firm's current liability structure, and its right to alter this structure in the future." (p.1930) In other words, bond prices (credit spreads) should reflect not only current information about a firm's condition, but also investors' expectations about future, firm-specific information.

Credit spreads thus present an opportunity to infer what market investors believe about theories of capital structure (leverage) determination. This opportunity is particularly attractive because directly modeling firm capital structures gives rise to serious econometric difficulties and uncertainties. Lemmon, Roberts and Zender (2006) contend that the empirical modeling of firms' capital structure decisions must include firm-specific effects and partial adjustment. But the combination of these two effects creates well-known biases in the application of traditional estimation techniques (Baltagi (2001, chapter 8)). The method employed to deal with these biases materially affects conclusions (Flannery and Rangan (2006), Table 2), but the literature has not yet identified a reliable method for correcting these biases. Studying credit spread changes thus provides a new (different) opportunity to gather market evidence about capital structure theories.

Previous empirical studies of credit spreads have not explicitly incorporated investors' expectations about a firm's subsequent condition, most likely because those expectations are unobservable. However, the various theories of a firm's capital structure permit us to infer expected future leverage changes and then incorporate these into an empirical model of credit spreads. First, the ***trade-off theory*** of capital structure maintains that each firm has a value-maximizing, target leverage ratio. Whenever leverage deviates from this target, firms adjust back toward it. With positive adjustment costs, however, firms generally find it more cost effective to approach their target leverage gradually (Leary and Roberts (2005)). The trade-off theory implies that investors should expect a future increase in leverage whenever the firm's leverage is below its target and a decrease whenever the firm's leverage presently exceeds the target. If investors believe that firms exhibit target-adjustment behavior, credit-spread changes should reflect not only contemporaneous leverage changes but also changes in target leverage.

The ***pecking order theory*** of capital structure provides a second mechanism for predicting future leverage changes. If the adverse selection (transaction) costs of issuing risky securities are substantial, firms should prefer to issue debt rather than equity when they need to raise external funds. Conversely, firms with excess internally-generated funds will tend to retire debt in order to preserve future options to borrow again (Lemmon and Zender (2004)). The pecking order theory implies no leverage target; leverage simply reflects the past imbalances between internal cash flows and investment opportunities. Under this theory, a financing deficit should be matched dollar-for-dollar by a change in firm debt (Shyam-Sunder and Myers (1999), Lemmon and Zender (2004)). Thus, investors should expect that firms about to face a financing deficit will be increasing their leverage, and hence their probability of default (*ceteris paribus*). Conversely, firms expected to run a financing surplus should be reducing their leverage.

If investors use current information to form expectations about a firm's future leverage, bond prices should reflect that information today. Furthermore, if investors consider capital structure theories relevant, bond prices should reflect the theory investors consider most relevant for the firms they hold in their portfolios. In this study, we examine whether credit spreads reflect investors' expectations of future leverage, and whether these expectations are consistent with the trade-off and/or pecking-order theories of capital structure.[2] We use a sample of publicly traded firms with outstanding bonds from 1986 to 1998 to investigate whether bondholders' expected leverage changes are consistent with the trade-off and/or pecking-order theories of capital structure. When tested against each other, neither theory seems to dominate as a basis for forming

[2] Two additional theories of capital structure have recently emerged, but we are unsure about how to operationalize them in the framework of this study. Baker and Wurgler (2002) propose a market-timing theory under which managers tend to issue equity whenever their firms' are overvalued and thus exploit informational asymmetries to benefit current shareholders. Welch (2004) proposes a managerial inertia theory under which observed changes in market leverage are the result of general movements in equity values rather than specific managerial actions affecting firm debt levels.

investors' expectations. The financing decisions of the *average* firm in our sample seem to be characterized by both trade-off and pecking-order considerations. However, a more detailed investigation reveals that for some *particular* firm types this is not the case. Investors appear to believe that only moderately levered firms are likely to behave in accordance with the pecking-order theory. In contrast, trade-off considerations seem important for all firms regardless of their leverage level. We also document support for the existence of debt capacity constraints consistent with Lemmon and Zender (2004), and for the proposition that pecking-order considerations are less likely to affect the financing choices of large firms as these face lower adverse selection costs of security issuance. Finally, we examine whether the possibility of a credit-rating change affects firms' choice of financing as documented by Kisgen (2006). We find that firms on the verge of an upgrade/downgrade experience lower credit-spread changes, consistent with our hypothesis that these firms are likely to decrease their future leverage. Our main results are robust to alternative leverage definitions and alternative methods for forming expectations.

The rest of the study is organized as follows. In Section II we develop our model and derive our main testable hypotheses. Section III describes our data sources and sample selection criteria. Section IV presents our empirical findings on how changes in leverage expectations affect credit-spread changes. Section V explores whether this effect depends on certain firm and bond characteristics. Section VI reports on the robustness of our findings and Section VII concludes.

II. A Model of Credit Spreads in the Context of Corporate Financing Decisions

In modeling a firm's credit spread we begin with structural models of default risk. These models are based on the insight of Black and Scholes (1973) and Merton (1974) that limited liability allows for the application of contingent-claim analysis to the valuation of a firm's equity and debt. In structural models, a firm defaults when the firm-value process crosses a default threshold. Thus, variables governing the firm-value process and default threshold will ultimately determine credit spreads and credit-spread changes. We focus on leverage as one such variable and explicitly incorporate the notion that prices of financial assets reflect not only current information but also investors' expectations of changes in this information over the life of the assets. That is, credit-spreads and credit-spread changes should be determined by both contemporaneous leverage changes and by changes in investors' expectations of future leverage. We rely on existing capital structure theories to provide the mechanism through which investors form these leverage expectations.

When firm *i* releases its quarter *t* accounting information, investors assess the firm's default probability and incorporate this information into the credit spreads at time *t*. The default probability depends on current leverage and investors' expectations of future (time *t+1*) leverage. That is,

$$CS_{i,t} = \alpha \cdot LEV_{i,t} + \gamma \cdot E_t LEV_{i,t+1} + \boldsymbol{\theta} \cdot \mathbf{Z_t} + \tilde{\omega}_{i,t} \tag{1}$$

where $CS_{i,t}$ is the i^{th} firm's credit spread at the end of quarter *t*,

$LEV_{i,t}$ is the i^{th} firm's ratio of interest, debt to total assets at the end of quarter *t*, and

$\mathbf{Z_t}$ is a vector of control variables motivated by structural models of credit risk, as in Collin-Dufresne *et al.* (2001).

Re-writing equation (1) as a difference equation eliminates unobserved, bond-specific features that may affect the credit spread:

$$\Delta CS_{i,t} = \alpha \cdot \Delta LEV_{i,t} + \gamma \cdot \Delta E_t LEV_{i,t+1} + \boldsymbol{\theta} \cdot \boldsymbol{\Delta} \mathbf{Z_t} + \varepsilon_{i,t} \tag{2}$$

where $\varepsilon_{i,t} = \Delta\tilde{\omega}_{i,t}$. One naturally expects that $\alpha > 0$: an increase in leverage raises the probability of default and hence the credit spread on outstanding bonds. We similarly expect that $\gamma > 0$ in (2). Note that α could be zero if investors expected a firm to reverse any leverage change very quickly. However, $\Delta E_t LEV_{i,t+1}$ must carry a nonzero coefficient if investors form expectations about future leverage changes from current information. In modeling investors' expectations of future leverage we turn to the two dominant theories of corporate capital structure – the trade-off theory and the pecking-order theory.

The ***trade-off theory*** of capital structure posits that firms select a target leverage ratio by trading off the costs and benefits of debt financing. It is typically assumed that target leverage can vary over time in response to changes in firm characteristics. The partial adjustment modification of the trade-off theory recognizes that leverage adjustments can be costly, which might make it optimal for firms to adjust back to their target partially over time rather than fully in any given quarter/year. In fact, recent studies document adjustment speeds of less than 100 percent consistent with the existence of such adjustment costs (Fama and French (2002), Flannery and Rangan (2006) and Leary and Roberts (2005)). To account for these recent findings, we specify a partial-adjustment model based on Flannery and Rangan (2006) in which target leverage is based on firm characteristics. Each quarter, the target-adjustment hypothesis specifies that a firm will change its leverage in the following manner:

$$LEV_{i,t+1} - LEV_{i,t} = \lambda\left(LEV^*_{i,t+1} - LEV_{i,t}\right) + \delta_{i,t+1} \tag{3}$$

where $LEV_{i,t}$ is defined above,

$LEV^*_{i,t}$ is the i^{th} firm's target debt-to-assets ratio at the end of quarter t. $LEV^*_{i,t}$ depends on a vector of firm characteristics described below.

λ is the quarterly adjustment speed.

In words, the typical firm closes a proportion λ of the distance between its actual and its target leverage every quarter. Under this hypothesis, today's expectation of next quarter's leverage is given by:

$$E_t LEV_{i,t+1} = [\lambda\, LEV^*_{i,t+1} + (1-\lambda)\cdot LEV_{i,t}] \tag{4}$$

where λ is the adjustment speed.

Substituting equation (4) into (2) gives a model of credit-spread changes conditional on the target-adjustment behavior of firm's leverage ratios:

$$\Delta CS_{i,t} = [\alpha_{TO} + \gamma_{TO}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \boldsymbol{\theta}_{\mathbf{TO}} \cdot \boldsymbol{\Delta}\mathbf{Z}_{\mathbf{t}} + \varepsilon_{TO,i,t} \qquad (5)$$

If investors form leverage expectations based on the trade-off theory, we anticipate that $\gamma_{TO} > 0$ in (5).

The ***pecking-order theory*** of capital structure proposes an alternative mechanism for forming expectations of a firm's future leverage. The basic idea is that a firm has either excess or surplus cash available during each time period. Following Shyam-Sunder and Myers (1999), we define a firm's net need to raise external funds as

$$FINDEFA_{i,t} = (DIV_{i,t} + I_{i,t} + \Delta W_{i,t} - C_{i,t}) / Assets_{i,t} \qquad (6)$$

where $DIV_{i,t}$ is the i^{th} firm's cash dividends paid during the quarter ending at *t*,

$I_{i,t}$ is the i^{th} firm's net investments during the quarter ending at *t*,

$\Delta W_{i,t}$ is the i^{th} firm's change in working capital during the quarter ending at *t*,

$C_{i,t}$ is the i^{th} firm's net cash flow after interest and taxes during quarter *t*, and

$Assets_{i,t}$ is the book value of the i^{th} firm's assets at the end of quarter *t*.[3]

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[3] Investment ($I_{i,t}$) is defined by the following Computat Quarterly data items: [91-85-109+90-83+94-110] for format code 7, and [91-85+90-83+94+95] for format codes 1, 2 and 3. Change in working capital ($\Delta W_{i,t}$) is defined by the following Computat Quarterly data items: [74-103-104-105-106-107-75-112] for format code 7, [74+75+73] for format code 1 and [74-75-73] for format codes 2, 3. Net cash flow after interest and taxes ($C_{i,t}$) is defined by the following Computat Quarterly data items: [76+77+78+79+80+102+81+114] for format code 7 and [76+77+78+79+80+102+81+87] for format codes 1, 2 and 3.

As presented by Myers (1984), the pecking order hypothesis is based on a refutable presumption that transaction costs – in particular the asymmetric information component of those costs – are higher on equity issuances than bond issuances. Retained earnings represent the preferred source of investment financing. If high desired investment makes (6) positive, firms strongly prefer to issue external debt. Equity is issued only as a last resort. Shyam-Sunder and Myers (1999) specify that the pecking order hypothesis should result in leverage changes following the pattern[4]

$$LEV_{i,t+1} - LEV_{i,t} = FINDEFA_{i,t+1} + \delta_{i,t+1} \quad (7)$$

We use (7) as our concrete specification of the pecking-order theory. Under this theory, therefore, expected future leverage follows from a simple re-arrangement of equation (7):

$$E_t LEV_{i,t+1} = E_t FINDEFA_{i,t+1} + LEV_{i,t} \quad (8)$$

Substituting equation (8) into (2) results in a model of credit-spread changes in which changes in investors' expectations of the firm's financing needs are added to the set of standard structural-model variables:

$$\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \mathbf{\Delta} E_t FINDEFA_{i,t+1} + \boldsymbol{\theta}_{PO} \cdot \mathbf{\Delta Z_t} + \varepsilon_{PO,i,t} \quad (9)$$

If investors form expectations based on the pecking-order theory, we anticipate that $\gamma_{PO} > 0$ in specification (9).

