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The Impact of Interest Rates on Firms' Financing Policies*

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Abstract

This study analyzes whether corporate financing policies of the US industrial firms have depended on borrowing costs during the last forty years. The results show that the impact is either zero or slightly negative. Even in the latter case, the results are economically insignificant. Overall, our findings suggest that firms do not adjust their capital structures based on interest rates, except when market participants expect that real gross domestic product growth will be negative. Using a dynamic partial equilibrium model, we show that relatively high leverage adjustment costs are able to explain the weak negative relation between interest rates and a firm's leverage. Our results are also consistent with the view that firms target debt-to-asset ratio rather than debt level.

Keywords: Interest rates; Firm's financing decisions; Monetary policy; Recession.

JEL classification: E43; G12; G32.

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1 Introduction

Despite the extensive research on firm's financing policies since the seminal paper by Modigliani and Miller (1958), the literature—both theoretical and empirical—of how interest rates and changes in monetary policy regime impact a firm's financing decisions is limited and the results of the existing studies are mixed. In this paper, we analyze whether corporate financing policies of the US industrial firms have depended on borrowing costs during the last forty years.

The effective interest rate that a firm is facing, can be expressed as $r_D \times (1 - \tau)$ where r_D is the nominal interest rate and τ is the effective tax rate. The empirical studies have mainly focused on the relation between tax rate and firm leverage. They find that tax rate has a significantly positive impact on the firms' borrowings (see, for example, recent studies by Faccio and Xu (2015) and Heider and Ljungqvist (2015)). Interest rates vary more than tax rates and their impact on interests paid is substantially higher. For example, the yield on Moody's Aaa-rated bonds decreased from 8.80% to 4.20% (i.e., by more than half (52%)) during the 1975-2014 period whereas the top rate of corporate income tax was cut from 48% to 35% (i.e., by slightly more than a quarter (27%)) during the same period; that is, the drop in yield is about twice the decrease in tax rate. Thus, the fact that the relation between interest rates and firms' leverage is under-researched is quite surprising.

The challenge of this study is that interest rates and macroeconomic conditions are interrelated. For example, official interest rates set by monetary authorities tend to be lower during the recessions and higher during non-recessionary periods. Further, the empirical studies provide some evidence that macroeconomic and market conditions significantly impact bond yields and firms' financing decisions. Cenesizoglu and Essid (2012) find that the positive impact of unexpected monthly changes in the Fed funds target rate on monthly changes in credit spreads between Moody's Baa- and Aaa-, Aa-, and A-rated bond indices is only significant during recession periods. Baum *et al.* (2009) find that firms' short-term leverage decreases with macroeconomic uncertainty measured as the conditional variance of the detrended index of leading indicators. Our article is also closely related to the growing literature on how corporate financing policies depend on the business cycle. Frank and Goyal (2009) report that firms' leverage is negatively impacted by the growth in aggregate corporate profits of non-financial firms but positively impacted by the expected inflation and gross domestic product (GDP) growth. Jermann and Quadrini (2008) also report a pro-cyclical behavior of aggregate corporate debt. This suggests that the firms' leverage is likely to be lower during recession periods. Korajczyk and Levy (2003) report that target leverage of financially unconstrained firms is counter-cyclical, but pro-cyclical for the constrained firms. The implications of recent theoretical papers are generally consistent with the results in Korajczyk and Levy (2003). For example, a contingent claims model of the levered firm in Hackbarth *et al.* (2006) predicts that leverage is countercyclical. A general equilibrium model in Levy and Hennessy (2007) implies that less financially-constrained firms choose more counter-cyclical financing policies; however, the debt ratio for more constrained firms does not depend on the business cycle. Bhamra *et al.* (2010) use a contingent-claim corporate financing model within a consumption-based asset-pricing model and show that capital structure is pro-cyclical; however, it is counter-cyclical in aggregate dynamics. They also find that leverage of financially constrained firms exhibits pro-cyclicality. In a similar framework, Chen (2010) shows that the firm's target leverage ratio is pro-cyclical; however, the actual leverage exhibits counter-cyclicality. A recent study by Halling *et al.* (2016) reports that target leverage ratios evolve counter-cyclically, on average. Erel *et al.* (2012) analyse how macroeconomic conditions affect capital raising. They find that for noninvestment-grade borrowers, capital raising tends to be pro-cyclical, while for investment-grade borrowers, it is countercyclical. Given the non-random relations between interest rates and business cycle, as well as between financial leverage and business cycle, we need to ensure that our empirical models are properly identified; that is, that we capture the impact of interest rates rather than the impact of macroeconomic conditions on firms' leverage. Thus, we control for year fixed effects in the regressions. Also, we estimate our models separately for recessionary and non-recessionary periods.

As we discuss in the next section, finance theory does not provide a clear answer about whether there should be a negative or positive, or no, relation between interest rates and a firm's leverage. If we find a significantly negative relation between interest rates and a firm's leverage, it will mean that firm behavior could be consistent with several theories; that is, that firms could be timing the market and/or that firms target debt level or leverage ratio. A significantly positive or no relation would indicate that firms target leverage ratio and do not time the market, in general (or at least, the former effect dominates the market timing activities). Thus, our results will shed some light on which theory dominates in explaining firm behavior.

The empirical evidence for the relation between interest rates and firm's leverage are mixed. Frank and Goyal (2004) estimate a VAR(1) model of aggregate values of debt and equity of all US public non-financial firms and find that interest rates impact neither debt nor equity significantly. Graham *et al.* (2015) report that aggregate leverage of US unregulated firms is higher in the periods of high 3-month Treasury bill rate over the 1925-2010 period. The effects of interest rates' spreads on firms' leverage and the volume of debt issues are not consistent across different empirical studies. Korajczyk and Levy (2003) find that firms' leverage increases with the difference between the three-month commercial paper rate and the rate on the three-month Treasury bill for firms that pay dividends and/or have a net equity or debt purchase within the quarter, or have a market-to-book ratio smaller or equal to one. Cai *et al.* (2013) report that straight debt initial public offerings' volume increases with the difference in the yields of 10-year Treasury bond and Treasury bill and the difference in the yield on Moody's Baa-rated bonds and on Aaa-rated bonds. However, Frank and Goyal (2009) find that firms' leverage decreases with the difference between the 10-year and the one-year Treasury bond yields. Neither Korajczyk and Levy (2003) nor Frank and Goyal (2009), nor Cai *et al.* (2013) test their hypotheses using market interest rates rather than spreads.[1] The recent

[1] In addition, Cook and Tang (2010) show that the adjustment speed of capital structure increases with the difference between the twenty-year government bond yield series and the three-month Treasury-bill rate series but

study by Graham *et al.* (2015) finds that the aggregate leverage of US unregulated firms decreases with the spread between the yield on Moody's Baa-rated bonds and on Aaa-rated bonds.

In this context, we analyze how corporate financing policies depend on borrowing costs. This study differs from the previous related studies as we consider the large number of different proxies of interest rates, including the expected interest rates. In comparison, other studies use one measure for a firm's borrowing costs (primarily, because they focus on other issues rather than the relation between interest rates and a firm's leverage). To the best of our knowledge, no previous study investigates how expected future interest rates or effective interest rates impact firms' leverage ratios. Further, our paper is different from the studies that analyse the relation between macro factors and leverage ratios (e.g., Korajczyk and Levy (2003), Jermann and Quadrini (2008), Frank and Goyal (2009) and others) because we analyse the relation between firm leverage and interest rates from the perspective of a firm. In other words, we investigate whether firms borrow more money when borrowing costs are lower whereas the papers mentioned above analyse firms' financing policies under different macroeconomic conditions. The relation between interest rates and macroeconomic activity is not straightforward. On the one hand, interest rates tend to be lower during economic downturns due to a lower demand for external financing and interventions by the monetary authorities. For example, US Fed cut gradually federal funds rate from 5.25% in September 2007 to 0-0.25% in December 2008. On the other hand, due to a higher uncertainty and increased bankruptcy costs, borrowing rates can be higher during economic downturns. For example, the average values of Moody's Seasoned Aaa and Baa Corporate Bond Yields are higher during the 2008-2009 period (5.47% and 7.37%, respectively) compared to the 2010-2011 period (4.79% and 5.85%, respectively). Therefore, the question whether firms' financing policies depend on interest rates remains unanswered by the extant literature, and our paper fills the gap. We do recognize the importance of macroeconomic conditions and that firms'

decreases with the difference between the average yield of bonds rated Baa and the average yield of bonds rated Aaa. That is, the adjustment speed is higher in good macroeconomic states.

financing policies are likely to be different across the phases of business cycles; thus, we control for them in the regression analysis.

The topic is also important for monetary policy makers, as their decisions indirectly impact industrial firms' borrowing conditions. For example, Cook and Hahn (1989) analyze the impact of changes in the federal funds rate target on the Treasury bill and note yields and find that changes in the target caused large movements in short-term rates and smaller but significant movements in intermediate- and long-term rates in the 1970s. Cenesizoglu and Essid (2012) find that the positive impact of unexpected monthly changes in the Fed funds target rate on monthly changes in credit spreads between Moody's Baa- and either Aaa-, Aa-, or A-rated bond indices is only significant during recession periods.

Our sample covers the US industrial firms over the period 1975 to 2014. To analyze how interest rates impact firms' leverage, we estimate the least-squares dummy variable regression models (the fixed effects models) using levels and first differences. The results show that the impact of interest rates on firms' leverage is either zero or slightly negative, in general. Even in the latter case, the results are economically insignificant. The results are robust for nominal and real, contemporaneous, historical and expected market interest rates. The sign and strength of the relation depend on the proxy for interest rate. This could explain to some extent why the empirical findings in the existing literature are mixed. Overall, our findings suggest that firms do not adjust their capital structures based on interest rates; that is, the observed capital structures are not sensitive to interest rates. However, there is an exception. We find that the negative relation between interest rate and leverage is economically significant only in periods when market participants expect that real gross domestic product (GDP) growth will be negative. Most of such observations were during the 1979-1991 period; thus, it is unclear whether the economically significant relation is observed in a more recent period. Our results have implications for monetary policy-makers and firm managers. An insignificant or weakly negative relation between interest rates and firm's leverage suggest that, on average, firms target their leverage ratios. Alternatively, due to high adjustment costs, firms are not able to effectively time the market; that is, issue debt securities when interest rates are low.

The rest of the paper is structured as follows. Section 2 discusses the related literature. Sections 3 and 4 describe the methodology and our sample, respectively. Obtained results are detailed in Section 5. Finally, Section 6 presents the conclusions.

2 Implications of major capital structure theories

In this section, we analyze the implications of the major capital structure theories. According to market timing theory, firms should sell bonds when interest rates are low and, conversely, firms should be reluctant to issue debt securities in periods with high interest rates. The survey conducted by Graham and Harvey (2001) supports this view. They find that managers do take into account the level of interest rate when deciding the level of financial leverage, and firms are more likely to conduct a debt issue in the periods of low interest rates.

The predictions of the trade-off theory depend on the assumption of whether firms target debt level or debt-to-asset ratio. According to the theory, firms select a certain debt level where the net benefits of debt are maximum. The benefits of debt are the debt tax shield. The costs of debt are expected bankruptcy costs; that is, the direct and indirect costs associated with servicing the debt. A higher interest rate leads to higher interest payments and lower profit in each period and thus increases the probability of firm default and bankruptcy costs. If firms target debt level (i.e., if we assume the constant debt level) (as in Modigliani and Miller (1958), Modigliani and Miller (1963), and Hamada (1969)), a higher interest rate does not impact the *total* debt tax shield because the latter is calculated as the product of debt level and effective tax rate. Thus, the channel to allow interest rates to impact leverage ratio is bankruptcy costs. As a result, a firm's financial leverage should decrease with interest rate due to higher expected bankruptcy costs, and vice versa.

$$\text{Net benefits of debt} = \text{Tax shield} - \text{Bankruptcy costs} \tag{1}$$

$$= \mathrm{D}\tau - f(r_D), \tag{2}$$

where D is the level of debt which is fixed forever and $f(r_D)$ is bankruptcy costs. The partial derivative of net benefits of debt with respect to interest rate rate, r_D, is:

$$\frac{\partial}{\partial r_D} = -\underbrace{f'(r_D)}_{>0} < 0. \tag{3}$$

As bankruptcy costs increase with interest rate, the partial derivative is negative, implying that the net benefits of debt decrease with interest rate. Thus, we should observe the negative relation between financial leverage and interest rate.