III. Data

This study uses corporate bond data from the Warga-Lehman Brothers Fixed Income Database. The database reports monthly price quotes for the major private and government debt issues traded in the United States. Bond prices are available from January 1973 until March 1998, but we begin our sample in January 1986 because one of our macro control variables (VIX) is

[4] Shyam-Sunder and Myers (1999) find support for this version of the pecking order hypothesis, although Fama and French (2002) and Frank and Goyal (2003) do not.

unavailable before that time.[5] We use only actual trader quotes on coupon-paying bonds issued by U.S. industrial firms.[6] We eliminate secured bonds, those with a call or put feature, and those backed by mortgages/assets. As in Warga (1991) and Eom *et al.* (2004), we eliminate bonds with less than one year to maturity, as they are very unlikely to trade.[7]

In order to compute a credit-risk spread, we collect yields on constant-maturity Treasury bonds from the Federal Reserve Board's H.15 releases. For each corporate bond *i*, we define a credit spread ($CS_{i,t}$) as the difference between its yield and the corresponding constant-maturity Treasury yield at the end of month *t*. When there is no precise maturity match, we interpolate to obtain an appropriate Treasury yield. We then retain only the spread observations corresponding to the quarter-ends for which Compustat provides financial information on the issuing firm. We eliminate from our sample observations for which $CS_{i,t}$ is negative or greater than 10%, as these are likely to be data entry errors or bonds in distress (for which a linear model like (2) is probably inappropriate). We define a change in credit spread ($\Delta CS_{i,t}$) as the change in a bond's credit spread between two consecutive quarter ends and winsorize the quarterly $\Delta CS_{i,t}$ observations at the 1st and 99th percentiles to reduce the effect of outliers.

[5] The growth in the credit-default swap market in the last 5-10 years has had some academics wonder about the effect of this de facto market for default insurance on bond prices. One benefit of using a somewhat older data is that it allows us to avoid any 'information contamination' across the two markets.

[6] While most prices reflect "live" trader quotes, some are "matrix" prices estimated from price quotes on bonds with similar characteristics. Sarig and Warga (1989) have shown that these matrix prices can be problematic, so we exclude them from our sample.

[7] The Warga-Lehman Brothers Fixed Income Database contains about 1.5 million monthly bond quotes for the period 1986-1998. After eliminating matrix prices and limiting our sample to corporate issuers we are left with a third of these quotes. We also exclude bonds with embedded options (about 300,000) and bonds with credit enhancing features (about 20,000). Eliminating from our sample financial firms and firms operating in regulated industries further reduces the number of observations by a third. Finally, after retaining only bond observations for which we are able to collect CRSP and Compustat data, we are left with about 17,000 bond-quarters. Note that the last data filter moves our sample from monthly to quarterly data frequency.

We obtain financial information for each firm from the quarterly Compustat file. Our analysis employs both book leverage and market leverage measures. Book leverage is defined using the book value of firm assets:

$$LEV_B = \left[\frac{Long\ TermDebt\ [51] + Short\ Term\ Debt\ [45]}{Total\ assets\ [44]} \right] \tag{10}$$

Market leverage is defined using market-valued instead of book-valued assets:

$$LEV_M = \left[\frac{Long\ TermDebt\ [51] + Short\ Term\ Debt\ [45]}{Total\ assets\ [44] - Book\ Equity\ [60] + Market\ Equity\ [14 * 61]} \right] \tag{11}$$

The numbers in brackets indicate the quarterly Compustat item numbers. Compustat also provides the financial data required to generate investor expectations about a firm's future leverage. (See below.) Consistent with previous capital-structure studies, we convert nominal accounting values to real 1983 values using the consumer price index. We then mitigate the effect of outliers by winsorizing the raw data and any resulting ratios at the 1st and 99th percentiles.

Finally, we follow Collin-Dufresne *et al.* (2001) in selecting macroeconomic series to control for bond market conditions ($\mathbf{Z_t}$ in equation (1) above):

R_t^{10} = the 10-year, constant maturity nominal Treasury bond rate at the end of month *t*;

$SLOPE_t$ = the difference between the 10-year and 2-year Treasury yields at the end of month *t*;

VIX_t = the implied volatility of the S&P 100 index, calculated by the Chicago Board Options Exchange on the basis of historical data on the S&P 100 index options;[8]

$S\&P_t$ = the return on the S&P 500 index for the quarter ending at *t*;

$JUMP_t$ = the slope of the "smirk" of implied volatilities from options on S&P 500 futures. We calculate this variable as described in Collin-Dufresne et al. (2001), using option and futures prices obtained from the Chicago Mercantile Exchange;

[8] Strictly speaking, "VIX" refers to the implied volatility in S&P 500 index options, but these data are unavailable before 1990. We therefore use the implied S&P 100 volatility to measure market uncertainty throughout our sample period.

$CRPREM_t$ = the difference between Moody's average yield on Baa and Aaa-rated bond indices, as a measure of market aversion to default risk.

The average treasury and corporate bond yields are obtained from the Federal Reserve Board's H.15 releases. VIX comes from the Chicago Board Options Exchange, and the S&P returns come from CRSP.

Table 1 provides summary statistics for our final sample of 1,243 bonds issued by 394 U.S. industrial firms. The average number of quarterly quotes per bond is 18 and the average number of bonds per firm is 3.[9] The average credit spread is 1.06% and the average quarterly credit-spread change is -0.01%. The average market-valued leverage for firms in our sample is 24%, with a mean quarterly change -0.29%. Book-valued leverage averages 34%, with a mean quarterly change of -0.18%.

IV. Expected Future Leverage and Credit Spreads

A. Are Future Leverage Changes Determinants of Credit-spread Changes?

We start our analysis with a simple diagnostic test of whether bondholders can foresee changes in a firm's leverage and appropriately price these in the firm's bonds. If future leverage changes are priced, then credit spreads should be affected by both contemporaneous leverage and by investors' expectations of future leverage as in (1). Omitting future leverage changes from the model will result in the estimation of:

$$\Delta CS_{i,t} = \alpha \cdot \Delta LEV_{i,t} + \theta \cdot \Delta Z_t + \varepsilon_{i,t} \qquad (12)$$

[9] Bonds do not appear to be concentrated by issuer. Of the 394 firms in our sample only 73 have more than 4 bond issues, 58 have more than 5 bond issues, and 47 have more than 6 bond issues. Furthermore, the several bond issues of the same firm are not always outstanding at the same time.

where $\varepsilon_{i,t} = \gamma \cdot \Delta E_t LEV_{i,t+1} + \tilde{\omega}_{i,t}$ [10] and $\gamma > 0$. Our hypothesis that an increase (decrease) in future leverage affects credit spreads today implies that the residuals from estimating equation (12) contain information. If the residuals are positive and investors' expectations are on average correct, then the firm will likely increase its debt (or reduce equity) in the quarters to come. Similarly, if the residuals from estimating equation (12) are negative, we should observe a decrease in future leverage.

We estimate equation (12) using simple OLS and present the results in Table 2, Panel A. We then use the residuals from this estimation to classify firms into two groups: those with positive residuals and those with negative residuals. We expect that firms with positive residuals will experience a larger increase (smaller decrease) in future leverage than will firms with negative residuals. Table 2, Panel B reports two tests of this hypothesis for leverage changes up to 4 quarters ahead of the current quarter. First, we use a simple t-test to investigate whether the *mean* future leverage change for the positive-residual observations is greater than the mean leverage change for the negative-residual ones.[11] The average leverage decrease for negative-residual bond-quarters is larger than that for positive-residual ones, up to four quarters following the residual estimation. We follow up with a non-parametric (Wilcoxon median) test of the hypothesis that the *median* leverage decrease for negative-residual observations is larger than that for positive-residual ones. The benefit of this test is that it makes no assumption about the underlying distribution of future leverage changes. Our findings remain the same under this less restrictive assumption. Overall, the results presented in Table 2, Panel B imply that changes in

[10] If the firm specific information is informative about firms' default probability for the upcoming k periods, this would result in:
$\varepsilon_{i,t} = \gamma_1 \cdot \Delta E_t LEV_{i,t+1} + \gamma_2 \cdot \Delta E_t LEV_{i,t+2} + \gamma_3 \cdot \Delta E_t LEV_{i,t+3} + ... + \gamma_k \cdot \Delta E_t LEV_{i,t+k} + \tilde{\omega}_{i,t}$. The T tests in Table 2 indicate that γ_k are positive and significant for $k \leq 4$.

[11] After confirming that the two residual groups have unequal variances, we use a t-test that accommodates this empirical feature of our data.

credit spreads in any given quarter reflect leverage changes up to four quarters into the future. These findings are robust to the inclusion of bond or firm fixed effects in the regression (not tabulated).

Note that it is possible for causality to be reversed in the setup above. An increase in credit spreads might induce a firm to lower its leverage and a decrease in credit spreads might encourage it to seek debt financing in the future. Under this hypothesis, we should find a *negative* relationship between regression (12)'s residuals and subsequent leverage changes. This is inconsistent with the results presented in Table 2, Panel B. While the mean (median) leverage-change differences between the two residual groups might underestimate the connection between credit spreads and future leverage as a result of this reverse causality effect, there is no doubt that credit spreads foresee subsequent leverage changes at least up to four quarters in the future.

Given this evidence that credit spreads predict subsequent leverage changes, we can test whether bond prices are consistent with alternative bases for investors' leverage-change expectations. Specifically, we test whether the expectations are consistent with the trade-off and/or the pecking-order theories of capital structure. Note that it is possible for both theories to explain investors' reactions to leverage changes as long as some firms behave according to each theory.

B. Tests of the Trade-off Theory

Equation (5) indicates that credit-spread changes will be affected not only by contemporaneous leverage changes but also by changes in investors' expectations about the firm's target leverage. As a first step in our analysis we estimate leverage targets for each firm in our sample. Because this estimation entails several important econometric difficulties, we use a variety of econometric approaches.

In general, previous researchers have estimated target leverage models that permit targets to vary across firms and over time:

$$LEV^*_{i,t+1} = \beta X_{i,t} \tag{13}$$

where $X_{i,t}$ is a vector of the i^{th} firm's characteristics designed to proxy for the costs and benefits of debt. We use the following set of such proxies:

EBIT_TA = earnings before interest and taxes as a proportion of total assets,

MB = the ratio of assets' market to book values,

DEP_TA = depreciation expense as a proportion of total assets,

Ln(TA) = log of total book assets (a measure of firm size),

FA_TA = fixed assets as a proportion of total assets,

R&D_TA = research and development expenses as a proportion of total assets,

R&D_DUM = a dummy variable equal to one if R&D expenditures are not reported; otherwise zero.

IND_Median = the prior quarter's median leverage ratio for the firm's industry. Industry classifications are based on the 48 industry categories in Fama and French (1997).

RATED = a dummy variable equal to one if the firm has a debt rating; otherwise zero.

Table 1 provides summary statistics for these variables.

Flannery and Rangan (2006) and Lemmon *et al.* (2006) assert that partial adjustment is important, and that firm fixed effects (F_i) should be added to the set of explanatory variables in equation (13):

$$LEV^*_{i,t+1} = \beta X_{i,t} + F_i \tag{14}$$

Substituting equation (14) into (3) produces the following estimable model:

$$LEV_{i,t+1} = (\lambda \cdot \beta) \cdot X_{i,t} + (1 - \lambda) \cdot LEV_{i,t} + \lambda \cdot F_i + \delta_{i,t+1} \tag{15}$$

Equation (15) represents a dynamic panel regression, which cannot be estimated properly using OLS. Following Flannery and Rangan (2006), we therefore substitute a fitted value for the lagged book leverage, using the lagged market value of leverage and $\mathbf{X_t}$ as instruments (Greene, 2003).[12] To further limit any bias resulting from the dynamic-panel characteristics of our data, we estimate equation (15) using all available data for our sample firms during the 1973-2006 time period. The results are presented in column (1) of Table 3. The estimated quarterly adjustment speed of 8.2% implies an annual rate of about 29%. Although this adjustment speed is a matter of considerable uncertainty for econometric reasons, it is of magnitude consistent with that reported in other studies. Leary and Roberts (2005) and Flannery and Rangan (2006) document annual adjustment speeds in the 30-40% range, while Lemmon *et al*. (2006) and Hankins (2006) report more conservative estimates of 20-22% per year.

Given the econometric issues in properly estimating the target leverage ratio, we present our main results using a variety of target leverage proxies. Column (2) of Table 3 therefore re-estimates equation (15) without the lagged dependent variable.[13] This specification imposes the assumption that the typical firm is at its long-run target leverage. The resulting coefficients on the $\mathbf{X_t}$ variables should be compared to the estimated long-run effects $(\hat{\beta})$ from column (1)[14]. Column (3) of Table 3 removes the fixed effects from the specification in column (2) and yields broadly similar results. Finally, note that the market leverage results in columns (4) – (6) of Table 3 closely resemble those for book leverage in the first three columns. [15] We use the estimated, long-

[12] In a dynamic panel, the error term in the lagged dependent variable is correlated with the firm fixed effect, yielding downward-biased estimates of (1-λ) in (15). (See Baltagi (2001), chapter 8.) Using an appropriate instrument for the lagged dependent variable eliminates this bias. When the dependent variable is market leverage, we use book leverage as an instrument.

[13] When the specification includes no lagged dependent variable, estimating it as a panel regression involves no bias.

[14] Note that in a partial-adjustment specification, the long-run effects of the $\mathbf{X_t}$ variables on leverage are given by the estimated coefficients divided by the adjustment speed, λ.

[15] The quarterly adjustment speed is 8.9% using market leverage and implies an annual rate of about 31%.

run targets implied by the three specifications in Table 3 to form alternative target leverage estimates for each firm in our sample in each quarter.[16]

Table 4 reports the results of estimating our basic regression for *ΔCS* (equation (5)), using alternative proxies for firm target leverage.[17] Panel A defines leverage using the book value of firm assets; Panel B uses market values. The first column of Table 4, Panel A defines the expected future change in leverage as a change in the firm's long-run target leverage. Both ΔLEV and ΔLEV^* are statistically significant at conventional levels. This implies that credit-spread changes are affected not only by contemporaneous leverage changes but also by changes in investors' expectations based on the trade-off theory. The rest of Table 4, Panel A demonstrates that this basic result holds regardless of how we estimate leverage targets. Column (2) uses the target leverage computed from the estimated coefficients in the second column of Table 3, which assumes that the typical firm always operates at its target leverage. Column (3) is based on a target computed without fixed effects, estimated in the third column of Table 3. In column (4) we allow for the possibility that leverage targets might stay relatively constant through time, so for each quarter in a calendar year we specify the same leverage target calculated as the average of the firm's quarterly targets over the previous year. Columns (5) and (6) of Table 4A specify each firm's target leverage as its average observed leverage over the preceding one or three years, as in Shyam-Sunder and Myers (1999) and others. These simpler target estimates appear to have a larger impact on credit-spread changes compared to the target estimates in the first three columns of Table 4A. One interpretation of this finding is that the econometric difficulties in estimating target-adjustment models might produce target estimates that are too

[16] In an attempt to remove seasonal variation from our leverage estimates, we include quarterly dummy variables when estimating equation (15) and then omit the quarterly effects when computing target leverage ratios. This adjustment has virtually no effect on the estimates or tests reported later in the paper.
[17] Our main results are robust to the use of standard errors adjusted for bond or firm clustering. We choose to report robust standard errors instead, because the consistency of clustered standard errors depends on the number of clusters and the extent to which a panel dataset is balanced (Petersen (2007)). These can be problematic in our estimations later by groups/terciles.

noisy. This noise is reduced when quarterly targets are averaged to produce annual targets as in column (4). An alternative explanation is that the standard set of firm characteristics used to estimate targets might be insufficient to capture all the benefits and costs of debt. Thus, a trailing average of a firm's past leverage might be a better proxy for its optimal debt-to-assets ratio. The bottom-line conclusion, however, is that regardless of how the book-valued target leverage is measured, credit spreads respond significantly to changes in that target, *beyond* their response to contemporaneous leverage changes. Panel B of Table 4 repeats these same regression specifications for market-valued measures of leverage and the leverage target. While the statistical significance of the control variables and contemporaneous leverage are basically unchanged from Panel A, target leverage loses some explanatory power. This might be an indication that market leverage is harder to forecast than is book leverage. The difference between targets based on firm characteristics and those based on average past leverage, is even more pronounced in Panel B. Once again, allowing for quarterly variation seem to introduce too much noise in the target estimates (compare columns (1) and (4)), and the usual determinants of optimal leverage seem to be insufficient to capture all of the variation in expected future leverage (compare columns (1)-(3) to (5) and (6)).

C. Tests of the Pecking-order Theory

If bond investors form expectations of future leverage in a manner consistent with the pecking-order theory, then equation (9) implies that credit-spread changes will be affected by changes in investors' expectations about a firm's future financing deficit. We thus need a model for forecasting a firm's future financing deficit:

$$FINDEFA_{i,t+1} = \boldsymbol{\varphi}\mathbf{Y_{i,t}} + \upsilon_{i,t+1} \qquad (16)$$

where $\mathbf{Y_{i,t}}$ is a vector of firm *i*'s characteristics at the end of quarter *t*.

We know of no prior study evaluating the components of $\mathbf{Y_{i,t}}$ and therefore start with the following firm-specific variables:

> $FINDEFA_{i,t-k+1}$, (k=1 to 4) = up to four lags of the dependent variable defined above,
>
> $IND\_DUM_{i,t}$ = an industry dummy based on the 47 industries defined in Fama and French (1997)
>
> $EBIT\_TA_{i,t}$ = earnings before interest and taxes as a proportion of total assets,

A subset of the results from these OLS estimations is presented in the first four columns of Table 5, for a variety of included lags of the dependent variable. The first lag of the financing deficit measure has the strongest explanatory power and adding additional lags does not improve the model's fit from an adjusted $R^2 = 0.38$. Lagged earnings-to-assets ratio (*EBIT_TA*) appears to be the only other accounting variable that adds to the model's fit although only marginally significant. Including other accounting variables leaves the explanatory power of the financing-deficit forecasting model unchanged (results not included).

Column (5) of Table 5 incorporates the data's panel characteristics by adding firm fixed effects to control for unobserved variables that are relatively stable over time for each firm. The resulting coefficient estimates and fit are similar to those in column (4). However, the dynamic panel specification in column (5) might provide biased coefficient estimates on the lagged dependent variable. We re-estimate this regression substituting an instrumental variable, $FINDEFA_{t-1}$, for the lagged dependent variable and then report the results in the last column of Table 5. This correction does not materially affect the model's fit or estimated coefficients.

We treat the seasonality-adjusted fitted values from the six alternative specifications of equation (16) as our measures of financing-deficit expectations and use them to explain credit-spread changes as in equation (9).[18] The results from an OLS regression are reported in Panel A of Table 6 for book-valued leverage. The coefficient on $\Delta E_t FINDEFA_{t+1}$ is positive and strongly significant in all cases, consistent with the hypothesis that investors adjust their expectations of a firm's future leverage as that firm's expected financing needs change. To put this differently, investors seem to believe that firms' leverage decisions are affected by their financing deficit or surplus, as implied by the pecking-order theory of capital structure.

Panel B of Table 6 replicates our analysis using market-leverage instead of book-leverage ratios. In contrast to Panel A, the coefficients on contemporaneous leverage are much larger and those on expected financing deficit are smaller and less significant. This might imply that future market leverage is harder to predict. Nonetheless, for all six alternative proxies of expected financing deficits, an increase in that deficit raises the market's expected future leverage, and hence raises the observed spread.

D. Joint Tests of the Trade-off and Pecking-order Theories

The analysis so far provides individual support for the trade-off and pecking-order theories in isolation. However, investors might believe that both theories are important in firms' financing decisions. We use the following specification to test this possibility:

$$\begin{aligned}\Delta CS_{i,t} = \alpha_{PO,TO} \cdot \Delta LEV_{i,t} + \gamma'_{PO,TO} \cdot \mathbf{\Delta} E_t FINDEFA_{i,t+1} + \gamma''_{PO,TO} \cdot \mathbf{\Delta} LEV^*_{i,t+1} \\ + \boldsymbol{\theta}_{PO,TO} \cdot \mathbf{\Delta Z_t} + \varepsilon_{PO,TO,\,i,t}\end{aligned} \tag{17}$$

If investors believe largely in the trade-off theory of capital structure, we should find that $\Delta LEV^*_{i,t+1}$ carries a positive coefficient while the one on $\Delta E_t FINDEFA_{i,t+1}$ is zero. If instead, investors believe largely in the pecking order model, we should find $\mathbf{\Delta} E_t FINDEFA_{i,t+1}$ with the

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[18] We adjust our estimates of expected financing deficit for seasonality in the same manner in which we adjust our leverage targets. We start by estimating equation (16) with quarterly dummies and then calculate fitted values excluding the dummies.

positive coefficient and $\Delta LEV^{*}_{i,t+1}$ showing no significant effect. If each model applies to a non-trivial number of firms, both estimated coefficients could be non-zero.

Table 7 presents the results from an OLS estimation of equation (17). For simplicity, we use the PO_1 Model from Table 5 for pecking order expectations in all columns of the table. Panel A measures leverage in book-value terms; Panel B presents market-valued leverage results. In Panel A, both ΔLEV^{*} and $\Delta E_t FINDEFA_{t+1}$ uniformly carry significantly positive coefficients of similar magnitude to those reported in the individual tests of the trade-off and pecking-order theories. In contrast, the effect of contemporaneous leverage changes on credit-spread changes becomes smaller and in the last three columns less significant once both ΔLEV^{*} and $\Delta E_t FINDEFA_{t+1}$ are included in the set of explanatory variables. This suggests that when pricing default risk, bond investors do incorporate their expectations about future leverage. When forming these expectations, they seem to consider both the firm's target leverage and its expected financing needs. This is consistent with recent evidence that firms might have target debt ratios, but also prefer internal funds to external financing (Hovakimian *et al*. (2001), Hovakimian *et al.* (2004) and Strebulaev (2003)). The market leverage results in Panel B carry the same implication about investor expectations, though once again future leverage expectations appear to be less important than current leverage.

E. Comparing Different-maturity Bonds of the Same Issuer

To further investigate the importance of future versus contemporaneous leverage changes, we focus on a bond's remaining maturity. Future leverage changes might be of less consequence to the pricing of short-term bonds since these changes might not occur until after the bond matures. This is why short-term bonds might react more strongly to contemporaneous leverage changes than to changes in expectations about future leverage, while the opposite might be true for long-term bonds. Long remaining maturity not only leaves more time for changes in firm default-probability to materialize, but also exposes more of a bond's cash flows to these default-probability changes. To examine these issues we limit our analysis to firms with both short-term and long-term bonds outstanding in an attempt to isolate the effect of maturity and to some degree endogenize the debt maturity choice. We define short-term (long-term) bonds as those having less (more) than 15 year to maturity. We then pair up each short-term bond with a long-term bond issued by the same firm and require that there is at least 5 years of maturity difference within each bond pair.[19] Finally, we specify a variant of our base model, equation (2), in which the dependent variable is the difference between the credit-spread change of the short-term and the long-term bond of the same firm:

$$\begin{aligned}\Delta CS_{LT,i,t} - \Delta CS_{ST,i,t} = (\alpha_{LT} - \alpha_{ST}) \cdot \Delta LEV_{i,t} + (\gamma_{LT} - \gamma_{ST}) \cdot \Delta E_t LEV_{i,t+1} \\ + (\boldsymbol{\theta}_{LT} - \boldsymbol{\theta}_{ST}) \cdot \boldsymbol{\Delta Z_t} + \varepsilon_{i,t}\end{aligned} \tag{18}$$

If a bond's remaining maturity affects the extent to which current or future leverage changes impact that bond's credit spread, then we will observe that $(\alpha_{LT} - \alpha_{ST})$ and/or $(\gamma_{LT} - \gamma_{ST})$ differ from zero. Expectations of future leverage under the trade-off and pecking-order theories are defined earlier by equations (4) and (8) respectively:

$$E_t LEV_{i,t+1} = [\lambda\, LEV^*_{i,t+1} + (1-\lambda) \cdot LEV_{i,t}] \tag{4}$$

$$E_t LEV_{i,t+1} = E_t FINDEFA_{i,t+1} + LEV_{i,t} \tag{8}$$

The results from individual (Panels A and B) and joint (Panel C) tests of the two capital-structure theories are presented in Table 8. They reveal that remaining maturity does not seem to affect the sensitivity of credit spreads to contemporaneous leverage changes, but it does affect their sensitivity to future leverage changes when these are based on the trade-off theory. In most specifications, the coefficients on ΔLEV^* are positive and statistically significant. This indicates

[19] This procedure produces a sample of 1,525 bond pairs. The average maturity of the short-term bonds in this subsample is 4.9 years. The average maturity of the long-term bonds is 25.1 years.

that for a given firm the same change in target leverage expectations impacts long-maturity bonds more than short-maturity bonds. We do not observe the same effect for leverage expectations based on the pecking-order theory. In all model specifications the coefficient on $\Delta E_t FINDEFA_{t+1}$ is not significant. This might be due to the inherently short-term nature of financing deficit as a predictor of future leverage changes. While firms must offset their financing deficit/surplus with an increase/decrease of external funds in any given quarter, they may choose to adjust toward their optimal leverage over the course of several quarters.