If firms target debt ratio (i.e., if we assume constant leverage ratio) (as in Miles and Ezzell (1985)), the net benefits of debt are more difficult to estimate, as their value in each period depends on firm size which can be seen as a stochastic variable. Assuming growing perpetuity (at a growth rate g), the net benefits of debt are as follows:[2]

$$\text{Net benefits of debt} = \frac{r_D \mathrm{D}\tau}{\underbrace{r_D \frac{\mathrm{D}}{\mathrm{D}+\mathrm{E}} + r_E \frac{\mathrm{E}}{\mathrm{D}+\mathrm{E}}}_{r_A} - g} - f(r_D), \tag{4}$$

where E is equity value of a firm, r_E is the return on equity, and r_A is the return on assets. The partial derivative of net benefits of debt with respect to interest rate rate, r_D, is:

$$\frac{\partial}{\partial r_D} = \frac{\mathrm{D}\tau\left(r_E \frac{\mathrm{E}}{\mathrm{D}+\mathrm{E}} - g\right)}{\left(r_D \frac{\mathrm{E}}{\mathrm{D}+\mathrm{E}} + r_E \frac{\mathrm{E}}{\mathrm{D}+\mathrm{E}} - g\right)^2} - \underbrace{f'(r_D)}_{>0}. \tag{5}$$

[2] The detailed derivation of the present value of the debt tax shield is provided in Cooper and Nyborg (2006) and Cooper and Nyborg (2007).

The value of the partial derivative can be positive, negative, or equal to zero. It is determined by the sign (and value) of $\left(r_E \frac{\mathrm{E}}{\mathrm{D+E}} - g \right)$ and the magnitude of the partial derivative of the bankruptcy costs. It is likely that $\left(r_E \frac{\mathrm{E}}{\mathrm{D+E}} - g \right) < 0$ for high-growth and heavily-levered firms. Thus, the partial derivative is negative in this case. However, $\left(r_E \frac{\mathrm{E}}{\mathrm{D+E}} - g \right) > 0$ for low growth and less levered firms. The sign of the partial derivative of net benefits of debt for such firms is determined by which factor—larger tax shield of debt or greater bankruptcy costs—dominates. Leland (1994) develops a dynamic model where firms target leverage ratio. He argues that leverage should increase with a risk-free interest rate because of greater tax benefits.

To conclude, finance theory does not provide a clear answer whether there should be a negative or positive or no relation between interest rates and a firm's leverage. If we find a negative relation between interest rates and a firm's leverage, it will mean that firm behavior could be consistent with all three cases discussed above; that is, that firms could be timing the market and/or that firms target debt level and/or leverage ratio. A positive or no relation would indicate that firms target leverage ratio and do not time the market, in general (or at least, the former effect dominates the market timing activities).

3 Methodology

To analyze how interest rates impact firms' leverage, we estimate the least-squares dummy variable models (the fixed effects models). We include firm-decade (or firm) and year fixed effects in the models to control for unobserved firm-level heterogeneity and time period-related factors. In the regressions, where we use the full sample, we include firm fixed effects for each ten years (firm-decade fixed effects); that is, we allow the individual firm-fixed effect to change each ten years: 1975-1984, 1985-1994, 1995-2004, and 2005-2014; otherwise, we include firm fixed effects.

The dependent variable is debt over book assets ratio, DEBT/A.[3] The independent variables include key firm characteristics. Their selection is based on prior studies (see, for example, Frank and Goyal (2009), Chang and Dasgupta (2009), Fama and French (2002), Lemmon *et al.* (2008)). Specifically, we estimate the following model:

$$\begin{aligned}\left(\text{DEBT/A}\right)_{it} &= \alpha_0 + \alpha_1\left(\text{IR}\right)_{it} + \alpha_2\left(\text{ASSETS}\right)_{it} + \alpha_3\left(\text{MA/A}\right)_{it} + \alpha_4\left(\text{TAX\_RATE}\right)_{it} + \alpha_5\left(\text{NI/A}\right)_{it} \\ &+ \alpha_6\left(\text{CASH/A}\right)_{it} + \alpha_7\left(\text{PPE/A}\right)_{it} + \alpha_8\left(\text{CAPEX/A}\right)_{it} + \alpha_9\left(\text{RD/A}\right)_{it} + \alpha_{10}\left(\text{RDD}\right)_{it} + \lambda_t + \mu_i + \varepsilon_{it};\end{aligned} \tag{6}$$

where the indices *i* and *t* correspond to firm and year, respectively. *IR* is a proxy for interest rate. λ and μ are time and firm-decade fixed effects. In all panel data models of this paper, the standard errors are corrected for clustering at the firm-decade (or firm) and year levels to accommodate heteroskedasticity as well as within-firm and within-year autocorrelations. For robustness, we also estimate our regressions using first differences rather than levels.

The analysis faces several challenges. First of all, we acknowledge the direction of causality. Firms are expected to borrow more if interest rates are low. However, the interest rate at which firms will be able to borrow is likely to increase with the firm's leverage. Thus, due to endogeneity concerns, we do not use the average borrowing rate computed from the firms' financial statements as a proxy for borrowing costs in the analysis. Instead, we use market interest rates which, some might argue, are not purely exogenous either, as the monetary authority, such as the US Federal Reserve System (Fed), does not make random decisions regarding the target range for the federal funds rate. It is more likely that the Fed cuts the target interest rate when economic growth is low, in order to stimulate economic activity. However, firms are likely to need less debt financing in the periods on low economic growth due to the small number of available project with positive net present value (NVP). Thus, firms might be reluctant to borrow then, even if interest rates are low. If economic growth is high, firms are more likely to have more projects with positive NPV; thus, firms could finance those projects with borrowed funds, even if interest rates are higher

[3] See the Appendix for variable definitions.

than during economic downturns. In the analysis, we will control for possible asymmetric impact of interest rates on firm's leverage across different phases of the business cycle.

Besides endogeneity, there is another reason why average borrowing rate is not the appropriate measure of borrowing costs for firms with unstable capital structure. Consider a firm with zero leverage. It borrows $10 million at 5% annual interest rate at the beginning of the fiscal year (e.g., on January 1). The firm incurs an interest expense of $0.5 million and repays the majority of the debt; that is, $9.9 million, at the end of the fiscal period (e.g., December 31). Thus, we would record that the firm had $0.1 million debt and paid interest expense of $0.5 million. This implies that the effective interest rate is 500%, whereas the actual interest rate is 5%. Untabulated descriptive statistics imply that average borrowing rates are high for firms with leverage ratios close to zero.

Similarly, end-of-year debt-to-assets ratio does not accurately measure firm leverage structure for firms with unstable leverage ratios. Consider a firm with zero debt at the beginning of a year. If it raises short-term debt and repays it before the end of the financial year, we would not even know it had any debt. If a firm with book value of equity of $20 million borrows $10 million at the beginning of the fiscal year and repays the majority of debt; that is, $9.9 million, at the end of the fiscal period, we would record that debt-to-assets ratio is 0.005 ($0.1 million / ($0.1 million + $20 million)). However, effectively firm's leverage was 0.33 ($10 million / ($10 million + $20 million)) during the entire financial year. Averaging the leverage ratios at the beginning and end of the financial year would not help improve the accuracy of leverage measurement. To take into account firms with unstable capital structure, we re-estimate the models for firms with book leverage above median, 75th, and 90th percentiles in that year.

As the true effective interest rate for each firm in each year is unobservable, we use nine proxies for interest rates, *IR*, in the analysis:

- AAA: annual average of monthly Moody's Seasoned Aaa Corporate Bond Yield©
- BAA: annual average of monthly Moody's Seasoned Baa Corporate Bond Yield©

- FFR: annual average of monthly effective federal funds rate
- T3m: annual average of monthly secondary market rate of 3-month Treasury bill
- T6m: annual average of monthly 6-month Treasury constant maturity rate
- T1y: annual average of monthly 1-year Treasury constant maturity rate
- T3y: annual average of monthly 3-year Treasury constant maturity rate
- T5y: annual average of monthly 5-year Treasury constant maturity rate
- T10y: annual average of monthly 10-year Treasury constant maturity rate.

All interest rate measures are exogenous from the perspective of an individual firm. Roley and Troll (1984) find that market interest rates—yields on short-, medium-, and long-term Treasury debt securities—increase with the Federal Reserve's discount rate. The effects are stronger for short-term Treasury bonds and weaker for long-term Treasury bonds. Thus, it is likely that all proxies for interest rates are positively correlated with FFR. Nevertheless, we use all of them (one at a time) in the regression models, as firms cannot borrow financial funds at FFR and we want to make sure that our results and conclusions are not impacted by a particular proxy for interest rates.

4 Data

Our initial sample is drawn from CRSP/Compustat Merged database. It covers the period 1975 to 2014. We eliminate financial firms (with Standard Industrial Classification (SIC) codes 6000-6999) since they have a different capital structure and their cash balances might be subject to the regulatory authority.[4] We also exclude public utility firms (with SIC codes 4900-4999) because they operate in regulated industries and their financing and capital structure decisions might be impacted by the changes in the regulatory environment. To be included in our sample, firms must have book value of assets (Compustat

[4] SIC codes are determined by Compustat item SICH (historical SIC code); if it is missing, then we take Compustat item SIC (current SIC code).

item AT), in 2009 US dollars, greater than $20 million, book value of equity (Compustat item CEQ), in 2009 US dollars, greater than $10 million, market-to-book ratio based on firm's assets less or equal to 20, and the positive values for the number of common shares outstanding (Compustat item CSHO) and close share price at the end of the fiscal period (Compustat item PRCC_F).[5] Further, all the firms must be publicly traded (Compustat item STKO is 0) and incorporated in the United States (Compustat item FIC is "USA"). We exclude firm-year observations for which the period of duration (Compustat item PDDUR) is not twelve months and if ISO currency code (Compustat item CURCD) is not "USD." We retain more than 101,000 firm-year observations in our final sample.

Figure 1 provides the evolution of financial leverage and borrowing costs over the sample period. In addition, we generate the average borrowing rate, INT_RATE, computed from the firms' financial statements rate ((interest and related expenses (Compustat item XINT) + interest capitalized (Compustat item INTC)) / (long-term debt (Compustat item DLTT) + debt in current liabilities (Compustat item DLC))). Figure 1a shows that annual average leverage and interest rates tend to decrease over time. Strebulaev and Yang (2013) find that the proportion of firms with zero leverage increases from 0.054 to 0.195 during the 1975-2009 period. Thus, the annual average values in Figure 1a might not properly reflect the general trends. Figure 1b, Figure 1c and Figure 1d show the data for firm with DEBT/A ratio above the median, 75th, and 90th percentile in that year, respectively. They suggest that leverage values are relatively stable over time, especially for firms with higher leverage, whereas borrowing costs proxied by AAA, BAA, FFR, and INT_RATE tend to decrease over time. As a result, firms spend less to service their debts. For example, debt servicing cost ratio, INT/AT (interest expense (the sum of interest and related expense (Compustat item XINT) and capitalized interest (Compustat item INTC)) over book value of assets), for all firms with non-zero leverage was 0.023 in 1975 and it peaked in 1981 with 0.032 value, and the ratio decreased to 0.013 in 2014 (see Figure 1a). The downward sloping trend of leverage in Figure 1a is driven by the firms

[5] To mitigate the impact of outliers and errors, we winsorize the majority of variables.

with leverage smaller than median. Untabulated descriptive statistics imply that interest rates are high for firms with leverage ratios close to zero. Figure 1 reflects this. The average borrowing rate (INT_RATE) is approximately equal to 0.12 and exceeds BAA rate in most cases for a full sample (see Figure 1a); however, it is approximately equal to BAA rate for firms with book leverage above median, 75th, and 90th percentile in that year (see Figure 1b, Figure 1c, and Figure 1d). As expected, Figure 1 shows that debt servicing costs, INT/A, are higher for more leveraged firms. On average, the ratio is equal to 0.019 for all firms, but it increases to 0.031 for firms with leverage above median in that year. The annual average of INT/A is 0.049 for firms with leverage above the 90th percentile in that year.

[Insert Figure 1 here]

The correlation matrix indicates that there is a negative relation between book leverage and average borrowing rate (INT_RATE), suggesting that firms are likely to borrow less when interest rates are high (Table 1).[6] However, leverage is positively correlated with various measures of market interest rates. The result is likely to be driven by net debt issues. Equity issues scaled by assets follow opposite direction, suggesting that firms issue equity when market interest rates are low. As expected, we find a consistently positive relation between interest expenses scaled by firm assets and interest rates. Average borrowing rate, INT_RATE, is weakly correlated with market interest rates (average correlation coefficient is 0.057). Lastly, untabulated results show that market interest rates are highly correlated with each other (average correlation coefficient is 0.960).

[Insert Table 1 here]

[6] Alternatively, the negative correlation could be interpreted as interest rate decreasing with leverage. However, this explanation has no logical explanation and is in contrast to any theory of capital structure.