The results reported in Table 8 provide additional support to the proposition that firm leverage does not follow a random walk. If it were to follow a random walk then the best estimate of future leverage should be current leverage, and predicted future behavior should therefore have no effect on credit spread changes. The fact that we observe different sensitivities to future leverage changes for bonds of different maturity but issued by the same firm, indicates that investors expect firms to make systematic changes in their leverage in the future.

V. Capital Structure Theories and Firm/Bond Characteristics

The analysis so far supports the conjecture that the *average* firm's corporate-bond credit spreads incorporate information about a firm's current financial state as well as expectations of future leverage changes formed under both the trade-off and pecking-order theories of capital structure. However, it is conceivable that for any *particular type* of firm or any *particular type* of bond, trade-off considerations might dominate pecking-order considerations or vice versa. In the subsections that follow we attempt to identify the characteristics that might make a subset of firms more or less likely to behave according to either one of the two capital structure theories. The presented results use our book-leverage specification (equation (10) above) and include structural-model motivated control variables which are not reported for ease of exposition.

A. The Effect of Leverage

We first examine whether a firm's leverage level affects the extent to which future leverage expectations are priced in its bonds' credit spreads. We re-run the above capital structure tests (equations (5), (9) and (16)) for different subsets of firms grouped according to their lagged leverage. The results are presented in Table 9, Panel A and show two noteworthy points. First, leverage level seems to be one of the firm characteristics that affect the extent to which bondholders base their expectations on the trade-off or pecking-order theory. While changes in target leverage remain positive and significant across all leverage terciles, changes in expected financing deficit lose explanatory power for low and high-leverage firms. This result is confirmed by the joint tests of the trade-off and pecking-order theories reported in columns (7)-(9). It appears that bond investors interpret an expected financing deficit (surplus) as a potential leverage increase (decrease) only for moderately levered firms. Credit spreads changes for low and high-leverage firms do not respond to changes in $\Delta E_t FINDEFA_{i,t+1}$ - a result inconsistent with predictions of the pecking-order theory. The second interesting point is that once we account for the effect of future leverage changes, current leverage changes become insignificant for the moderately levered firms in our sample. For firms with extreme (low or high) leverage both changes in current leverage and target leverage appears to affect bond spreads.

B. The Effect of Firm Size

The driving assumption behind the pecking-order theory of capital structure is the existence of asymmetric information costs, which are likely to be higher for equity issuances than for debt issuances. This implies that for firms facing low asymmetric information costs, pecking-order considerations might be less relevant in forming expectations about future leverage changes. Although we might have difficulties addressing this issue with our sample (all of the firms have both public equity and public debt outstanding), we nonetheless attempt to do so by using firm size as a proxy for asymmetric information. In each quarter-year of our sample period, we assign each firm a size rank relative to the market capitalization of all NYSE stocks.[20] We then assign firms to the following three size groups. Firms with market equity below the NYSE median are defined as small, those with market equity in the 50-85th percentile range are medium-size, and those with market equity above the 85th percentile are considered large. We follow this approach rather than simply forming terciles because our sample is heavily weighted towards large-size firms as confirmed by the number of observations in each of the size groups reported in Table 9, Panel B. Finally, we estimate via OLS equations (5), (9), and (17) for each size group. The results are reported in Table 9, Panel B. As expected, the coefficient on $\Delta E_t FINDEFA_{i,t+1}$ is insignificant in the large-size group. This finding supports the notion that the pecking order theory offers a better basis for forming future leverage expectations for firms with higher asymmetric information costs. Trade-off considerations, on the other hand, are relevant for all firms regardless of their size. This relevance seems to be in addition to that of pecking-order considerations for the subset of small and medium-size firms. When both measures are included in the set of explanatory variables, each measure's coefficient retains its magnitude and statistical significance.

C. The Effect of Credit Rating

The standard version of the pecking-order theory predicts that whenever firms face a cash shortfall, they will always choose to issue debt over equity. However, as Lemmon and Zender (2004) point out firms subject to high default risk might be limited in their ability to borrow funds despite their preference for debt over equity financing. These debt-capacity constraints have important implications for empirical tests of the pecking-order theory. Deviations from the pecking order by high default-risk firms can indicate inability rather than unwillingness to issue debt. Note that the existence of debt-capacity constraints does not have as clear implications for

[20] We use the monthly ME breakpoints available on Kenneth French's website. ME is price times shares outstanding (divided by 1,000,000) at month end. The breakpoints for each month t use all NYSE stocks for which market equity is available.

the trade-off theory since the market should support any leverage increase that moves a firm closer to its target. To test the argument in Lemmon and Zender (2004) in the framework of our study we use a below-investment-grade credit rating as a proxy for debt capacity constraints. We then undertake separate regressions for investment-grade and junk-rated bonds, and report the results in Table 9, Panel C. The overall results are consistent with our expectations. First, high default-risk firms are evaluated less on their future actions than on what they do today. That is, investors' expectations of future leverage appear less important for the pricing of junk bonds than for the pricing of investment-grade bonds. Our finding that pecking-order based predictions of future leverage changes are statistically insignificant in explaining credit-spread changes, also supports the idea that firms facing high default risk are constrained in the manner suggested by Lemmon and Zender (2004). The last two columns of Table 9C reveal an interesting finding. While expected financing deficit changes are insignificant, target leverage changes are marginally significant for below-investment-grade firms. This implies that even when firms face high default risk, investors do not fully discard the trade-off theory implications when forming expectations of a firm's future leverage.

D. Does the Expected Direction of the Future Leverage Change Matter?

The analysis so far confirms that leverage changes, as predicted by the trade-off and pecking-order theories of capital structure, affect current bond prices. In this section we examine whether this effect is asymmetric with respect to the expected direction of the future leverage change. Prior evidence indicates that investors' response to bad news is more pronounced that their response to good news. To the extent that leverage increases are bad-news events for a firm's debtholders, we might observe a stronger reaction of credit-spread changes to expected leverage increases than to decreases. Alternatively, firms may adjust their leverage slower or faster depending on whether they are below or above their target leverage, or whether they face a financing deficit or surplus. If investors recognize this asymmetry in future financing behavior, then we might observe a difference in the valuation of expected leverage increases and decreases.

To investigate these issues, we re-estimate the trade-off credit-spread model (equation (5)) separately for firms expected to be above their target leverage and those expected to be below. We use each firm's current-quarter leverage relative to its target for the next quarter to form above-target and below-target groups. The results of these OLS estimations are reported in Table 10, columns (1) and (2). Changes in target leverage carry significantly positive coefficients, which are not statistically different for firms expected to be above compared to below their leverage targets. This implies that there is no statistical difference in the manner in which investors price expected leverage increases and decreases under the trade-off theory. A separate estimation of the pecking-order model (equation (9)) for firms expected to run a financing surplus or deficit, yields different results. These are presented in columns (3) and (4) of Table 10. Changes in expected financing deficit remain significant for firms about to face a shortage of internal funds, but are no longer significant for firms about to face a surplus. This might be due to investors regarding future leverage increases as bad news and reacting to these more strongly than to the good news indicated by future leverage decreases. However, this explanation is inconsistent with the results reported in columns (1) and (2) of Table 10. If investors' reaction to expected leverage increases were stronger than that to expected leverage decreases, then we should be able to observe this difference regardless of whether leverage expectations are based on the trade-off or pecking-order theories. A comparison of the estimation results in columns (1) and (2) shows no such difference. A more likely explanation of the statistically insignificant coefficient on $\Delta E_t FINDEFA_{i,t+1}$ in column (3) is that firms expected to have excess internal funds do not necessarily use these to pay down debt. These firms might use some of their financing surpluses to purchase back shares and thus increase leverage – a result inconsistent with the pecking-order theory of capital structure.

VI. Robustness

The results presented so far yield support to our conjecture that investors price their expectations of a firm's future financing choices as soon as these expectations are formed. That is, quarter-ahead leverage changes as predicted by the trade-off and pecking-order theories of capital structure are reflected in this quarter's credit-spread changes. In this section, we investigate the robustness of our results along several dimensions. First, we address the possible concern that our main specifications presume that current and future leverage affect credit spread changes in a linear fashion, while theory predicts a non-linear relationship. Second, we attempt to distinguish between the effect of accounting variables previously documented to predict a firm's default risk and the effect of the trade-off and pecking-order proxies for future leverage. We do so by re-running the analysis in Sections IV.B.- IV.D with the inclusion of a number of accounting ratios. Third, we examine whether re-defining our dependent variable as price change rather than yield changes impacts our results. Finally, we investigate the possibility that our trade-off and pecking-order leverage expectations are capturing the effect of credit ratings. In a recent study, Kisgen (2006) argues that the prospect of a credit-rating change might affect a firm's financing choice. To investigate the robustness of our findings to this alternative explanation for observed capital structures, we re-estimate our base models, equations (5), (9) and (17), with the inclusion of credit-rating consideration proxies.

A. Non-linear specifications

Structural models of credit risk predict that changes in credit spreads should be non-linear functions of changes in firm leverage. To investigate whether our simplified linear specifications have affected our findings, we model credit spreads as a non-linear function of both current and future leverage. That is, equation (1) now becomes:

$$CS_{i,t} = \alpha \cdot LEV_{i,t} + \beta \cdot LEV_{i,t}^2 + \gamma \cdot E_t LEV_{i,t+1} + \delta \cdot (E_t LEV_{i,t+1})^2 + \boldsymbol{\theta} \cdot \mathbf{Z_t} + \tilde{\omega}_{i,t} \qquad (19)$$

Re-writing it as a difference equation now produces:

$$\begin{aligned}\Delta CS_{i,t} &= \alpha \cdot \Delta LEV_{i,t} + \beta \cdot [LEV_{i,t}^2 - LEV_{i,t-1}^2] + \gamma \cdot (E_t LEV_{i,t+1} - E_{t-1} LEV_{i,t}) \\ &\quad + \delta \cdot [(E_t LEV_{i,t+1}^2)^2 - (E_{t-1} LEV_{i,t})^2] + \boldsymbol{\theta} \cdot \boldsymbol{\Delta} \mathbf{Z_t} + \varepsilon_{i,t}\end{aligned} \qquad (20)$$

where $\varepsilon_{i,t} = \Delta\tilde{\omega}_{i,t}$. Expectations of future leverage under the trade-off and pecking-order theories are respectively defined by equations (4) and (8) above. This non-linear specification introduces squares of leverage, target leverage and expected financing deficit in our base models, equations (5), (9) and (17).

The estimation results (not reported here) indicate that the relationship between changes in credit spreads and changes in leverage is in fact non-linear. The squared leverage and squared expected leverage terms are both positive and statistically significant. However, allowing for non-linearity does not alter our earlier conclusions. Both target leverage and expected financing deficit remain significant determinants of credit-spreads changes, thus yielding support to both the trade-off and pecking-order theories of capital structure.

B. Specifications including accounting variables

Previous research has investigated whether accounting variables can forecast the default probability of a firm and thus affect investors' valuation of the firm's debt. Although this research has documented well the predictive ability of accounting variables, it has offered no theoretical explanation for it. Our study can potentially fill this gap. Colling-Dufresne and Goldstein (2001) offer a theoretical model that incorporates future leverage expectations in bond prices and in this paper we provide empirical evidence that these expectations of future leverage (whether based on the trade-off or pecking-order theories) affect bond credit spreads. If investors form target leverage or financing deficit expectations using the firm's current accounting statements, then the findings of previous studies can be the result of accounting variables proxying for future leverage estimates. To investigate whether this conjecture has any empirical validity we first estimate a model that omits future leverage changes while adding a variety of accounting predictors of default:

$$\Delta CS_{i,t} = \alpha \cdot \Delta LEV_{i,t} + \tau \cdot \Delta A_{i,t} + \boldsymbol{\theta} \cdot \boldsymbol{\Delta Z_t} + \varepsilon_{i,t} \tag{21}$$

The vector of firm-specific characteristics, $A_{i,t}$, includes combinations of the following variables:[21]

O-score = a default probability score based on Ohlson (1980),

Z-score = a default probability score based on Altman (1968),

NI_GROWTH = change in net income scaled by total assets,

IC = interest coverage ratio,

QR = quick ratio,

CASH = cash availability,

TRADE = trading account activities (Inventories / Cost of goods sold),

SL_GROWTH = change in sales scaled by lagged sales.

We then re-estimate equation (21) by adding future leverage changes to the set of explanatory variables. The results (not reported here) show that regardless of the accounting variables used, target leverage and expected financing deficit remain strongly significant. Adding these estimates of future leverage changes to the model reduces the size and often the statistical significance of the accounting predictors of default. This is consistent with our conjecture that these variables'

[21] We compile a large set of accounting predictors of default probability by relying on Altman (1968), Olhson (1980), Zmijewski (1984), Shumway (2001), Hillegeist et al. (2004), Beaver, McNichols, and Rhie (2005), and Das, Hanouna, and Sarin (2006).

ability to explain credit spread changes is likely the result of their close relation to expected changes in future leverage.

C. Specification using returns rather than yield changes

The pricing implications of new information might be more directly observed in bond returns rather than yield changes. In this section we explore whether changes in future leverage expectations affect the credit-risk component of a bond's holding-period return in the same manner in which they affect its credit-spread change. To do so, we re-define the dependent variable as the product of each bond's credit-spread change and modified duration.[22] That is, equation (2) now becomes:

$$D_{i,t}^{MODIFIED} \cdot \Delta CS_{i,t} = \alpha \cdot \Delta LEV_{i,t} + \gamma \cdot \Delta E_t LEV_{i,t+1} + \boldsymbol{\theta} \cdot \boldsymbol{\Delta Z_t} + \varepsilon_{i,t} \qquad (22)$$

Expectations of future leverage under the trade-off and pecking-order theories are defined earlier by equations (4) and (8) respectively. We then replicate the individual and joint tests of the trade-off and pecking order theories (equations (5), (9) and (16)) with this alternative definition of the left-hand side variable. The estimation results (not reported) do not alter our earlier conclusions. The credit portion of a bond's holding-period return responds to expected changes in future leverage just as much as the bond's credit-spread change does. Both target leverage and expected financing deficit changes remain significant thus yielding support to both the trade-off and pecking-order theories of capital structure.

D. Specifications including proxies for credit-rating considerations

In a recent study, Kisgen (2006) demonstrates that a firm's financing decisions are motivated by considerations beyond the usual trade-off and pecking-order ones. He argues that since there are clear benefits associated with higher credit-rating levels, the manager of a firm close to a rating

[22] This specification follows from the duration model: $\Delta P/P = -D^{MODIFIED} \cdot \Delta YTM$ where P is the bond's price, $D^{MODIFIED}$ is its modified duration and YTM is its yield to maturity.

change will choose equity over debt financing in an attempt to push the firm into a higher rating category. He finds evidence that credit-rating upgrades and downgrades are an important second-order determinant of firm leverage changes. To test whether investors recognize this and use the likelihood of a credit-rating change as another tool for predicting future leverage, we add proxies for this likelihood to our earlier tests of the two standard capital structure theories. More specifically, we follow Kisgen (2006) and construct an indicator variable, *CRPOM*, which equals 1 for firms with a "plus or minus" credit rating and 0 otherwise. *CRPOM* is designed to proxy for how close a firm is to a credit-rating upgrade or downgrade. We then add this newly constructed variable to equations (5), (9) and (17):

$$\Delta CS_{i,t} = [\alpha_{TA} + \gamma_{TO}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \kappa_{TO} \cdot CRPOM_{t} + \theta_{TO} \cdot \Delta Z_{t} + \varepsilon_{TO,i,t} \quad (23)$$

$$\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \mathbf{\Delta E}_{t} FINDEFA_{i,t+1} + \kappa_{PO} \cdot CRPOM_{t} + \theta_{PO} \cdot \Delta Z_{t} + \varepsilon_{PO,i,t} \quad (24)$$

$$\Delta CS_{i,t} = \alpha_{PO,TO} \cdot \Delta LEV_{i,t} + \gamma'_{PO,TO} \cdot \mathbf{\Delta E}_{t} FINDEFA_{i,t+1} + \gamma''_{PO,TO} \cdot \mathbf{\Delta} LEV^{*}_{i,t+1} + \kappa_{PO,TO} \cdot CRPOM_{t} + \theta_{PO,TO} \cdot \Delta Z_{t} + \varepsilon_{PO,TO,i,t} \quad (25)$$

If investors take a firm's credit-rating considerations into account, then we would observe that the coefficient on *CRPOM* is negative since a potential credit-rating change will make a firm more likely to decrease its leverage. This expectation of a leverage decrease will reduce current credit spreads. We estimate equations (23), (24), and (25) using OLS regression and present the results in Table 11, Panels A, B, and C respectively. In all three specifications *CRPOM* is uniformly significant with a negative sign. This implies that if firms on the verge of a credit-rating change are more likely to reduce their leverage, then investors recognize this behavior and price it in the firm's bond spreads. The effect of these credit-rating considerations is above and beyond that of the trade-off and pecking-order theories as indicated by the continued statistical significance of the leverage target and financing deficit expectations.

VII. Conclusion

Most of the empirical evidence on capital structure comes from studies of the determinants of corporate debt ratios and studies of issuing firms' debt versus equity financing choice. These studies have examined whether firm capital structure is the result of trade-off or pecking-order considerations (among others) and have provided evidence to support each side of the debate. In this study we use insights from the literature on credit-risk models to set up a new test of capital structure theories. Collin-Dufresne and Goldstein (2001) show that a firm's option to adjust its leverage can have a first-order impact on bond credit spreads. If expectations of future leverage are reflected in investors' pricing decisions, we can examine these to infer investors' beliefs about how firms make capital structure choices. This innovative approach allows us to circumvent leverage-target estimation and financing-deficit calculation criticisms. If these criticisms were well-founded then future leverage based on the corresponding target or deficit measure will not be a significant bond-pricing factor.

The main contributions of our paper are three-fold. First, we document that investors' expectations about future leverage changes do significantly affect credit spread changes. We find empirical support for expectations based on both the trade-off and pecking-order theories: changes in a firm's target leverage and changes in its expected financing needs both have a positive and significant effect on that firm's bond spreads. A joint test of the two theories confirms this conclusion. Our bond-price tests seem to provide additional support to the findings of recent capital structure studies that firms make financing decisions with both optimal-leverage and pecking-order considerations in mind.

Second, although we find evidence that investors use information on both target leverage and expected financing deficit when forming expectations about the *average* firm's future leverage, this does not appear to be the case for some *particular* firm types. Estimating our model by firm leverage, size, and credit rating groups often reduces the explanatory power of expected financing deficit while leaving that of target leverage unchanged. Bond investors behave as if the trade-off theory of capital structure enjoys a more universal applicability than does the pecking-order theory. For instance, we document that the trade-off theory of capital structure affects investor leverage expectations across all leverage terciles, while pecking-order considerations appear important only for moderately levered firms. Estimations by credit-rating categories confirm that the existence of debt capacity constraints affects the ability of firms to adhere to predictions by the pecking-order theory of capital structure. However, we also document that these high-default-risk firms are still expected to adjust their leverage towards its optimal level as proposed by the trade-off theory. Finally, we demonstrate that the extent to which firms follow a pecking order of financing is related to the asymmetric-information costs they face. The future leverage proxy implied by the pecking-order theory does not affect the credit spreads of large-size firms.

Additional support for the trade-off theory is provided by our finding that while movement toward optimal leverage is equally likely for firms below and above their target leverage, there is an asymmetry in investors' expectations of future leverage changes under the pecking-order theory. The credit spreads of firms expected to have a surplus of funds are not affected by forecasted changes in external financing needs. We interpret this as evidence that surplus firms are equally likely to pay down debt or buy back shares, which is inconsistent with the pecking-order theory of capital structure.

Our final contribution is to the growing literature on the determinants of credit spreads and credit-spread changes (e.g. Collin-Dufresne et al. (2001), Krishnan et al. (2005), Avramov et al. (2005), Campbell and Taksler (2003), Chen, Lesmond, and Wei (2005)). We document that investors' expectations about future leverage changes do significantly affect credit spread changes and that this effect is above and beyond the effect of contemporaneous leverage changes. Previous studies' focus on a firm's current financial state appears to have been a limitation.

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Table 1: Summary Statistics

Summary statistics are on our sample of 1,243 bonds issued by 394 unique industrial firms. The sample covers the period January 1986 – March 1998 (when the data source ceased publishing).

Variables	Definition	Mean	Std Dev	Median	Min	Max
Bond characteristics:						
CS	Credit spread measured as the difference between the bond's yield and the yield on a Treasury with equal maturity (%)	1.06	0.80	0.84	0.03	9.23
ΔCS	Change in credit spread between two consecutive quarter-ends (%)	-0.01	0.24	-0.01	-0.89	1.01
Maturity	Bond maturity in years	10.46	8.38	7.71	1.00	39.73
Duration	Bond duration in years	6.05	2.97	5.75	0.95	13.35
Issue Amount	Bond issue amount still outstanding in $thousands	205,369	136,408	174,000	7,305	1,250,000
Moody's Rating	Moody's credit rating on an ordinal scale with 1=Aaa	7.12	2.69	7.00	1.00	18.00
Leverage-related variables:						
LEV (market)	Book value of debt ([51]+[45]) / (Total assets [44] - Book value of equity[60] + Market value of equity [14*61])	0.2418	0.1335	0.2222	0.0022	0.7045
ΔLEV (market)	Change in LEV (%)	-0.29	2.94	-0.31	-53.34	55.68
LEV (book)	Book value of debt ([51]+[45]) / Total assets [44]	0.3366	0.1468	0.3246	0.0035	0.9085
ΔLEV (book)	Change in BLEV (%)	-0.18	3.40	-0.25	-78.25	88.18
FINDEFA	Financing deficit / Total assets [44]	0.01	0.05	0.00	-0.18	0.30
Variables used to predict target leverage:						
EBIT_TA	Earnings before interest and taxes ([8]+[22]+[6]) / Total assets [44]	0.02	0.02	0.02	-0.06	0.10
MB	Book value of debt plus market value of equity ([51]+[45]+[55]+[14]*[61]) / Book value of total assets [44]	1.23	0.61	1.08	0.32	4.42
DEP_TA	Depreciation [5] as a proportion of total assets [44]	0.01	0.01	0.01	0.00	0.04
lnTA	Log of total assets [44], measured in 1983 dollars	22.44	1.14	22.51	18.48	24.73
FA_TA	Property, plant, and equipment [42] / Total assets [44]	0.41	0.22	0.38	0.01	0.89
RD_TA	R&D expenses [4] / Total assets [44]	0.00	0.01	0.00	0.00	0.03
RD_DUM	An indicator variable equal to 1if a firm did not report R&D expenses and equal to 0 otherwise	0.40	0.49	0.00	0.00	1.00
RATED	An indicator variable equal to 1 if the firm has a public debt rating in Compustat and equal to 0 otherwise	0.99	0.12	1.00	0.00	1.00
IND_Median	Prior quarter's median leverage ratio for the firm's industry. Industries are defined according to Fama and French (1997).	0.20	0.06	0.20	0.05	0.59
MVE ($M)	Market value of equity	12,034	17,131	5,098	23	85,086
Macro variables measuring bond market conditions						
ΔR^{10}	Change in the spot rate measured as the 10-year Treasury yield	-0.04	0.52	-0.02	-1.89	1.36
ΔSLOPE	Change in the slope of the yield curve measured as the difference between the 10-year and 2-year Treasury yields	-0.05	0.27	-0.06	-0.85	0.68
S&P	Quarterly return on the S&P 500	0.01	0.03	0.01	-0.22	0.13
ΔVIX	Change in the implied volatility of the S&P 500 index	0.29	3.83	0.02	-25.86	44.96
ΔJUMP	Change in the slope of the “smirk” of implied volatilities of options on S&P 500 futures	0.02	1.21	0.12	-5.89	6.78
ΔCRPREM	Change in the credit risk premium measured as the difference between the yields on Aaa and Baa rated bonds	-0.01	0.10	0.00	-0.33	0.32