5 Results

In this section, we first analyze how interest rates impact firms' financing decisions. First of all, we use nominal interest rates. Then, we assume that firms rebalance their capital structures based on real interest rates. Further, we examine whether expected future interest rates impact capital structure decisions. Then we analyze whether macroeconomic conditions impact the relation between interest rates and firms' leverage ratios. Lastly, we discuss the transmission mechanism of the relation between interest rate and firms' leverage and run robustness tests.

5.1 The impact of nominal interest rates

To analyze how interest rates impact firms' financing decisions, we estimate Equation (6) using nine different proxies for interest rates (see Panel A in Table 2). We find that only short-term market interest rates (FFR and T3m) are negatively significant. Coefficient estimates for the other seven rates are negative but statistically insignificant.[7] The weak negative relation is to some extent consistent with our expectation that firms would borrow more when interest rates are low. The average coefficient estimate for interest rates is –0.1446. It means that, if the interest rate decreases by one percentage point, then leverage would increase by 0.0014. The mean leverage in our sample is 0.210; therefore, after a hypothetical decrease in the interest rate, it would be 0.2114 (or 0.69% larger). Keeping in mind that market interest rates rarely jump up or down by 100 basis points, the change in leverage is trivial. Thus, the results presented in Panel A of Table 2 are economically insignificant.

[Insert Table 2 here]

[7] The number of observations in Model 5 is smaller than in other models because data for T6m, used in Model 5, is available from 1982 rather than from 1975.

The results in Table 2 suggest that book leverage increases with firm size and tangibility ratio (PPE/A). Larger firms are likely to be less risky, and tangible assets can be used as a collateral; therefore, such firms can attract funds from an external credit market at a lower cost. We also find that more profitable firms, firms with more cash holdings and higher growth opportunities (measured using MA/A, CAPEX/A, and RD/A) have less debt. The results are generally consistent with the previous studies (see, for example, Frank and Goyal (2009)). Table 2 reports that book leverage decreases with effective tax rate. This is in contrast to the previous studies (see, for example, Faccio and Xu (2015) and Heider and Ljungqvist (2015)).

Panels B, C, and D in Table 2 show the regression results for firms with DEBT/A ratio above the median, 75^{th}, and 90^{th} percentile in that year, respectively. Due to the cleaner sample, the negative relation between interest rates and leverage is stronger in Panels B and C. Eight coefficient estimates for interest rates are significant in Panels B and C. Average coefficient estimates for interest rates are –0.211 and –0.257. Average book leverage is 0.356 and 0.460 for the sample of firms with DEBT/A ratio above the median and 75^{th} percentile in that year, respectively. A one hundred basis points increase in interest rate would lead to 0.59% and 0.56% higher leverage for these firms. The results are economically insignificant. The results in Panel D indicate that there is an insignificant—both statistically and economically—relation between interest rates and leverage for firms with DEBT/A ratio above 90^{th} percentile in that year. Consistent with the results in Panel A, we also find that a firm's book leverage increases with firm size and the tangibility of firm's assets; however, leverage is negatively impacted by effective tax rate, profitability, capital expenditure, and R&D expenses. The impacts of market-to-book ratio and cash holdings are conditional on leverage. For the full sample, the relation between leverage and market-to-book ratio is negative (Panel A), for firms with DEBT/A ratio above the median and 75^{th} percentile in that year, market-to-book ratio has no impact on firms' leverage (see Panels B and C); however, for firms with DEBT/A ratio above the 90^{th} percentile in that year, debt financing increases with market-to-book ratio (see Panel D). The coefficient estimates for CASH/A ratio are significantly negative for the full sample and for firms with DEBT/A ratio above the median in that year but statistically insignificant for firms with DEBT/A ratio above the 75th and 90th percentiles in that year. The signs and significance levels of coefficient estimates of the control variables (except for market-to-book ratio) are generally consistent with those in the previous studies (see, for example, Frank and Goyal (2009), Chang and Dasgupta (2009), Lemmon *et al.* (2008)). Models 10, 20, 30, and 40 in Table 2 do not include any proxies for interest rates. The comparison of these models with the rest reveals that the exclusion or inclusion of interest rates do not impact the coefficient estimates of other regressors and the explanatory power of the regression models, in general.

Gertler and Gilchrist (1994) and Covas and Den Haan (2011) argue that the financing policy of firms depends on firm size. Gertler and Gilchrist (1994) find that financing policies of large and small firms are different during economic downturns. Covas and Den Haan (2011) show that debt and equity issuance activity are strongly pro-cyclical for all but the top one percent largest firms in the Compustat universe. Regarding equity issuance activity, smaller firms exhibit stronger cyclicality whereas the behavior of the largest one percent firms is countercyclical. The theoretical model in Cooley and Quadrini (2006) implies that the impact on leverage of the increase in lending rate is more negative for smaller firms. Thus, it is possible that a weak relation between leverage and interest rates in Table 2 is caused by the opposite impact of interest rates on leverage of small and large firms. To investigate whether the results depend on firm size, we split the sample in deciles according to the book value of assets in that year and we re-estimate Equation (6) for each decile separately. For brevity, we report the coefficient estimates and significance levels only for interest rate measures (see Table 3). For the whole sample (see Panel A), only the smallest firms (the first decile of book value of assets) exhibit the consistent significantly negative relation between leverage and interest rates. For firms with leverage above median in that year (Panel B), five interest rate measures out of nine are significantly negative for the largest firms (the tenth decile); however, none is significant for the smallest firms. Thus, the significant results for smallest firms in Panel A are driven by less levered firms. For subsample of firms with DEBT/A ratio above the 75th percentile in that year (Panel C), there are four and three significantly negative interest rates measures for the first and tenth decile of firms. Panel D shows the interest rates do not impact leverage for firms with DEBT/A ratio above the 90th percentile in that year. Overall, we find some evidence that smallest and largest firms have different leverage sensitivities to interest rates. However, the results are less pronounced as in Covas and Den Haan (2011). More importantly, we do not find any systematic impact of firm size on the relation between corporate financing policies and interest rates. Further, our results suggest that firms other than those in the first and tenth decile of assets do not adjust their debt ratio when interest rate changes (except for the fourth decile of firms with DEBT/A ratio above median).

[Insert Table 3 here]

To capture how the propensity to increase debt varies with interest rates, we also regress the changes in leverage on the changes in interest rates. In the models, we control for the same set of variables as in Table 2; however, they are measured using first differences rather than levels. The models do not include firm-decade fixed effects. The condensed results are presented in Table 4. The average coefficient estimate for interest rate is -0.174 for the full sample and -0.275 – -0.244 for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year. The results are qualitatively similar to those in Table 2, except the sensitivities to interest rate changes are more negative in the last subsample.

[Insert Table 4 here]

Further, we check whether the results in Table 4 are driven by small and/or large firms. Thus, we split the sample in deciles according to the book value of assets in that year and we re-estimate regressions for each decile separately. Table 5 shows the results for four subsamples. For the full sample and for firms with leverage above the median in that year, we find that leverage ratios of the largest firms and the firms from the fourth decile are the most sensitive to the changes in interest rates (see Panels A and B). For firms with DEBT/A ratio above the 75th, and 90th percentile in that year, there is some evidence that the changes in leverage ratios of only largest firms exhibit sensitivity to changes in interest rates. The results are in contrast to those in Table 3 (Panels A and C), where we find that the smallest firms have the highest sensitivity of leverage to interest rates. One could argue that largest firms are the least financially constrained and their leverage adjustment costs are the lowest; therefore, their leverage ratios are the most sensitive to the changes in interest rates, but it is hard to find any reason why we observe the significant relations for the fourth decile.[8] Given the conflicting results in Table 3 and Table 5, we conclude that the impact of the firm size on the leverage sensitivity to interest rates is weak.

[Insert Table 5 here]

It is entirely conceivable that the proxies of interest rates used in the analysis above poorly reflect the actual borrowing costs. To compute the effective interest rate for each firm-year observation, we merge our sample with S&P credit rating database (S&P domestic long-term issuer credit rating (Compustat item SPLTICRM)). Then each firm-year observation with non-missing credit rating can be assigned the respective interest rate. We use two sources of interest rates:

- Moody's corporate bond yields
- BofA Merrill Lynch corporate bond indexes (BofA Merrill Lynch US Corporate Master Effective Yield©).

Each source has certain advantages and disadvantages. Moody's Investor Services provide data for the whole sample period. However, their data includes only yields for Aaa and Baa corporate bonds (the respective S&P credit ratings are AAA and BBB). Our sample contains less than 300 observations with S&P AAA credit rating and more than 5,400 observations with S&P BBB credit rating. We notice that our sample retains more than 1,000 firm-year observations with S&P AA credit rating. We assume that their borrowing costs are the same as for firms with S&P AAA credit rating.[9] Then we assign for each firm-year

[8] In untabulated tests, we find that the significant relations for the fourth decile are not driven by outliers, particular industry, or time period.

[9] The values of BofA Merrill Lynch US Corporate AAA Effective Yield© were even higher than the values of BofA Merrill Lynch US Corporate AA Effective Yield© during 28-02-2002 – 12-10-2005, 31-05-2013 – 10-12-2014, and 28-02-2015 – 24-09-2015 time periods.

observation the respective Moody's corporate bond yield. The newly-created variable is EIR (effective interest rate).

Model 1 in Panel A of Table 6 shows the results for both subsamples (i.e., for firms with S&P AAA, AA, or BBB credit ratings). In contrast to our previous findings, the coefficient estimate for EIR is significantly positive, implying that firms are more leveraged when interest rates are high. Models 2 and 3 show the results for each subsample (i.e., for firms with S&P AAA or AA credit rating and for firms with S&P BBB credit rating, respectively). In these cases, the impact of EIR on firms' leverage is negative but statistically insignificant. Models 4-12 in Panel A of Table 6 show the results for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year. In five models out of nine, we find a negative impact of EIR on firms' leverage. In the remaining four cases, the impact of EIR is statistically insignificant. Due to inconsistent results, the impact of EIR on firms' leverage is inconclusive.

[Insert Table 6 here]

BofA Merrill Lynch provides a large range of corporate yields; that is, for firms with S&P credit ratings of AAA, AA, A, BBB, BB, B, and CCC. However, the data range starts in 1996. Based on the corporate bond yields from BofA Merrill Lynch, we generate another proxy for effective borrowing costs, EIR2. Then we re-estimate Model 1 from Panel A of Table 6 using EIR2 instead of EIR. Model 1 in Panel B of Table 6 shows the results. We also estimate the regression models for firms with either investment or non-investment grade only, as well as for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year.[10] We find that nine out of twelve coefficient estimates for EIR2 are positively significant. Panel B of Table 6 suggests that there is a positive relation between effective interest rate and leverage for the full sample and for firms with non-investment credit rating. Average leverage ratio is 0.386,

[10] Investment grade credit ratings include S&P credit ratings of AAA, AA+, AA, AA-, A+, A, A-, BBB+, BBB, and BBB-. Non-investment grade credit ratings include S&P credit ratings of BB+, BB, BB-, B+, B, B-, CCC+, CCC, and CCC-.

0.414, 0.481, and 0.578 for all firms with non-investment credit rating and for those with DEBT/A ratio above the median, 75th, and 90th percentile in that year, respectively. A one hundred basis points increase in interest rate would lead to 1.47%, 1.25%, 1.19%, and 0.70% higher leverage. Given that market interest rates rarely change by 100 basis points, the impact on leverage is economically insignificant. We re-estimate models from Table 2 for sub-sample of firms with non-investment credit rating and find that the results are qualitatively similar to those in Table 2. Nevertheless, keeping in mind that the credit rating data is available for a limited number of firms (e.g., we retain 6,978 firm-year observations for firms with non-investment credit rating; however, our total sample contains more than 101,000 firm-year observations), we believe that the weak positive relation (in terms of economic significance) between EIR2 and leverage cannot be generalized to all Compustat firms.

5.2 The impact of real interest rates

It is possible that firms adjust their capital structures based on real interest rates rather than nominal interest rates because real interest rates reflect true borrowing costs for a firm. For example, if the nominal interest rate is 5% and the inflation rate is either 0% or 10%. Then the real interest rates are 5% and –5%, respectively. Firms would be keener to increase their debt levels in the second scenario. To generate real interest rates, we subtract the GDP deflator from nominal interest rates.[11] Then we re-estimate all the models in Table 2 and Table 6 using real interest rates instead of nominal interest rates. Untabulated results show that none of the coefficient estimates for market interest rates adjusted for the change in price level are statistically significant. Three out of twelve coefficient estimates for EIR, adjusted for inflation, are significantly positive and one significantly negative. Ten out of twelve coefficient estimates for EIR2

[11] We compute GDP deflator using GDP chain-type price index (source: US. Bureau of Economic Analysis; series ID: GDPCTPI).

adjusted for inflation are significantly positive.[12] Given that real interest rates are either mostly insignificant in the regressions or have inconsistent signs if significant, we conclude that real interest rates do not impact firms' financing decisions.