Table 2: Future Leverage Changes as Determinants of Credit-spread Changes

Panel A presents the results from an OLS estimation of the following model on the sample of 1,243 bonds over the 1986-1998 period:

$$\Delta CS_{i,t} = \alpha \cdot \Delta LEV_{i,t} + \theta \cdot \Delta Z_t + \varepsilon_{i,t} \qquad (12)$$

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔZ includes the following structural-model motivated variables: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively. Panel B presents tests which evaluate the hypothesis that firms with positive residuals from the OLS estimation above experience larger *k*-period-ahead increases in leverage than do firms with negative residuals. $\Delta LEV^{Neg}_{i,[t,t+k]}$ is the *k*-quarter-ahead change in leverage for firms with negative residuals and $\Delta LEV^{Pos}_{i,[t,t+k]}$ is the *k*-quarter-ahead change in leverage for firms with positive residuals. T-tests with the assumption of unequal variances test whether the means of the two residual groups are equal (against the alternative that the difference in means between positive and negative-residual firms is strictly positive), and non-parametric Wilcoxon median tests assess whether the medians of the two residual groups are equal (against the alternative that they are different). Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

PANEL A. OLS estimation results

ΔLEV_t	0.386 ***
	(0.068)
ΔR_t^{10}	-0.098 ***
	(0.004)
$(\Delta R_t^{10})^2$	0.096 ***
	(0.006)
$\Delta SLOPE_t$	-0.117 ***
	(0.008)
ΔVIX_t	0.006 ***
	(0.001)
$S\&P_t$	-0.077
	(0.062)
$\Delta JUMP_t$	0.029 ***
	(0.002)
$\Delta CRPREM_t$	0.389 ***
	(0.020)
Intercept	-0.048 ***
	(0.003)
Observations	13,764
R^2	0.11

PANEL B. Residual test results

Null Hypothesis	***Nobs,*** $\Delta LEV^{Pos}_{i,[t,t+k]}$ ***Nobs,*** $\Delta LEV^{Neg}_{i,[t,t+k]}$	***Mean Difference*** $\Delta LEV^{Pos}_{i,[t,t+k]} - \Delta LEV^{Neg}_{i,[t,t+k]}$	***Median Difference*** $\Delta LEV^{Pos}_{i,[t,t+k]} - \Delta LEV^{Neg}_{i,[t,t+k]}$
$\Delta LEV^{Neg}_{i,[t,t+1]} = \Delta LEV^{Pos}_{i,[t,t+1]}$	6,961 8,352	0.36% ***	0.18%***
$\Delta LEV^{Neg}_{i,[t,t+2]} = \Delta LEV^{Pos}_{i,[t,t+2]}$	6,917 8,299	0.49% ***	0.32%***
$\Delta LEV^{Neg}_{i,[t,t+3]} = \Delta LEV^{Pos}_{i,[t,t+3]}$	6,861 8,254	0.60% ***	0.34%***
$\Delta LEV^{Neg}_{i,[t,t+4]} = \Delta LEV^{Pos}_{i,[t,t+4]}$	6,820 8,221	0.70% ***	0.46%***

Table 3: Estimation of Target Leverage

This is an estimation of the following model on the quarterly accounting data for the 394 bond issuers in our sample from 1973 to 2006:

$$LEV_{i,t+1} = (\lambda \cdot \beta) \cdot X_{i,t} + (1-\lambda) \cdot LEV_{i,t} + \lambda \cdot F_i + \delta_{i,t+1} \quad (15)$$

LEV is a debt-to-assets ratio. *EBIT_TA* is earnings before interest and taxes scaled by total assets. *MB* is the ratio of market-to-book value of assets. *DEP_TA* is depreciation expense to total assets. *lnTA* is the natural log of total assets. *FA_TA* is the ratio of fixed-to-total assets. *R&D_DUM* is an indicator variable for whether the firm reports an R&D expenditure or not. *R&D_TA* is R&D expenditures scaled by total assets. *RATED* is an indicator for whether the firm has rated debt. *IND_MED* is the median leverage for each firm's industry. FE is a dynamic panel estimation of the model and uses instruments for the lagged dependent variable. FE λ=1 is a panel estimation under the assumption of full adjustment towards target every period (i.e. λ=1). OLS λ=1 is an OLS estimation under the full-adjustment assumption. Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	PANEL A. BOOK LEVERAGE			**PANEL B. MARKET LEVERAGE**		
	FE (1)	**FE λ=1 (2)**	**OLS (3)**	**FE (4)**	**FE λ=1 (5)**	**OLS (6)**
LEV_t	0.918***		0.962***	0.911***		0.957***
	(0.003)		(0.003)	(0.003)		(0.002)
$EBIT\_TA_t$	-0.093***	-0.803***	-0.073***	-0.120***	-0.846***	-0.109***
	(0.014)	(0.032)	(0.017)	(0.013)	(0.027)	(0.015)
MB_t	0.001**	-0.009***	0.001***	0.001	-0.059***	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
DEP_TA_t	-0.027	-0.373***	0.039	-0.086*	-0.456***	-0.012
	(0.056)	(0.128)	(0.044)	(0.050)	(0.109)	(0.039)
$lnTA_t$	-0.001***	0.002**	-0.001***	0.001**	0.015***	-0.000**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
FA_TA_t	0.016***	0.056***	0.004***	0.015***	0.067***	0.005***
	(0.003)	(0.008)	(0.002)	(0.003)	(0.006)	(0.001)
$R\&D\_DUM_t$	0.001	0.006***	0.002***	0.003***	0.012***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
$R\&D\_TA_t$	0.045	-0.963***	-0.122**	0.044	-0.022	-0.165***
	(0.078)	(0.178)	(0.048)	(0.070)	(0.151)	(0.036)
$RATED_t$	0.006***	0.046***	0.003***	0.001**	0.023***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
IND_MED_t	-0.004	0.438***	0.005	-0.004	0.405***	-0.003
	(0.005)	(0.010)	(0.004)	(0.004)	(0.008)	(0.004)
Intercept	0.039***	0.104***	0.020***	-0.014	-0.110***	0.013***
	(0.011)	(0.024)	(0.005)	(0.009)	(0.020)	(0.004)
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	No
Observations	32,962	33,259	32,962	32,757	33,052	32,757
R^2	0.93	0.23	0.93	0.93	0.33	0.93

Table 4: Tests of the Trade-off Theory

This is an OLS estimation of the following model on the sample of 1,243 bonds from 1986 to 1998:

$$\Delta CS_{i,t} = [\alpha_{TO} + \gamma_{TO}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \boldsymbol{\theta}_{\mathbf{TO}} \cdot \Delta \mathbf{Z}_{\mathbf{i}} + \varepsilon_{TA,i,t} \quad (5)$$

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔLEV*=change in target debt-to-assets ratio. ΔZ includes the following structural-model motivated variables: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. FE λ=1 uses target leverage based on the panel estimation of equation (15) under the assumption of full-adjustment towards target in every quarter. OLS uses target leverage based on the OLS estimation of equation (15) under the partial-adjustment assumption. CONSTANT 1 YR uses the same leverage target for each quarter in a calendar year where this target is constructed as the average of the prior year's FE quarterly targets. TRAIL 1 YR and TRAIL 3 YR use respectively the 1-year and 3-year trailing average of that firm's leverage as a measure of its leverage target. Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	PANEL A. BOOK LEVERAGE					
	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	0.423***	0.327***	0.372***	0.398***	0.228**	0.283***
	(0.085)	(0.086)	(0.085)	(0.086)	(0.091)	(0.086)
ΔLEV^*_{t+1}	0.156***	0.474***	0.144**	1.880***	0.853***	1.866***
	(0.030)	(0.120)	(0.062)	(0.372)	(0.166)	(0.288)
ΔR_t^{10}	-0.098***	-0.100***	-0.099***	-0.101***	-0.098***	-0.097***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.100***	0.097***	0.097***	0.097***	0.097***	0.096***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.111***	-0.119***	-0.119***	-0.117***	-0.120***	-0.123***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.006***	0.006***	0.006***	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.132**	-0.107*	-0.104*	-0.100*	-0.077	-0.075
	(0.061)	(0.061)	(0.061)	(0.061)	(0.059)	(0.059)
$\Delta JUMP_t$	0.030***	0.029***	0.029***	0.030***	0.028***	0.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.353***	0.388***	0.389***	0.396***	0.387***	0.390***
	(0.028)	(0.027)	(0.028)	(0.028)	(0.027)	(0.027)
Intercept	-0.048***	-0.048***	-0.048***	-0.048***	-0.049***	-0.049***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,400	13,400	13,434	13466	13,764	13,764
R^2	0.11	0.11	0.11	0.11	0.11	0.11

Table 4: Tests of the Trade-off Theory (Cont.)

	PANEL B. MARKET LEVERAGE					
	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	1.108***	1.078***	1.102***	1.102***	0.734***	0.881***
	(0.107)	(0.114)	(0.107)	(0.106)	(0.114)	(0.106)
ΔLEV^*_{t+1}	0.149*	0.133	0.106**	1.345***	1.650***	3.106***
	(0.088)	(0.117)	(0.049)	(0.340)	(0.199)	(0.327)
ΔR_t^{10}	-0.099***	-0.099***	-0.098***	-0.100***	-0.098***	-0.096***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.098***	0.098***	0.097***	0.097***	0.099***	0.097***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.118***	-0.118***	-0.118***	-0.118***	-0.121***	-0.128***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.032	-0.025	-0.036	-0.032	0.002	0.006
	(0.061)	(0.061)	(0.061)	(0.060)	(0.059)	(0.059)
$\Delta JUMP_t$	0.027***	0.027***	0.027***	0.028***	0.027***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.381***	0.382***	0.380***	0.385***	0.379***	0.380***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Intercept	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,384	13,384	13,434	13451	13,736	13,736
R^2	0.12	0.12	0.12	0.12	0.13	0.13

Table 5: Estimation of Expected Financing Deficit

This is an estimation of the following model on the quarterly accounting data for the 394 bond issuers in our sample from 1973 to 2006:

$$FINDEFA_{i,t+1} = \boldsymbol{\varphi}\mathbf{Y_{i,t}} + \upsilon_{i,t+1} \tag{16}$$

FINDEFA is a measure of financing deficit scaled by total assets. **Y** is a vector of firm characteristics, which includes the following variables in addition to lags of *FINDEFA*. *EBIT_TA* is EBIT as a proportion of total assets. *IND_DUM* is an industry indicator variable based on the Fama-French 48 industry categorizations. PO_1-PO_4 are OLS estimations of the model. PO_5 is a panel estimation that includes firm fixed effects. PO_6 is a dynamic panel estimation with firm fixed effects and instruments for the lagged dependent variable. Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	PO_1 (1)	**PO_2** (2)	**PO_3** (3)	**PO_4** (4)	**PO_5** (5)	**PO_6** (6)
$FINDEFA_t$	0.594***	0.598***	0.603***	0.602***	0.556***	0.510***
	(0.012)	(0.011)	(0.011)	(0.009)	(0.010)	(0.009)
$FINDEFA_{t-1}$	-0.018	-0.022**	-0.004			
	(0.011)	(0.011)	(0.009)			
$FINDEFA_{t-2}$	-0.032***	0.028***				
	(0.010)	(0.009)				
$FINDEFA_{t-3}$	0.098***					
	(0.009)					
$EBIT\_TA_t$	-0.032*	-0.038**	-0.034*	-0.025	0.023	0.010
	(0.018)	(0.018)	(0.018)	(0.018)	(0.021)	(0.017)
IND_DUM_t	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes	Yes
Intercept	0.005	0.005	0.001	0.004	0.005	0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)
Observations	25,069	25,516	25,968	26,426	26,426	25,968
R^2	0.38	0.37	0.38	0.38	0.32	0.38

Table 6: Tests of the Pecking-order Theory

This is an OLS estimation of the following model on the sample of 1,243 bonds from 1986 to 1998:

$$\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \mathbf{\Delta E}_t FINDEFA_{i,t+1} + \boldsymbol{\theta}_{PO} \cdot \mathbf{\Delta Z_i} + \varepsilon_{PO,i,t} \quad (9)$$

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔE FINDEFA=change in expected financing deficit scaled by total assets. ΔZ includes the following structural-model motivated variables: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. PO_1-PO_4 are OLS estimations of the model. PO_5 is a panel estimation that includes firm fixed effects. PO_6 is a dynamic panel estimation with firm fixed effects and instruments for the lagged dependent variable. Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	PANEL A. BOOK LEVERAGE					
	PO_1	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	0.308***	0.296***	0.295***	0.295***	0.299***	0.298***
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)
$\Delta E_t FINDEFA_{t+1}$	0.369***	0.423***	0.427***	0.428***	0.457***	0.497***
	(0.098)	(0.103)	(0.101)	(0.101)	(0.110)	(0.120)
ΔR_t^{10}	-0.097***	-0.097***	-0.097***	-0.097***	-0.097***	-0.097***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.095***	0.096***	0.096***	0.096***	0.096***	0.096***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.118***	-0.119***	-0.119***	-0.119***	-0.119***	-0.119***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.007***	0.006***	0.007***	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.073	-0.075	-0.075	-0.075	-0.075	-0.075
	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)
$\Delta JUMP_t$	0.029***	0.029***	0.029***	0.029***	0.029***	0.029***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.389***	0.389***	0.388***	0.389***	0.389***	0.389***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Intercept	-0.048***	-0.048***	-0.048***	-0.048***	-0.048***	-0.048***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,764	13,764	13,764	13,764	13,764	13,764
R^2	0.11	0.11	0.11	0.11	0.11	0.11

Table 6: Tests of the Pecking-order Theory (Cont.)