5.3 The impact of expected interest rates

In the analysis above, we assume that firms implement their financing policies based on contemporaneous interest rates. This assumption is used in the vast majority of empirical corporate finance studies on firms' capital structures. In this section, we check whether our previous conclusions hold if expected interest rates are used in the analysis. We generate the expected interest rates using forecasts from Surveys of Professional Forecasters which are conducted by the Federal Reserve Bank of Philadelphia. The interest rate forecasts are available either from 1981 or 1992.

We generate the expected values of Moody's AAA corporate bond yield (F_AAA), nominal and real three-month Treasury bill rate (F_T3m, F_R_T3m), 10-year Treasury bond rate (F_T10y) for different quarterly (current and up to four next quarters) and annual (current and next year as well as the annual average over the next ten years) horizons.

Then we estimate Equation (6) for each of the proxies of expected interest rates. Panel A in Table 7 shows only the values of coefficient estimates for interest rates using variables in levels. We find that all 29 values but one are statistically insignificant, in contrast to our predictions. Then we repeat this exercise for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year (see Columns 3, 4 and 5 in Table 7) and find that only for firms with DEBT/A ratio above the 75th percentile in that year are coefficient estimates for expected values of Moody's AAA corporate bond yield, nominal and real three-month Treasury bill rate significantly negative. In all other cases, the coefficient estimates are insignificant. The magnitude of statistically significant coefficient estimates imply that the impact of expected interest

[12] The results of all untabulated tests discussed in this paper are available upon request.

rates is economically insignificant. Further, we test whether expected interest rate spreads for different quarterly and annual horizons impact firms' financing policies. We estimate Equation (6) using forecasts for the spread either between the nominal rate on Moody's AAA bonds and the nominal rate on 10-year Treasury bonds (F_AAA-T10y) or between the nominal rate on 10-year Treasury bonds and the nominal rate on three-month Treasury bills (F_T10y-T3m). The results in Table 7 show that the impact of the spread is mostly insignificant for full sample as well as for firms with DEBT/A ratio above the median, 75^{th}, and 90^{th} percentile in that year.

[Insert Table 7 here]

Panel B in Table 7 reports the results using variables in first differences. In this specification, the results are more statistically significant than in Panel A. We find that the predicted yield on 10-year Treasury bonds negatively impacts firms' leverage ratios for all four subsamples. In addition, the firms' leverage decreases with the expected yield on Moody's AAA corporate bonds for firms with DEBT/A ratio above the median, 75^{th}, and 90^{th} percentile in that year. Though some of the coefficient estimates for predicted interest rates are statistically significant, their absolute values are relatively small; thus, the impacts are economically insignificant.

Further, we re-estimate models in Table 7 for each decile of firm size separately. Table 8 presents the results for the full sample (Panel A for models in levels and Panel B for models in first differences). We do find that some instances of significant relations between firms' leverage and interest rates; however, there is no obvious pattern such as the weakening or strengthening relation between interest rates and leverage when we move from firms from the first decile to firms from the tenth decile. For robustness, we also estimate models for each decile of firm size separately for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year. The untabulated results are qualitatively similar for all three subsamples to those reported in Table 8.[13]

[Insert Table 8 here]

5.4 The impact of macroeconomic conditions on the relation between interest rates and leverage

Firms' financing policies are likely to be different across the phases of business cycles (see Korajczyk and Levy (2003) and Halling *et al.* (2016) and others). For example, during downturns, firms might be reluctant to borrow money even if interest rates are low. However, firms are likely to sell bonds in the environment of high economic growth and low interest rates.

To control for different phases of business cycles, we estimate Equation (6) separately for recession and non-recession periods. Table 9 shows the results if recessionary periods are defined using the Organisation of Economic Development (OECD) trough method (a recession lasts from the period following the peak through the trough). We find that the impacts of interest rates are much higher during the recessions compared to the whole sample period for the full sample as well as for firms with leverage above the median in that year (see Table 2). However, the impact of interest rates on leverage of firms with DEBT/A ratio above the 75th, and 90th percentile in that year is insignificant. Thus, the significant relations for the full sample are driven by firms with the small leverage ratios. The average coefficient estimates are –0.652 and –0.284 for the full sample and for the firms with leverage above the median in that year. The values imply that a 100 basis point increase in interest rate would lead to 3.0% and 0.8% lower leverage, respectively. Though the coefficient estimates for interest rates are higher than those in the previous tables, the results are still economically insignificant and seem to be driven by the firms with small leverage. We also find that the impact of interest rates is insignificant during the non-recessions. Thus, consistent with the previous literature, the impact of interest rates on firm's leverage is asymmetrical across different phases

[13] The results are available upon request.

of the business cycle, except for highly levered firms whose debt ratio is impacted by interest rates neither in recessions nor during the non-recessionary periods.

[Insert Table 9 here]

We repeat the analysis for the alternative recession indicators:

- OECD midpoint method (a recession lasts from the midpoint of the peak through the midpoint of the trough)
- OECD peak method (a recession lasts from the period of the peak to the trough)
- The National Bureau of Economic Research (NBER) midpoint method (a recession lasts from the midpoint of the peak through the midpoint of the trough)
- NBER trough method (a recession lasts from the period following the peak through the trough)
- NBER peak method (a recession lasts from the period of the peak to the trough).[14]

We find that the results for recession periods are qualitatively similar to those presented in Table 9 in all cases, except for when the recession is defined using the NBER midpoint and trough methods. In the former case, the coefficient estimates for interest rates are significantly negative only for firms with debt ratios above the 75th percentile in that year. In the latter case, the coefficient estimates for interest rates are significantly negative only for firms with debt ratios above the median in that year. Regarding non-recession periods, the results in all five cases are qualitatively similar to those presented in Table 9.

For robustness, we also regress firm leverage on forecasted interest rate using levels in different economic environments (i.e., recessions and non-recessions according to OECD trough method) and then using first differences. We find that the relation between leverage and forecasted interest rates is generally the same during recessions and non-recessions (i.e., mostly insignificant). Then we analyse the determinants

[14] Although definitions are the same, the values of time series provided by OECD and NBER are slightly different.

of leverage by deciles of firm assets during recessions and non-recessions. We find that the relation between leverage and forecasted interest rate is mostly insignificant in both environments and that firm size does not impact the relation. Lastly, we investigate how the changes in expected interest rates impact the changes in leverage by deciles of firm assets in different economic environments. Consistent with our previous results, we find no clear pattern on how firm size impacts the relation between the change in leverage ratios and the changes in forecasted interest rates.[15]

Further, we consider the probabilities of a decline in real GDP in the current quarter or in the upcoming quarters by using forecasts from Surveys of Professional Forecasters:

- the probability that real GDP will decline in the current quarter (ANX0)
- the probability that real GDP will decline in the next quarter (which is also known as the Anxious Index) (ANX1)
- the probability that real GDP will decline in the second next quarter (ANX2)
- the probability that real GDP will decline in the third next quarter (ANX3)
- the probability that real GDP will decline in the fourth next quarter (ANX4).

We estimate Equation (6) for three subsamples:

- for firm-year observations with Anxious Index values less or equal to 0.1 (this would reflect firms' financing decisions under normal economic conditions)
- for firm-year observations with Anxious Index greater or equal to 0.25
- for firm-year observations with Anxious Index greater or equal to 0.5.

The last two cases would show the results when market participants expect that real GDP might fall in the next quarter. These observations are concentrated in the earlier period (see Figure 1). During the period 1975-1992, there were eight years with Anxious Index greater than or equal to 0.25. Afterwards, the

[15] The results are available upon request.

index value exceeded 0.25 only twice: in 2001 and 2008. We expect that the negative relation between interest rates and leverage is weak or non-existent in the first case but much stronger in the last two scenarios. Table 10 shows the results for ANX1. As expected, we find that market interest rates do not impact firms' leverage if the probability of the decline in real GDP next quarter is less or equal to 0.1.

[Insert Table 10 here]

If the probability of the decline in real GDP next quarter is more or equal to 0.25, the impact of interest rates on firms' leverage is more pronounced but only for the full sample and for firms with DEBT/A ratio above the median in that year. The average coefficient estimates for interest rate are -0.76 and -0.39, respectively. In computing the average coefficient estimate, we exclude T6m measure due to a low number of observations which might bias our results (the coverage of T6m starts in 1982). The coefficient estimates suggest that, if interest rates are cut by 100 basis points in the period where ANX is equal to or greater than 0.25, then the average firm would increase its leverage by 3.4% and 1.1%, respectively. The value for the full sample is greater than those computed from regressions estimated during recessionary periods (see Table 9), and can be considered as economically significant.

If the probability of the decline in real GDP next quarter is more or equal to 0.5, the impact of interest rates on firms' leverage is even greater, but only for the full sample and for firms with DEBT/A ratio above the median in that year. As in the previous case, the results show that the impact is insignificant for firms with DEBT/A ratio above the 75th and 90th percentile in that year.[16] The average coefficient estimates for interest rates for the full sample and for firms with DEBT/A ratio above the median in that year are –3.56 and –1.60. They suggest that, if interest rates are cut by 100 basis points in the period where ANX is equal to or greater than 0.5, then the average firm would increase its leverage by 15.4%, while firms with leverage above the median in that year would increase their leverage by 4.3%. The results are economically

[16] For firms with DEBT/A ratio above the 90th percentile in that year, the regression model cannot be estimated if interest rate is proxied using T6m due to the insufficient number of observations.

significant and suggest that firms tend to make bigger adjustments of their debt ratios in economic downturns. This seems to be inconsistent with Cook and Tang (2010) who find that the adjustment speed is higher in good macroeconomic states. There are only four years with Anxious Index greater than or equal to 0.5 in our sample: three of them were during the 1975-1990 period and the last such year was in 2008 (see Figure 1). Thus, the results in Table 10 are driven by the 1975-1991 period and it is unclear whether the economically significant relation between interest rates and firms' leverage is observed after 1991. We repeat the analysis using ANX0, ANX2, ANX3, and ANX4. We get qualitatively similar results as in Table 10 when we use the first three measures; however, the coefficient estimates for interest rates are insignificant when ANX4 is used.

5.5 The transmission mechanism

The changes in interest rate might impact firms' leverage via debt and/or equity issues. According to market timing theory, if the interest rate decreases, firms should be more likely to sell bonds, ceteris paribus. Similarly, if the interest rate increases, then firms should tend to sell seasoned equity. To analyze whether debt and equity issues are impacted by the interest rates, we regress net debt issues as well as net equity issues on interest rates controlling for firm characteristics as in Equation (6) plus lagged leverage, firm-decade and year fixed effects. Table 11 shows that net debt issues for an average firm are not impacted by interest rates. The result holds for the full sample as well as for firms with DEBT/A ratio above the median, 75th, and 90th percentile in that year. We find that net equity issues are significantly impacted by the changes in interest rates. This holds for all firms as well as for firms with DEBT/A ratio above the median in that year. The signs of coefficient estimates of interest rates are in line with our expectations (but opposite to those in the correlation table (see Table 1)). The average values of coefficient estimates for interest rates imply that a 100 basis point increase in the interest rate would lead to 5.4% and 11.4% greater net equity issues for full sample and for firms with DEBT/A ratio above the median in that year, respectively. This might suggest that the impact on net equity issues is economically significant; however, the changes in net equity issues would hardly affect leverage. Greater net equity issues due to a hypothetical 100 basis point increase in the interest rate would reduce leverage by 0.9% for full sample and by 0.4% for firms with DEBT/A ratio above the median in that year. Therefore, we conclude that the impacts are economically insignificant. This is consistent with our main findings (see Table 6) that the impact of interest rates on leverage is trivial.

[Insert Table 11 here]

Covas and Den Haan (2011) show that debt and equity issuance activity are strongly pro-cyclical for all but the top one percent largest firms in the Compustat universe. We do not find support for this view using leverage ratios; however, it is possible that debt and equity activities offset each other and lead to an unchanged leverage ratio. Thus, we re-estimate models in Table 11 for each decile of firm size separately. Consistent with our previous results, we find no clear pattern of the sensitivity of security issues to interest rates and firm size decile (see Table 12). For example, the sensitivities of net debt issues tend to be significantly positive only for firms from the third decile. The sensitivities of net equity issues tend to be significantly positive for firms from the first, fourth, seventh, and ninth deciles; however, they are mostly significantly negative for firms from the third decile. Therefore, we do not find evidence that the relations between security (net debt or net equity) issues and interest rates depend on firm size.

[Insert Table 12 here]

Net debt issues are defined as the difference between long-term debt issuance (Compustat item DLTIS) and long-term debt reduction (Compustat item DLTR) over book value of assets. Thus, we re-estimate our regression models as in Table 11 separately for long-term debt issuance over book value of assets and for long-term debt reduction over book value of assets. Untabulated results show that the impacts of interest rates on the both variables are insignificant.

5.6 Information content of interest rates

A lot of the information contained in the interest rates variables is redundant. To reduce the amount of noise contained in the various interest rate measures, we apply the principal component analysis. In the latter, we use AAA, BAA, FFR, T3m, T1y, T3y, T5y, and T10y. We exclude T6m as its coverage starts in 1982. The principal component analysis suggests that only one principal component has eigenvalue higher than one (see Figure 3). It can explain 96.6% of variance in the data. The second principal component explains only 2.9% of the variance. The scatterplot of loadings of the first two principal components (PC1 and PC2) indicates that the values of PC2 are the smallest for FFR and then gradually increases with maturity of Treasury bonds. PC2 has the largest values for AAA and BAA. Thus, PC2 is likely to be related to maturity and bankruptcy risk premium. The untabulated correlation matrix shows that PC1 is highly correlated with all interest rate measures used in the principal component analysis and with T6m. The correlation coefficient is the highest for T3y and T5y (99.7%) and the smallest for BAA (96.1%). The correlation between INT_RATE and PC1 is weak (5.9%), however.

[Insert Figure 3 here]

[Insert Figure 4 here]

Then we estimate Equation (6) using PC1 and PC2 as the proxies for interest rates. Table 13 shows that PC1 is significantly negative only for firms with DEBT/A ratio above the 75^{th} and 90^{th} percentile in that year. The impact of PC2 is insignificant for all four subsamples. The standard deviation of PC1 is 75.7-112.2 times higher than standard deviations of market interest rates. Thus, the values of coefficient estimates for PC1 in Table 13 are comparable to the values of coefficient estimates for interest rate measures in Table 2. Thus, the impact of PC1 on firms' leverage ratios is economically insignificant, consistent with our previous results.

[Insert Table 13 here]

5.7 Robustness checks

We conduct a battery of robustness checks. First, to see whether the economically insignificant relation between firms' leverage and interest rates is stable over time, we re-estimate our panel data regressions (as in Panel A of Table 2) by decades; that is, we run our tests separately for the following time periods: 1975-1984, 1985-1994, 1995-2004, and 2005-2014. The untabulated results suggest that the relation is insignificant in all four subsamples. Then we repeat this exercise for models using real interest rates and find that the impact of real borrowing costs on firms' leverage is generally insignificant in all four periods as well.

Further, it is possible that due to the low speed of adjustment towards target capital structure, firms' leverage is impacted by not only the contemporaneous interest rate but also by the lagged interest rates. In other words, the current capital structure is a function of the current interest rate and/or historical interest rates. To test whether this is the case, we estimate Equation (6) using lagged nominal and real values of FFR, AAA, and BAA. We consider up to the third lag and include either one lagged value of a particular proxy of interest rate or the contemporaneous and three lagged (i.e., first, second, and third lags) values in a regression model. We estimate regressions for full sample as well as for firms with DEBT/A ratio above the median, 75^{th}, and 90^{th} percentile in that year. Untabulated results suggest that, in general, firms' leverage does not depend on lagged values of interest rates. The results are significantly negative only for the first lag of FFR (both nominal and real). However, the magnitude of the coefficient estimate is economically insignificant and similar to those in Models 3, 13, 23, and 33 in Table 2.

Equation (6) implies that firm's leverage is a function of the contemporaneous values of interest rate and other control variables. For robustness, we re-estimate our main models using lagged values of control variables (except for interest rate) as well as lagged values of all control variables, including interest rates. The obtained results are qualitatively similar to those in Table 2.

The robustness tests support our main results. In general, we show that the impact of interest rates on firms' leverage is either zero or slightly negative.

5.8 Why is the relation between interest rates and leverage weak?

The insignificant and inconsistent results could be due to several reasons. Firstly, if the majority of firms target leverage ratio, then the higher benefits of debt (the debt tax shield) due to increased interest rate could be offset by greater expected bankruptcy costs, leading to zero or close to zero net effect (see Section 2). Secondly, high adjustment costs might prevent firms from frequently rebalancing their capital structures. Direct debt issue costs are around 2.2%, as reported in Lee *et al.* (1996) and are likely to substantially mitigate (or maybe even eliminate) the additional benefits of newly-issued debt. Thirdly, the theoretical models generally assume that firms issue one-year debt in each period. In reality, the most popular term for corporate bonds is ten years. Not all bonds include call provisions; thus, if interest rates decrease, firms cannot call previously issued bonds and re-issue new debt securities at a lower interest rate. Ederington and Stock (2002) find that call feature has no significant impact on bond yields; however, they do not analyze whether bond issue costs are higher for callable bonds. If it is the case, then the debt adjustment costs are even higher. If bonds are not callable, then firms cannot instantly reissue debt at a lower rate. The absence of call feature and long maturities of bonds negatively impact the speed of adjustment of debt leading to a low sensitivity of debt level to interest rates. This explanation is consistent with the empirical evidence that it takes 2-7 years for a firm to move halfway toward its target capital structure (see Table 8 on page 267 in Huang and Ritter (2009)).

Debt issue costs, long bond maturities, and firms' inability to call back their bonds suggest that debt adjustment costs might be high enough to prevent firms from issuing or reissuing debt securities when interest rates are low or buying back their bonds when interest rates are high. We use the dynamic stochastic partial equilibrium model developed in Karpavičius (2014b) to show how debt adjustment costs impact the sensitivity of leverage to interest rates.

The model in Karpavičius (2014a) implies a negative relation between optimal debt level and interest rates, ceteris paribus. The relation is driven by the fact the marginal utility of the firm's manager obtained by raising one monetary unit should be the same regardless of whether a firm conducts equity or debt issue. Greater interest payments reduce the net income of the firm and thus the marginal utility of debt. As a result, it is optimal for a firm to reduce its debt level and rely more on equity financing.

We modify Equation (8) in Karpavičius (2014b) which defines the interest rate at which a firm can borrow funds, r_t, to include the exogenous shock to the hypothetical interest rate on corporate bonds for firms with zero leverage (it can be also interpreted as risk-free rate), r^*:

$$r_t = r^* e^{r_t^*} \left(1 + \Phi_r \frac{D_t}{D_t + P_t^b N_t} \right), \tag{7}$$

where r_t^* is the exogenous shock to interest rate that follows the AR(1) process:

$$r_t^* = \rho_r r_{t-1}^* + \eta_t^r, \text{ where } \eta_t^r \sim N\left(0, \sigma_r^2\right). \tag{8}$$

Karpavičius (2014b) calibrates the quarterly interest rate on corporate bonds for unlevered firm, r^*, to 0.01. It implies that the hypothetical annual interest rate for firms without debt is 4%. Φ_r is the parameter of risk premium, D_t is debt outstanding at time t, P_t^b is the book value of equity per share, and N_t is the number of shares outstanding. The model in Karpavičius (2014b) includes the quadratic number of shares outstanding, debt, and capital adjustment costs that directly negatively impact the book value of equity. The functional form of the quadratic debt adjustment costs is as follows:

$$\Phi_D \frac{\left(D_t - D_{t-1}\right)^2}{D_{t-1}}, \tag{9}$$

where Φ_D is debt adjustment cost parameter. Since we are only interested in debt adjustment costs, we assume that the number of shares outstanding and capital adjustment costs are zero. We set AR(1) coefficient of the shock to interest rate to 0.5. Then we compute the impulse responses of leverage to the exogenous increase to the interest rate of unlevered firms by 1% (not 1 p.p.); that is, we set $\eta_t^r = 0.01$ at t=0, for the following values of debt adjustment cost parameter, Φ_D: 0, 0.01, 0.05, and 0.25. Figure 2a shows that the sensitivity of leverage to the changes in interest rate decreases with the debt adjustment cost parameter. Therefore, relatively high leverage adjustment costs are indeed one of the explanations for the weak relation between interest rates and firms' leverage.

[Insert Figure 2 here]

Similarly, firms might be reluctant to issue seasoned equity even when interest rates are high due to high equity issue costs. Lee *et al.* (1996) find that direct equity issue costs are approximately 7.1%. High adjustment costs are likely to remove any incentives for firms to rebalance their capital structures. We conduct the sensitivity analysis of the number of shares outstanding adjustment costs using the model in Karpavičius (2014b). The functional form of the quadratic number of shares outstanding adjustment costs is as follows:

$$\Phi_N \frac{\left(N_t - N_{t-1}\right)^2}{N_{t-1}}, \tag{10}$$

where Φ_N is the number of shares outstanding adjustment cost parameter. As seasoned equity issue costs exceed debt issue costs, we consider higher values of Φ_N in the analysis; that is, 0, 1, 2, and 4. Figure 2b shows that the sensitivity of leverage to the changes in interest rate decreases with the number of shares outstanding adjustment cost parameter. However, the impact is less pronounced compared to the debt adjustment costs as in Figure 2a.

It is also possible that firms' management ignore the interest rate in making financing decisions because interest rates are quite volatile and it is hard to predict their future values. Of course, it is possible to hedge future interest rates; however, hedging is not popular among firms.[17] In comparison, corporate income tax rates are more stable over time; thus, firms' managers are more confident about their future values. This might be another potential explanation for why the firms' leverage is more sensitive to tax changes than to changes in interest rates.

6 Conclusion

This study analyzes whether corporate financing policies have depended on borrowing costs during the last forty years. The results show that the impact is either zero or slightly negative, in general. Even in the latter case, the results are economically insignificant. The results are robust for a number of different proxies of interest rates, including nominal and real, contemporaneous, historical, and expected, as well as market and average borrowing rates. Overall, our findings suggest that firms do not adjust their capital structures based on interest rates; that is, the observed capital structures are not sensitive to interest rates. However, there is an exception. We find that the negative relation between interest rate and leverage is economically significant only when market participants expect that real GDP growth will be negative. Most of such observations were during the 1979-1991 period; thus, it is unclear whether the economically significant relation is observed in a more recent period. The general results are in contrast to market timing theory of capital structure that suggests firms would opt to borrow more money when borrowing costs are low.

The insignificant results could be due to several reasons. First, firms target leverage ratio in aggregate and do not time the market, in general. Second, we demonstrate that high adjustment costs might prevent firms from frequent rebalancing of their capital structures. Direct equity and debt issue costs are around 7.1% and 2.2%, respectively, as reported in Lee *et al.* (1996) and are likely to substantially mitigate (or

[17] For example, Guay and Kothari (2003) report that derivative securities held by the median firm could hedge only 3% to 6% of its aggregate interest rate and currency exchange rate exposures.

maybe even eliminate) the additional benefits of debt. Third, the theoretical models generally assume that firms issue one-year debt in each period. In reality, the most common expiration period of bond issues is 10 years. Not all bonds include call provisions; thus, if the interest rate decreases, firms cannot call them and re-issue new debt securities at a lower interest rate. High adjustment costs are likely to remove any incentives for firms to rebalance their capital structures. This implies a low speed of adjustment and a low sensitivity of debt level to interest rates.

The conclusions of the study are of the great importance to monetary policy-makers. We find that the relation between market interest rates, including the federal fund rate, and firms' leverage is very weak or even non-existent. This suggests that the adjustments to the federal fund rate are a weaker monetary policy tool than expected and, *under normal economic conditions*, policy-makers should not anticipate that a lowered rate would translate into higher corporate debt and, consequently, into increased investments and employment. The federal fund rate has a significantly negative impact on firms' leverage only during recessions or when market participants expect that real GDP growth will be negative. However, in such periods, monetary policy is more important and market participants anticipate policy decisions which could help stimulate the economy.

Theory suggests that interest rates should impact firms' financing decisions as interest rates are the cost of debt. However, the empirical tests show that the impact is insignificant. If leverage adjustment costs are smaller than we discussed above, then firm managers could potentially further improve firm value by cutting debt level when interest rates are high and increasing debt when interest rates are low. The net effect would depend on the magnitude of the debt and equity adjustment costs (as well as on whether firms target debt level or leverage ratio). We leave this issue for future research.