	PANEL B. MARKET LEVERAGE					
	PO_1	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	1.060***	1.049***	1.047***	1.047***	1.049***	1.049***
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
$\Delta E_t\ FINDEFA_{t+1}$	0.199**	0.250**	0.254**	0.254**	0.269**	0.293**
	(0.097)	(0.101)	(0.100)	(0.100)	(0.109)	(0.118)
ΔR_t^{10}	-0.097***	-0.097***	-0.097***	-0.097***	-0.097***	-0.097***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.096***	0.096***	0.096***	0.096***	0.096***	0.096***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.118***	-0.118***	-0.118***	-0.118***	-0.118***	-0.118***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.007	-0.009	-0.009	-0.009	-0.009	-0.009
	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)
$\Delta JUMP_t$	0.027***	0.027***	0.027***	0.027***	0.027***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.382***	0.382***	0.382***	0.382***	0.382***	0.382***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Intercept	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,736	13,736	13,736	13,736	13,736	13,736
R^2	0.12	0.12	0.12	0.12	0.12	0.12

Table 7: Joint Tests of Trade-off and Pecking-order Theories

This is an OLS estimation of the following model on the sample of 1,243 bonds from 1986 to 1998:

$$\Delta CS_{i,t} = \alpha_{PO,TO} \cdot \Delta LEV_{i,t} + \gamma'_{PO,TO} \cdot \mathbf{\Delta} E_t FINDEFA_{i,t+1} + \gamma''_{PO,TO} \cdot \mathbf{\Delta} LEV^*_{i,t+1} + \boldsymbol{\theta}_{PO,TO} \cdot \mathbf{\Delta Z_t} + \varepsilon_{PO,TO,i,t} \quad (17)$$

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔLEV*=change in target debt-to-assets ratio. ΔE FINDEFA=change in expected financing deficit scaled by total assets. ΔZ includes the following structural-model motivated variables: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. FE λ=1 uses target leverage based on the panel estimation of equation (15) under the assumption of full-adjustment towards target in every quarter. OLS uses target leverage based on the OLS estimation of equation (15) under the partial-adjustment assumption. CONSTANT 1 YR uses the same leverage target for each quarter in a calendar year where this target is constructed as the average of the prior year's FE quarterly targets. TRAIL 1 YR and TRAIL 3 YR use respectively the 1-year and 3-year trailing average of that firm's leverage as a measure of its leverage target. Expected financing deficit is proxied by the fitted value from specification PO_1 above. PO_1 is an OLS estimation of equation (16). Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	PANEL A. BOOK LEVERAGE					
	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	0.334***	0.256***	0.294***	0.323***	0.136	0.193**
	(0.089)	(0.090)	(0.089)	(0.090)	(0.097)	(0.091)
ΔLEV^*_{t+1}	0.179***	0.450***	0.143**	1.839***	0.898***	1.943***
	(0.030)	(0.120)	(0.062)	(0.371)	(0.167)	(0.288)
$\Delta E_t\, FINDEFA_{t+1}$	0.455***	0.367***	0.381***	0.369***	0.398***	0.408***
	(0.100)	(0.099)	(0.099)	(0.099)	(0.098)	(0.098)
ΔR_t^{10}	-0.097***	-0.099***	-0.099***	-0.101***	-0.097***	-0.097***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.100***	0.097***	0.097***	0.096***	0.097***	0.096***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.111***	-0.120***	-0.120***	-0.119***	-0.122***	-0.124***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.006***	0.006***	0.006***	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.133**	-0.103*	-0.100	-0.096	-0.073	-0.070
	(0.061)	(0.061)	(0.061)	(0.061)	(0.059)	(0.059)
$\Delta JUMP_t$	0.030***	0.029***	0.029***	0.030***	0.028***	0.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.347***	0.388***	0.388***	0.395***	0.387***	0.390***
	(0.028)	(0.027)	(0.027)	(0.028)	(0.027)	(0.027)
Intercept	-0.048***	-0.048***	-0.048***	-0.048***	-0.048***	-0.049***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,400	13,400	13,434	13,466	13,764	13,764
R^2	0.11	0.11	0.11	0.11	0.11	0.11

Table 7: Joint Tests of Trade-off and Pecking-order Theories (Cont.)

	PANEL B. MARKET LEVERAGE					
	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ΔLEV_t	1.063***	1.035***	1.056***	1.051***	0.675***	0.818***
	(0.111)	(0.118)	(0.111)	(0.111)	(0.119)	(0.111)
ΔLEV^*_{t+1}	0.139	0.125	0.101**	1.373***	1.676***	3.170***
	(0.088)	(0.117)	(0.049)	(0.339)	(0.199)	(0.328)
$\Delta E_t\, FINDEFA_{t+1}$	0.206**	0.210**	0.213**	0.233**	0.241**	0.269***
	(0.099)	(0.099)	(0.098)	(0.098)	(0.096)	(0.096)
ΔR_t^{10}	-0.099***	-0.099***	-0.098***	-0.099***	-0.098***	-0.096***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$(\Delta R_t^{10})^2$	0.098***	0.097***	0.097***	0.097***	0.098***	0.097***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta SLOPE_t$	-0.119***	-0.119***	-0.119***	-0.119***	-0.122***	-0.129***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ΔVIX_t	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.032	-0.026	-0.036	-0.033	0.002	0.006
	(0.061)	(0.061)	(0.061)	(0.060)	(0.059)	(0.059)
$\Delta JUMP_t$	0.027***	0.027***	0.027***	0.028***	0.027***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.381***	0.382***	0.381***	0.386***	0.380***	0.381***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Intercept	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***	-0.046***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	13,384	13,384	13,434	13,451	13,736	13,736
R^2	0.12	0.12	0.12	0.12	0.13	0.13

Table 8: The Effect of Bond Maturity in Separate and Joint Tests of Trade-off and Pecking-order Theories

These are the results from an OLS estimation of the following models:

$$\Delta CS_{LT,i,t} - \Delta CS_{ST,i,t} = (\alpha_{LT} - \alpha_{ST}) \cdot \Delta LEV_{i,t} + (\gamma_{LT} - \gamma_{ST}) \cdot \Delta E_t LEV_{i,t+1} + (\boldsymbol{\theta}_{LT} - \boldsymbol{\theta}_{ST}) \cdot \boldsymbol{\Delta Z_t} + \varepsilon_{i,t} \quad (18)$$

Under the trade-off (TO) theory:

$$E_t LEV_{i,t+1} = [\lambda LEV^*_{i,t+1} + (1-\lambda) \cdot LEV_{i,t}] \quad (4)$$

Under the pecking-order (PO) theory:

$$E_t LEV_{i,t+1} = E_t FINDEFA_{i,t+1} + LEV_{i,t} \quad (8)$$

ST indicates a short-term bond and *LT* indicates a long-term bond. ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔE LEV=change in expected future debt-to-assets ratio. LEV*=target debt-to-assets ratio. E FINDEFA=expected financing deficit scaled by total assets. ΔZ includes the following structural-model motivated variables the coefficients on which are not reported for ease of exposition: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. FE λ=1 uses target leverage based on the panel estimation of equation (15) under the assumption of full-adjustment towards target in every quarter. OLS uses target leverage based on the OLS estimation of equation (15) under the partial-adjustment assumption. CONSTANT 1 YR uses the same leverage target for each quarter in a calendar year where this target is constructed as the average of the prior year's FE quarterly targets. TRAIL 1 YR and TRAIL 3 YR use respectively the 1-year and 3-year trailing average of that firm's leverage as a measure of its leverage target. Expected financing deficit is proxied by the fitted value from specification PO_1 above. PO_1 is an OLS estimation of equation (16). Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

Panel A. Tests of the Trade-off Theory

	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
ΔLEV_t	0.180	0.085	0.132	0.065	0.018	0.072
	(0.156)	(0.161)	(0.156)	(0.156)	(0.173)	(0.159)
ΔLEV^*_{t+1}	0.158**	0.490**	0.157	0.776***	0.802**	1.944***
	(0.062)	(0.243)	(0.121)	(0.269)	(0.362)	(0.675)
Observations	2,721	2,721	2,726	2,740	2,740	2,740
R^2	0.12	0.12	0.12	0.12	0.12	0.12

Panel B. Tests of the Pecking Order Theory

	PO_1	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
ΔLEV_t	0.103	0.104	0.102	0.102	0.104	0.104
	(0.167)	(0.168)	(0.168)	(0.168)	(0.168)	(0.168)
$\Delta E_t FINDEFA_{t+1}$	0.199	0.198	0.205	0.205	0.218	0.237
	(0.206)	(0.214)	(0.211)	(0.212)	(0.230)	(0.250)
Observations	2740	2740	2740	2740	2740	2740
R^2	0.12	0.12	0.12	0.12	0.12	0.12

Panel C. Joint Tests of the Trade-off and Pecking Order Theories

	FE ***(1)***	FE λ=1 ***(2)***	OLS ***(3)***	CONSTANT 1 YR ***(4)***	TRAIL 1 YR ***(5)***	TRAIL 3 YR ***(6)***
ΔLEV_t	0.127	0.048	0.090	0.010	-0.033	0.021
	(0.167)	(0.173)	(0.168)	(0.170)	(0.188)	(0.173)
ΔLEV^*_{t+1}	0.169***	0.474*	0.154	0.803***	0.826**	1.996***
	(0.064)	(0.242)	(0.121)	(0.272)	(0.364)	(0.682)
$\Delta E_t\, FINDEFA_{t+1}$	0.257	0.184	0.200	0.246	0.221	0.228
	(0.209)	(0.206)	(0.206)	(0.209)	(0.208)	(0.207)
Observations	2,721	2,721	2,726	2,740	2,740	2,740
R^2	0.12	0.12	0.12	0.12	0.12	0.12

Table 9: Additional Separate and Joint Tests of Trade-off and Pecking-order Theories

These are the results from an OLS estimation of the following models:

TO model: $\Delta CS_{i,t} = [\alpha_{TO} + \gamma_{TA}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \boldsymbol{\theta}_{\mathbf{TO}} \cdot \boldsymbol{\Delta}\mathbf{Z_i} + \varepsilon_{TO,i,t}$ (5)

PO model: $\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \boldsymbol{\Delta} E_t\, FINDEFA_{i,t+1} + \boldsymbol{\theta}_{PO} \cdot \boldsymbol{\Delta}\mathbf{Z_i} + \varepsilon_{PO,i,t}$ (9)

Joint TO and PO model: $\Delta CS_{i,t} = \alpha_{PO,TO} \cdot \Delta LEV_{i,t} + \gamma'_{PO,TO} \cdot \boldsymbol{\Delta} E_t FINDEFA_{i,t+1} + \gamma''_{PO,TO} \cdot \boldsymbol{\Delta} LEV^{*}_{i,t+1} + \boldsymbol{\theta}_{PO,TO} \cdot \boldsymbol{\Delta}\mathbf{Z_i} + \varepsilon_{PO,TO,i,t}$ (17)

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔLEV*=change in target debt-to-assets ratio. ΔE FINDEFA=change in expected financing deficit scaled by total assets. ΔZ includes the following structural-model motivated variables the coefficients on which are not reported for ease of exposition: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. For ease of exposition we present results with target leverage estimated through the FE approach and expected financing deficit estimated through the PO_1 specification. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. $\mathbf{PO_1}$ is an OLS estimation of equation (16). Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

Panel A presents results by lagged leverage terciles. Low-leverage firms have lagged book leverage of less than 0.28; medium-leverage firms have lagged book leverage in the 0.28-0.38 range; and high-leverage firms have lagged book leverage higher than 0.38. Panel B presents results by firm size terciles. Size terciles are based firms' market capitalization ranking in each quarter-year relative to the universe of NYSE firms. Small firms have market value of equity lower than that of the median NYSE firm; medium-size firms have equity values in the 50-85 percentile range; and large firms have equity values higher than 85% of NYSE firms. Panel C presents results for investment-grade and junk bonds. To classify bonds into investment-grade and junk we use Moody's credit rating whenever available, and S&P credit rating whenever the Moody's rating is missing.