Appendix

Variable definitions

Variable	Definition	Winsorization
MA/A	*market value of assets* (*book value of assets* (Compustat item AT) – *book value of equity* (Compustat item CEQ) + *market value of equity* (common shares outstanding (Compustat item CSHO) × closing share price at the end of the fiscal year (Compustat item PRCC_F))) over *book value of assets*	max 20 (censorized)
ASSETS	natural logarithm of *book value of assets*, adjusted for inflation using GDP deflator	min $20 million (censorized)
NI/A	*net income* (Compustat item NI) over *book value of assets*	at the tails of 0.5% and 99.5%
DEBT/A	*debt* (the sum of long-term debt (Compustat item DLTT) and debt in current liabilities (Compustat item DLC)) over *book value of assets*	at the tails of 0.5% and 99.5%
CASH/A	*cash and short-term investments* (Compustat item CHE) over *book value of assets*	at the tails of 0.5% and 99.5%
PPE/A	*net property, plant, and equipment* (Compustat item PPENT) over *book value of assets*	at the tails of 0.5% and 99.5%
CAPEX/A	*capital expenditures* (Compustat item CAPX) *to book value of assets* ratio	at the tails of 0.5% and 99.5%
RD/A	*research and development (R&D) expense* (Compustat item XRD) to *book value of assets* ratio	at the tails of 0.5% and 99.5%
RDD	equal to one when R&D expense is reported in Compustat and zero otherwise	
TAX_RATE	total income tax (Compustat item TXT) / pre-tax income (Compustat item PI)	at the tails of 1% and 99%
INT/AT	*interest expense* (the sum of interest and related expense (Compustat item XINT) and capitalized interest (Compustat item INTC)) over *book value of assets*	at the tails of 0.5% and 99.5%
DI/AT	the difference between long-term debt issuance (Compustat item DLTIS) and long-term debt reduction (Compustat item DLTR) over *book value of assets*	at the tails of 0.5% and 99.5%
EI/AT	the difference between sale of common and preferred stock (Compustat item SSTK) and purchase of common and preferred stock (Compustat item PRSTKC) over *book value of assets*	at the tails of 0.5% and 99.5%
INT_RATE	*interest expense* over *debt* (in decimals)	at the tails of 1% and 99%
AAA	annual average of monthly Moody's Seasoned Aaa Corporate Bond Yield© (in decimals); source: https://research.stlouisfed.org/fred2/	
BAA	annual average of monthly Moody's Seasoned Baa Corporate Bond Yield© (in decimals); source: https://research.stlouisfed.org/fred2/	
FFR	annual average of monthly effective federal funds rate (in decimals); source: https://research.stlouisfed.org/fred2/	
T3m	annual average of monthly secondary market rate of 3-month treasury bill (in decimals); source: https://research.stlouisfed.org/fred2/	
T6m	annual average of monthly 6-month treasury constant maturity rate (in decimals); source: https://research.stlouisfed.org/fred2/	
T1y	annual average of monthly 1-year treasury constant maturity rate (in decimals); source: https://research.stlouisfed.org/fred2/	
T3y	annual average of monthly 3-year treasury constant maturity rate (in decimals); source: https://research.stlouisfed.org/fred2/	
T5y	annual average of monthly 5-year treasury constant maturity rate (in decimals); source: https://research.stlouisfed.org/fred2/	

T10y	annual average of monthly 10-year treasury constant maturity rate (in decimals); source: https://research.stlouisfed.org/fred2/	
EIR	*AAA* if *S&P domestic long term issuer credit rating* (Compustat item SPLTICRM) is AAA or AA, *BAA* if *S&P domestic long term issuer credit rating* is BBB (in decimals)	
EIR2	the yield of respective BofA Merrill Lynch corporate bond index (BofA Merrill Lynch US Corporate Master Effective Yield©; AAA, AA, A, BBB, BB, B, and CCC) based on *S&P domestic long term issuer credit rating* (in decimals)	
F_AAA_Q0	the expected value of Moody's AAA corporate bond yield in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Q1	the expected value of Moody's AAA corporate bond yield in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Q2	the expected value of Moody's AAA corporate bond yield in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Q3	the expected value of Moody's AAA corporate bond yield in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Q4	the expected value of Moody's AAA corporate bond yield in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Y0	the expected value of Moody's AAA corporate bond yield in the current financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA_Y1	the expected value of Moody's AAA corporate bond yield in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Q0	the expected value of three-month Treasury bill rate in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Q1	the expected value of three-month Treasury bill rate in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Q2	the expected value of three-month Treasury bill rate in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Q3	the expected value of three-month Treasury bill rate in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Q4	the expected value of three-month Treasury bill rate in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Y0	the expected value of three-month Treasury bill rate in the current financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Y1	the expected value of three-month Treasury bill rate in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Q0	the expected value of 10-year Treasury bond rate in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	

F_T10y_Q1	the expected value of 10-year Treasury bond rate in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Q2	the expected value of 10-year Treasury bond rate in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Q3	the expected value of 10-year Treasury bond rate in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Q4	the expected value of 10-year Treasury bond rate in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Y0	the expected value of 10-year Treasury bond rate in the current financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Y1	the expected value of 10-year Treasury bond rate in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T3m_Y10	the expected annual average of three-month Treasury bill rate over the next ten years; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y_Y10	the expected annual average of 10-year Treasury bond rate over the next ten years ; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Q0	the expected value of real three-month Treasury bill rate in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Q1	the expected value of real three-month Treasury bill rate in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Q2	the expected value of real three-month Treasury bill rate in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Q3	the expected value of real three-month Treasury bill rate in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Q4	the expected value of real three-month Treasury bill rate in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_R_T3m_Y1	the expected value of real three-month Treasury bill rate in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Q0	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Q1	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Q2	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	

F_AAA-T10y_Q3	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Q4	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Y0	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the current financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_AAA-T10y_Y1	the expected spread between Moody's AAA corporate bond yield and 10-year Treasury bond rate in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Q0	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the current quarter (end of financial year); source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Q1	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Q2	the expected spread 10-year Treasury bond rate and three-month Treasury bill rate in the second next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Q3	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the third next quarter after the end of financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Q4	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the last quarter of the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Y0	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the current financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
F_T10y-T3m_Y1	the expected spread between 10-year Treasury bond rate and three-month Treasury bill rate in the next financial year; source: Surveys of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia (in decimals)	
PC1	the most important principal component from principal component analysis conducted using AAA, BAA, FFR, T3m, T1y, T3y, T5y, and T10y	
PC2	The second most important principal component from principal component analysis conducted using AAA, BAA, FFR, T3m, T1y, T3y, T5y, and T10y	

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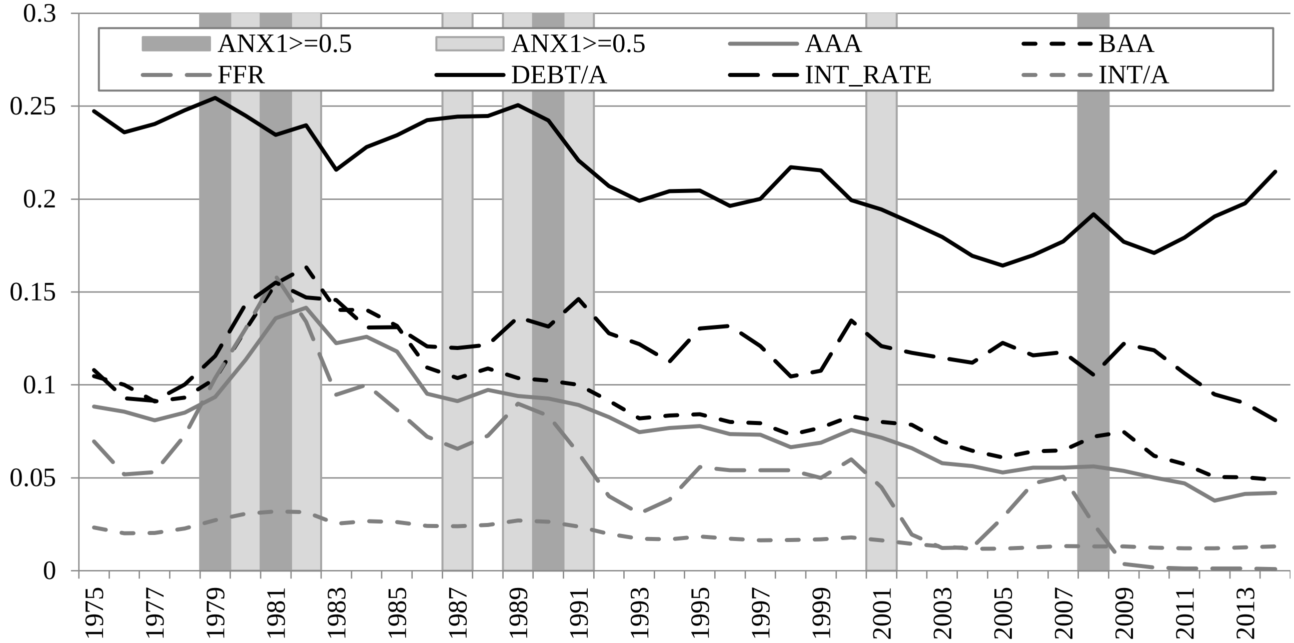
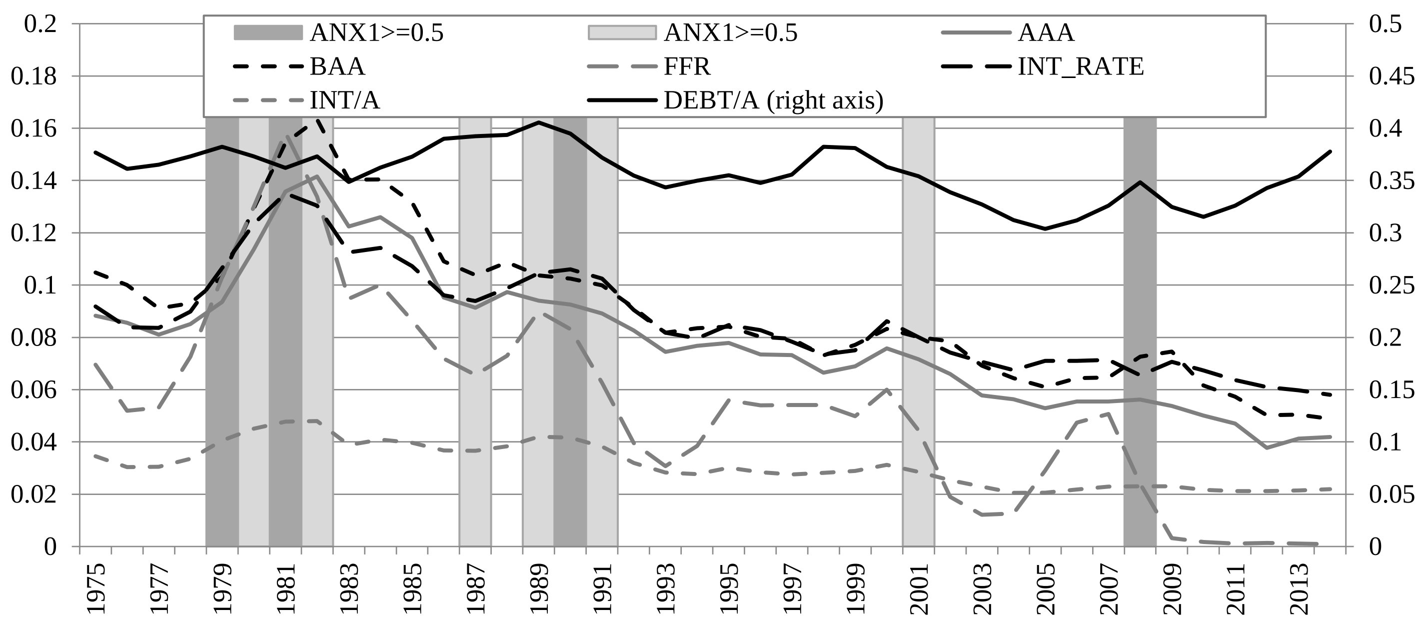
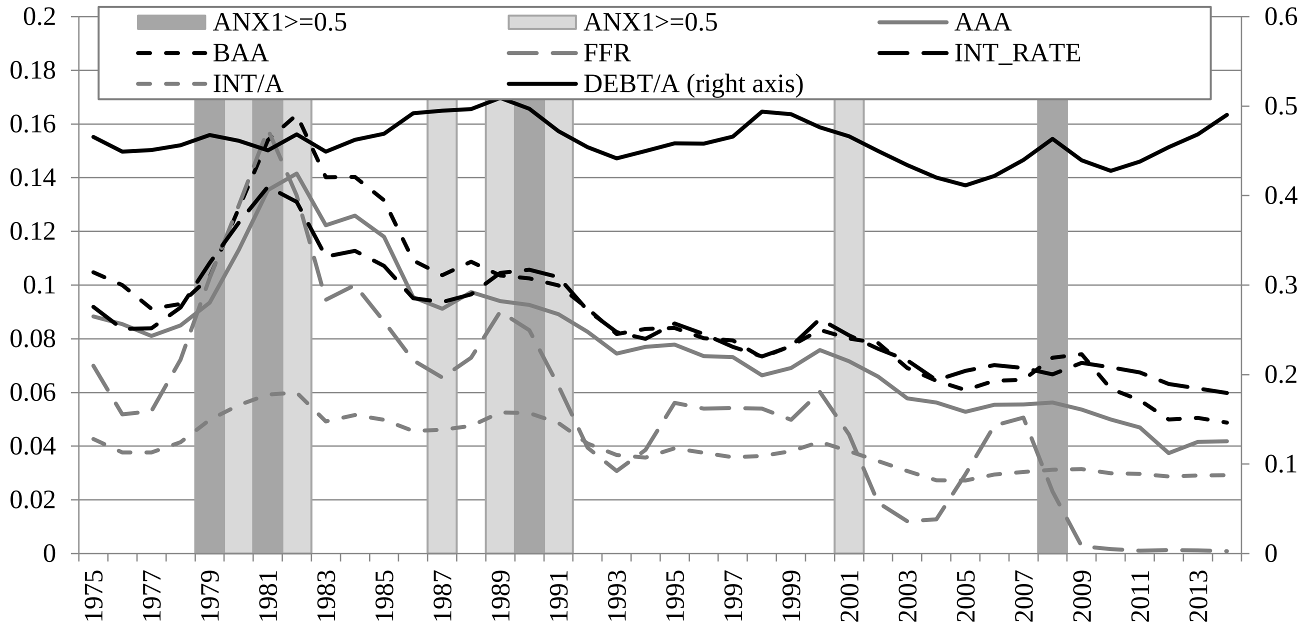
Figures



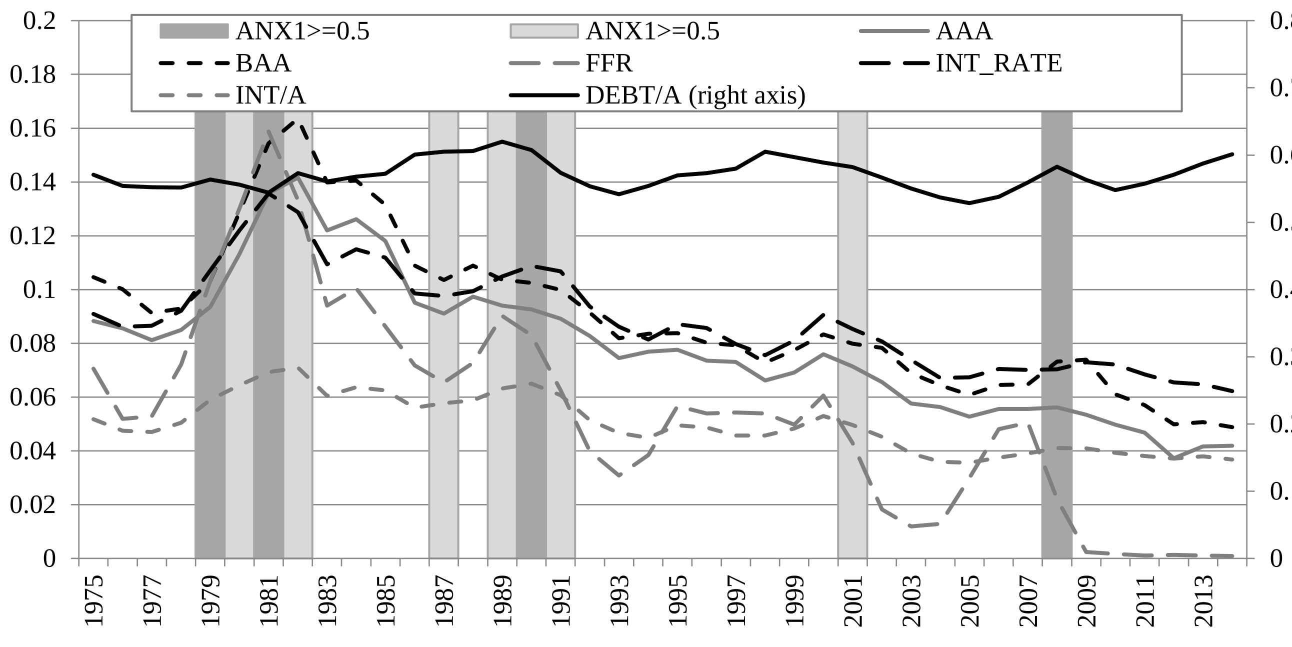
a) Full sample.



b) For firm-year observations with DEBT/A is above median in that year.

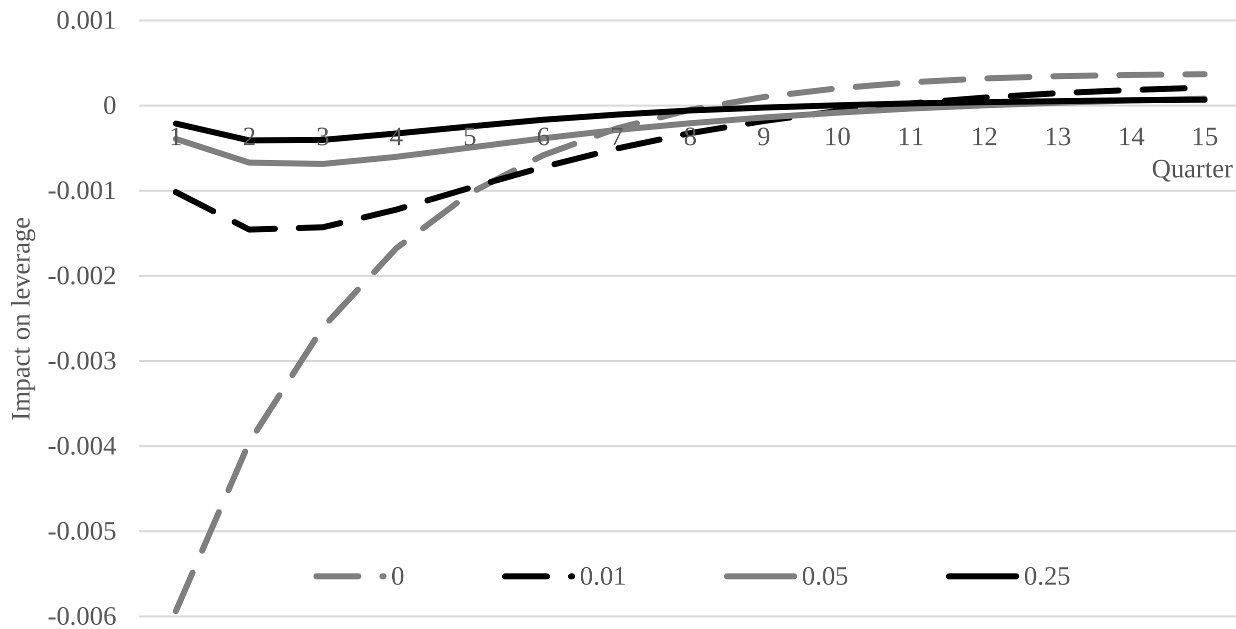


c) For firm-year observations with DEBT/A is above 75th percentile in that year.

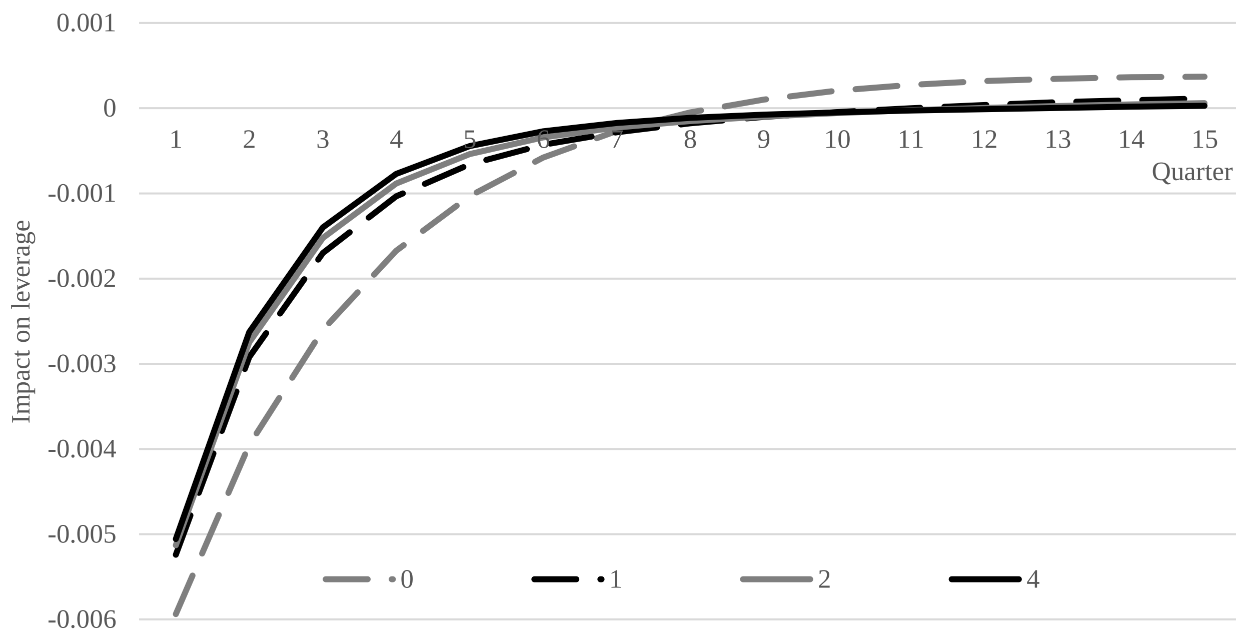


d) For firm-year observations with DEBT/A is above 90th percentile in that year.

Figure 1. Evolution of financial leverage and borrowing costs over the sample period.



a) For different values of the parameters of debt adjustment costs.



b) For different values of the parameters of the number of shares outstanding adjustment costs.

Figure 2. The impulse responses of leverage. This figure shows the impulse responses of leverage to 1% (not 1 percentage point or 100 basis points) increase in risk-free rate which quarterly value is set to 0.01. We use the model from Karpavičius (2014b). The series name reflects the value of the parameters of debt (subfigure a) and the number of shares outstanding (subfigure b) adjustment costs. The responses are expressed as the deviations in levels from the steady state.

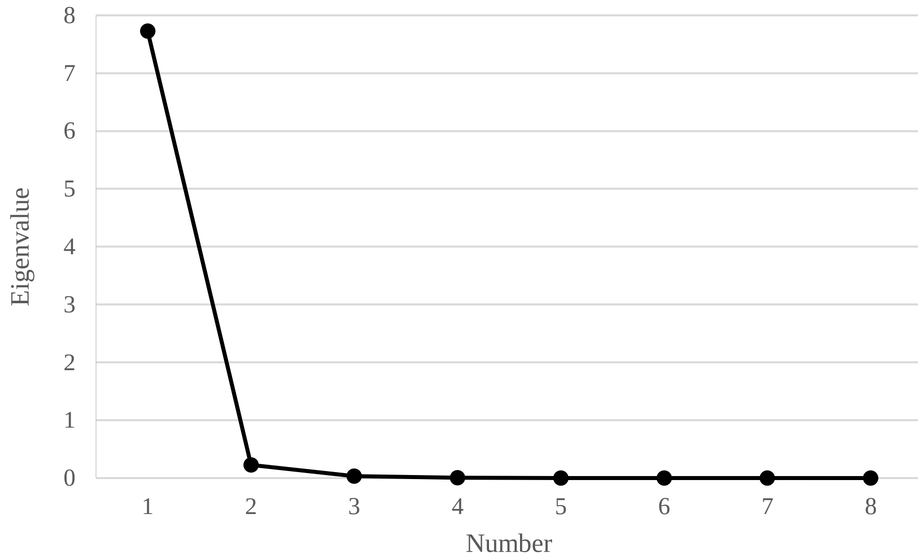


Figure 3. Scree plot. This figure shows the eigenvalues related to the number of the principal component. Principal component analysis was conducted using AAA, BAA, FFR, T3m, T1y, T3y, T5y, and T10y.