Panel A. Estimations by Leverage Groups

	TO model			PO model			Joint TO and PO model		
	Low	***Medium***	***High***	***Low***	***Medium***	***High***	***Low***	***Medium***	***High***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***	***(9)***
ΔLEV_t	0.284***	0.298*	0.720***	0.231**	0.139	0.669***	0.236**	0.175	0.681***
	(0.093)	(0.158)	(0.187)	(0.094)	(0.157)	(0.192)	(0.094)	(0.158)	(0.191)
ΔLEV^{*}_{t+1}	0.132***	0.113**	0.226***				0.138***	0.174***	0.241***
	(0.042)	(0.047)	(0.061)				(0.043)	(0.048)	(0.063)
$\Delta E_t\, FINDEFA_{t+1}$				0.116	0.883***	0.183	0.162	0.974***	0.276
				(0.104)	(0.164)	(0.196)	(0.105)	(0.166)	(0.200)
Observations	4,452	4,523	4,425	4,452	4,523	4,425	4,452	4,523	4,425
R^2	0.09	0.13	0.12	0.09	0.14	0.12	0.09	0.14	0.12

Panel B. Estimations by Size Terciles

	TO model			PO model			Joint TO and PO model		
	Small	***Medium***	***Large***	***Small***	***Medium***	***Large***	***Small***	***Medium***	***Large***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***	***(9)***
ΔLEV_t	0.662***	0.347**	0.332***	0.594***	0.135	0.282***	0.578***	0.155	0.367***
	(0.213)	(0.150)	(0.101)	(0.219)	(0.166)	(0.105)	(0.220)	(0.168)	(0.135)
ΔLEV^*_{t+1}	0.231**	0.237***	0.134***				0.247**	0.271***	0.173***
	(0.117)	(0.059)	(0.031)				(0.118)	(0.060)	(0.040)
$\Delta E_t\,FINDEFA_{t+1}$				0.337**	0.528**	0.066	0.384**	0.664***	0.256
				(0.165)	(0.209)	(0.129)	(0.166)	(0.211)	(0.159)
Observations	3,401	3,656	6,343	3,464	3,741	6,559	3,401	3,656	6,343
R^2	0.11	0.13	0.10	0.10	0.13	0.10	0.11	0.13	0.08

Panel C. Estimations by Credit-rating Groups

	TO model		PO model		Joint TO and PO model	
	Inv grade	***Junk***	***Inv grade***	***Junk***	***Inv grade***	***Junk***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
ΔLEV_t	0.298***	0.780*	0.168**	0.787*	0.208***	0.693*
	(0.074)	(0.407)	(0.077)	(0.422)	(0.078)	(0.418)
ΔLEV^*_{t+1}	0.124***	0.307			0.149***	0.314*
	(0.025)	(0.190)			(0.026)	(0.190)
$\Delta E_t\,FINDEFA_{t+1}$			0.372***	0.507	0.452***	0.508
			(0.084)	(0.490)	(0.086)	(0.488)
Observations	12,107	1,293	12,460	1,304	12,107	1,293
R^2	0.13	0.12	0.14	0.11	0.14	0.12

Table 10: Asymmetric Effect of Leverage Changes on Credit Spreads

This is an OLS estimation of the following models on the sample of 1,243 bonds from 1986 to 1998:

TO model: $$\Delta CS_{i,t} = [\alpha_{TO} + \gamma_{TO}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \boldsymbol{\theta}_{\mathbf{TO}} \cdot \mathbf{\Delta Z_i} + \varepsilon_{TO,i,t} \quad (5)$$

PO model: $$\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \mathbf{\Delta} E_t FINDEFA_{i,t+1} + \boldsymbol{\theta}_{PO} \cdot \mathbf{\Delta Z_i} + \varepsilon_{PO,i,t} \quad (9)$$

Below-target, above-target, deficit and surplus groups are formed based on current leverage relative to target leverage and expected financing deficit one quarter ahead. ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔLEV*=change in target debt-to-assets ratio. ΔE FINDEFA=change in expected financing deficit scaled by total assets. ΔZ includes the following structural-model motivated variables: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. For ease of exposition we present results with target leverage estimated through the FE approach and expected financing deficit estimated through the PO_1 specification. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. $\mathrm{PO}_{\mathbf{1}}$ is an OLS estimation of equation (16). Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

	TO Model		**PO Model**	
	Above Target	**Below Target**	**Financing Surplus**	**Financing Deficit**
	(1)	***(2)***	***(3)***	***(4)***
ΔLEV_t	0.505***	0.304**	0.393***	0.200
	(0.104)	(0.146)	(0.105)	(0.142)
ΔLEV^*_{t+1}	0.184***	0.107***		
	(0.063)	(0.039)		
$\Delta E_t\, FINDEFA_{t+1}$			0.190	0.287**
			(0.136)	(0.146)
ΔR_t^{10}	-0.112***	-0.083***	-0.075***	-0.120***
	(0.006)	(0.006)	(0.005)	(0.006)
$(\Delta R_t^{10})^2$	0.098***	0.096***	0.077***	0.115***
	(0.010)	(0.010)	(0.009)	(0.011)
$\Delta SLOPE_t$	-0.115***	-0.112***	-0.114***	-0.128***
	(0.014)	(0.011)	(0.011)	(0.013)
ΔVIX_t	0.008***	0.005***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
$S\&P_t$	-0.325***	0.103	0.029	-0.178**
	(0.086)	(0.087)	(0.081)	(0.086)
$\Delta JUMP_t$	0.031***	0.027***	0.025***	0.031***
	(0.002)	(0.003)	(0.002)	(0.002)
$\Delta CRPREM_t$	0.308***	0.412***	0.365***	0.408***
	(0.038)	(0.043)	(0.034)	(0.043)
Intercept	-0.049***	-0.047***	-0.052***	-0.044***
	(0.004)	(0.004)	(0.004)	(0.004)
Observations	7,227	6,173	7,265	6,499
R^2	0.11	0.11	0.10	0.12

Table 11: Tests of the Trade-off and Pecking Order Theories with Credit-Rating Considerations

This is an OLS estimation of the following model on the sample of 1,243 bonds from 1986 to 1998:

$$\Delta CS_{i,t} = [\alpha_{TO} + \gamma_{TO}(1-\lambda)] \cdot \Delta LEV_{i,t} + [\gamma_{TO}\lambda] \cdot \Delta LEV^{*}_{i,t+1} + \kappa_{TO} \cdot CRPOM + \theta_{TO} \cdot \Delta Z_{t} + \varepsilon_{TO,i,t} \quad (23)$$

$$\Delta CS_{i,t} = (\alpha_{PO} + \gamma_{PO}) \cdot \Delta LEV_{i,t} + \gamma_{PO} \cdot \Delta E_{t} FINDEFA_{i,t+1} + \kappa_{PO} \cdot CRPOM + \theta_{PO} \cdot \Delta Z_{t} + \varepsilon_{PO,i,t} \quad (24)$$

$$\Delta CS_{i,t} = \alpha_{PO,TO} \cdot \Delta LEV_{i,t} + \gamma'_{PO,TO} \cdot \Delta E_{t} FINDEFA_{i,t+1} + \gamma''_{PO,TO} \cdot \Delta LEV^{*}_{i,t+1} + \kappa_{PO,TO} \cdot CRPOM + \theta_{PO,TO} \cdot \Delta Z_{t} + \varepsilon_{PO,TO,i,t} \quad (25)$$

ΔCS=change in bond credit spreads. ΔLEV=change in debt-to-assets ratio. ΔLEV*=change in target debt-to-assets ratio. ΔE FINDEFA=change in expected financing deficit scaled by total assets. CRPOM= 1 for plus/minus credit ratings; 0 otherwise. ΔZ includes the following structural-model motivated variables the coefficients on which are not reported for ease of exposition: ΔR=change in the spot rate measured by the 10-year Treasury yield. ΔSLOPE=change in the slope of the yield curve measured as the difference between 10-year and 2-year Treasury yields. ΔVIX=change in the implied volatility on the S&P 500 index. S&P=quarterly S&P 500 return. ΔJUMP=change in the slope of the "smirk" of implied volatilities of options on S&P 500 futures. ΔCRPREM=change in the spread between the yield on Aaa and Baa-rated bonds. Changes are measured over consecutive quarters. FE uses target leverage measures obtained through a dynamic panel estimation of equation (15) and the use of instruments for the lagged dependent variable. FE λ=1 uses target leverage based on the panel estimation of equation (15) under the assumption of full-adjustment towards target in every quarter. OLS λ=1 uses target leverage based on the OLS estimation of equation (15) under the full-adjustment assumption. CONSTANT 1 YR uses the same leverage target for each quarter in a calendar year where this target is constructed as the average of the prior year's FE quarterly targets. TRAIL 1 YR and TRAIL 3 YR use respectively the 1-year and 3-year trailing average of that firm's leverage as a measure of its leverage target. Expected financing deficit is proxied by the fitted value from PO_1 above. PO_1 is an OLS estimation of equation (16). Robust standard errors are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and * respectively.

Panel A. Tests of the Trade-off Theory

	FE	**FE λ=1**	**OLS**	**CONSTANT 1 YR**	**TRAIL 1 YR**	**TRAIL 3 YR**
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
ΔLEV_t	0.428***	0.334***	0.378***	0.395***	0.223**	0.281***
	(0.085)	(0.086)	(0.084)	(0.085)	(0.090)	(0.085)
ΔLEV^*_{t+1}	0.156***	0.462***	0.138**	1.894***	0.860***	1.842***
	(0.030)	(0.120)	(0.062)	(0.369)	(0.165)	(0.287)
$CRPOM_t$	-0.017***	-0.017***	-0.017***	-0.017***	-0.018***	-0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	13,384	13,384	13,418	13,449	13,747	13,747
R^2	0.11	0.11	0.11	0.11	0.11	0.11

Panel B. Tests of the Pecking Order Theory

	PO_1	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
ΔLEV_t	0.307***	0.296***	0.295***	0.295***	0.298***	0.298***
	(0.088)	(0.089)	(0.089)	(0.089)	(0.088)	(0.088)
$\Delta E_t FINDEFA_{t+1}$	0.365***	0.416***	0.420***	0.422***	0.450***	0.490***
	(0.097)	(0.102)	(0.100)	(0.100)	(0.109)	(0.119)
$CRPOM_t$	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	13,747	13,747	13,747	13,747	13,747	13,747
R^2	0.11	0.11	0.11	0.11	0.11	0.11

Panel C. Joint Tests of the Trade-off and Pecking Order Theories

	FE	FE λ=1	OLS	CONSTANT 1 YR	TRAIL 1 YR	TRAIL 3 YR
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ΔLEV_t	0.339***	0.263***	0.301***	0.321***	0.133	0.193**
	(0.089)	(0.090)	(0.089)	(0.089)	(0.096)	(0.090)
ΔLEV^*_{t+1}	0.180***	0.437***	0.137**	1.853***	0.904***	1.918***
	(0.030)	(0.120)	(0.062)	(0.368)	(0.165)	(0.287)
$\Delta E_t\,FINDEFA_{t+1}$	0.457***	0.368***	0.382***	0.364***	0.393***	0.403***
	(0.099)	(0.098)	(0.098)	(0.098)	(0.097)	(0.097)
$CRPOM_t$	-0.017***	-0.017***	-0.017***	-0.017***	-0.017***	-0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	13,384	13,384	13,418	13,449	13,747	13,747
R^2	0.11	0.11	0.11	0.11	0.11	0.12