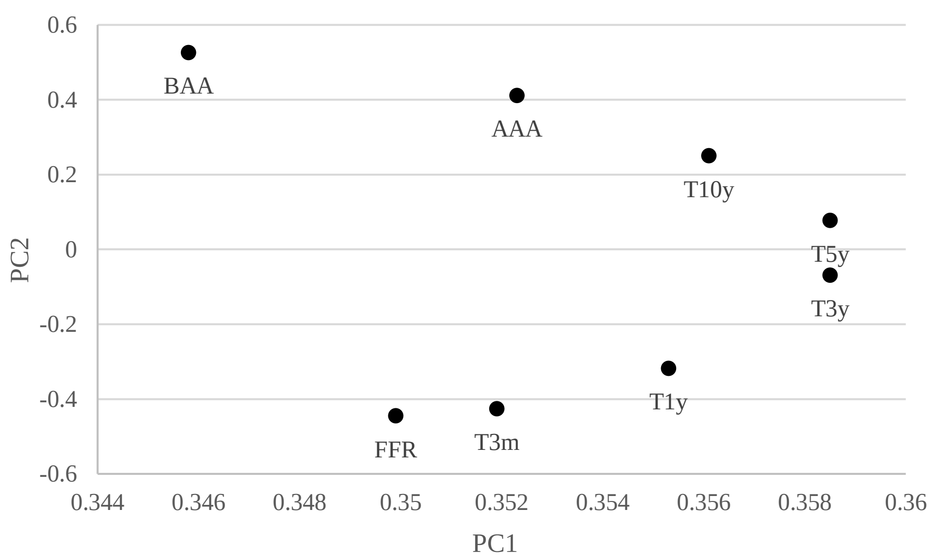


Figure 4. Loadings of the first two principal components. This figure shows the scatterplot of loadings of the first two principal components (PC1 and PC2). Principal component analysis was conducted using AAA, BAA, FFR, T3m, T1y, T3y, T5y, and T10y.

Tables

Table 1: Correlation matrix.

This table shows the correlation matrix. See Appendix for variable definitions. All correlation coefficients are statistically significant at 0.01 level, except for those smaller or equal to –0.07 (they are significant at 0.05 level).

	INT_RATE	AAA	BAA	FFR	T3m	T6m	T1y	T3y	T5y	T10y
DEBT/A	-0.232	0.103	0.100	0.102	0.102	0.088	0.104	0.105	0.105	0.105
INT/A	0.041	0.288	0.285	0.280	0.280	0.243	0.282	0.286	0.287	0.289
DI/A	-0.181	0.015	0.010	0.037	0.036	0.030	0.035	0.028	0.024	0.020
EI/A	0.188	-0.008	-0.018	-0.011	-0.008	0.019	-0.010	-0.007	-0.007	-0.010
INT_RATE	1	0.059	0.058	0.058	0.058	0.054	0.057	0.058	0.058	0.058

Table 2. Determinants of leverage.

This table presents the results of least-squares dummy variable regressions where the dependent variable is book leverage (DEBT/A). See Appendix for variable definitions. Interest rate measure (IR) is different for each model. Panel A shows the results for the full sample. Panel B presents the results for firm with DEBT/A ratio above the median in that year. Panels C and D show the results for firms with DEBT/A ratio above 75th and 90th percentile in that year, respectively. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable: DEBT/A									
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	IR (interest rate measure):									
Independent variables	AAA	BAA	FFR	T3m	T6m	T1y	T3y	T5y	T10y	
Panel A. Full sample.										
IR	-0.197	-0.160	-0.154**	-0.176**	-0.097	-0.139	-0.128	-0.125	-0.125	
	[1.072]	[1.075]	[2.213]	[2.064]	[0.707]	[1.309]	[0.950]	[0.844]	[0.773]	
ASSETS	0.053***	0.053***	0.053***	0.053***	0.051***	0.053***	0.053***	0.053***	0.053***	0.053***
	[18.009]	[18.007]	[17.982]	[17.982]	[16.342]	[17.992]	[18.000]	[18.004]	[18.006]	[18.001]
MA/A	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	[4.235]	[4.238]	[4.236]	[4.236]	[4.488]	[4.237]	[4.235]	[4.234]	[4.236]	[4.242]
TAX_RATE	-0.010***	-0.010***	-0.010***	-0.010***	-0.009***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	[6.839]	[6.843]	[6.831]	[6.832]	[5.796]	[6.833]	[6.834]	[6.835]	[6.836]	[6.838]
NI/A	-0.197***	-0.197***	-0.197***	-0.197***	-0.175***	-0.197***	-0.197***	-0.197***	-0.197***	-0.197***
	[11.751]	[11.760]	[11.741]	[11.742]	[12.549]	[11.742]	[11.741]	[11.742]	[11.745]	[11.751]
CASH/A	-0.129***	-0.129***	-0.129***	-0.129***	-0.124***	-0.129***	-0.129***	-0.129***	-0.129***	-0.129***
	[13.393]	[13.385]	[13.386]	[13.389]	[12.055]	[13.393]	[13.398]	[13.399]	[13.399]	[13.381]
PPE/A	0.130***	0.130***	0.130***	0.130***	0.101***	0.130***	0.130***	0.130***	0.131***	0.131***
	[8.021]	[8.021]	[8.007]	[8.011]	[6.416]	[8.017]	[8.020]	[8.021]	[8.018]	[7.996]
CAPEX/A	-0.094***	-0.094***	-0.094***	-0.094***	-0.098***	-0.094***	-0.094***	-0.094***	-0.094***	-0.094***
	[6.069]	[6.066]	[6.078]	[6.076]	[5.189]	[6.076]	[6.076]	[6.076]	[6.075]	[6.081]
RD/A	-0.233***	-0.233***	-0.234***	-0.234***	-0.194***	-0.233***	-0.233***	-0.234***	-0.234***	-0.234***
	[7.689]	[7.690]	[7.697]	[7.698]	[7.452]	[7.693]	[7.691]	[7.690]	[7.690]	[7.692]
RDD	0.000	0.000	-0.000	-0.000	0.005	-0.000	-0.000	-0.000	-0.000	-0.000
	[0.001]	[0.000]	[0.003]	[0.003]	[1.178]	[0.002]	[0.001]	[0.001]	[0.001]	[0.006]
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	101,102	101,102	101,102	101,102	83,924	101,102	101,102	101,102	101,102	101,102
Adjusted R-squared	0.792	0.792	0.792	0.792	0.790	0.792	0.792	0.792	0.792	0.792

	Dependent variable: DEBT/A									
	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20
	IR (interest rate measure):									
Independent variables	AAA	BAA	FFR	T3m	T6m	T1y	T3y	T5y	T10y	
Panel B. DEBT/A is above median in that year.										
IR	-0.384***	-0.293**	-0.133**	-0.160**	-0.076	-0.156**	-0.195**	-0.229**	-0.269**	
	[2.891]	[2.614]	[2.614]	[2.492]	[0.803]	[2.123]	[2.152]	[2.294]	[2.453]	
ASSETS	0.036***	0.036***	0.036***	0.036***	0.033***	0.036***	0.036***	0.036***	0.036***	0.036***
	[9.878]	[9.872]	[9.864]	[9.865]	[8.184]	[9.870]	[9.874]	[9.875]	[9.877]	[9.874]
MA/A	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	[1.601]	[1.606]	[1.595]	[1.596]	[1.651]	[1.600]	[1.601]	[1.601]	[1.602]	[1.603]
TAX_RATE	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	[5.462]	[5.460]	[5.469]	[5.473]	[4.687]	[5.469]	[5.464]	[5.463]	[5.463]	[5.462]
NI/A	-0.271***	-0.271***	-0.271***	-0.271***	-0.249***	-0.271***	-0.271***	-0.271***	-0.271***	-0.271***
	[15.933]	[15.952]	[15.919]	[15.928]	[16.592]	[15.929]	[15.928]	[15.926]	[15.926]	[15.914]
CASH/A	-0.022*	-0.022*	-0.022	-0.022	-0.014	-0.022*	-0.022*	-0.022*	-0.022*	-0.022
	[1.701]	[1.702]	[1.682]	[1.682]	[1.022]	[1.685]	[1.689]	[1.691]	[1.693]	[1.681]
PPE/A	0.072***	0.072***	0.073***	0.073***	0.049***	0.073***	0.073***	0.072***	0.072***	0.073***
	[4.979]	[4.980]	[4.991]	[4.990]	[3.319]	[4.990]	[4.988]	[4.986]	[4.985]	[4.993]
CAPEX/A	-0.068***	-0.067***	-0.068***	-0.068***	-0.072***	-0.068***	-0.068***	-0.068***	-0.068***	-0.068***
	[4.523]	[4.508]	[4.548]	[4.545]	[4.051]	[4.541]	[4.535]	[4.534]	[4.535]	[4.547]
RD/A	-0.258***	-0.258***	-0.258***	-0.258***	-0.209***	-0.258***	-0.258***	-0.258***	-0.258***	-0.259***
	[5.307]	[5.304]	[5.307]	[5.309]	[4.675]	[5.308]	[5.308]	[5.309]	[5.310]	[5.316]
RDD	0.004	0.004	0.004	0.004	0.007*	0.004	0.004	0.004	0.004	0.004
	[1.120]	[1.120]	[1.104]	[1.106]	[1.696]	[1.111]	[1.117]	[1.120]	[1.122]	[1.108]
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,213	49,213	49,213	49,213	40,595	49,213	49,213	49,213	49,213	49,213
Adjusted R-squared	0.716	0.716	0.716	0.716	0.717	0.716	0.716	0.716	0.716	0.716

	Dependent variable: DEBT/A									
	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
	IR (interest rate measure):									
Independent variables	AAA	BAA	FFR	T3m	T6m	T1y	T3y	T5y	T10y	
Panel C. DEBT/A is above 75th percentile in that year.										
IR	-0.395**	-0.292*	-0.130	-0.190*	-0.272**	-0.197*	-0.252*	-0.286**	-0.296*	
	[2.073]	[1.780]	[1.489]	[1.796]	[2.138]	[1.803]	[1.953]	[2.025]	[2.000]	
ASSETS	0.019***	0.019***	0.019***	0.019***	0.015**	0.019***	0.019***	0.019***	0.019***	0.019***
	[3.959]	[3.957]	[3.955]	[3.954]	[2.706]	[3.953]	[3.954]	[3.955]	[3.959]	[3.963]
MA/A	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	[1.308]	[1.298]	[1.309]	[1.311]	[1.123]	[1.308]	[1.310]	[1.310]	[1.307]	[1.296]
TAX_RATE	-0.008***	-0.008***	-0.008***	-0.008***	-0.009***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	[4.279]	[4.272]	[4.300]	[4.307]	[4.777]	[4.301]	[4.291]	[4.286]	[4.283]	[4.287]
NI/A	-0.237***	-0.237***	-0.238***	-0.237***	-0.214***	-0.237***	-0.237***	-0.237***	-0.237***	-0.238***
	[13.091]	[13.105]	[13.099]	[13.104]	[13.407]	[13.099]	[13.091]	[13.086]	[13.085]	[13.102]
CASH/A	0.004	0.004	0.004	0.004	0.008	0.004	0.004	0.004	0.004	0.004
	[0.186]	[0.187]	[0.200]	[0.201]	[0.342]	[0.198]	[0.195]	[0.194]	[0.193]	[0.203]
PPE/A	0.071***	0.071***	0.072***	0.072***	0.049**	0.072***	0.072***	0.072***	0.072***	0.072***
	[4.276]	[4.276]	[4.297]	[4.296]	[2.680]	[4.296]	[4.292]	[4.289]	[4.288]	[4.304]
CAPEX/A	-0.069***	-0.069***	-0.070***	-0.070***	-0.063***	-0.070***	-0.070***	-0.070***	-0.070***	-0.070***
	[4.851]	[4.820]	[4.878]	[4.879]	[3.656]	[4.877]	[4.871]	[4.869]	[4.865]	[4.857]
RD/A	-0.120*	-0.120*	-0.120*	-0.119*	-0.073	-0.119*	-0.119*	-0.119*	-0.119*	-0.120*
	[1.994]	[1.994]	[1.990]	[1.986]	[1.206]	[1.983]	[1.982]	[1.985]	[1.989]	[1.994]
RDD	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001
	[0.219]	[0.220]	[0.228]	[0.229]	[1.139]	[0.231]	[0.229]	[0.229]	[0.228]	[0.229]
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,675	23,675	23,675	23,675	19,461	23,675	23,675	23,675	23,675	23,675
Adjusted R-squared	0.664	0.664	0.664	0.664	0.666	0.664	0.664	0.664	0.664	0.664

	Dependent variable: DEBT/A									
	Model 31	Model 32	Model 33	Model 34	Model 35	Model 36	Model 37	Model 38	Model 39	Model 40
	IR (interest rate measure):									
Independent variables	AAA	BAA	FFR	T3m	T6m	T1y	T3y	T5y	T10y	
Panel D. DEBT/A is above 90th percentile in that year.										
IR	-0.001	0.028	-0.005	-0.039	0.126	-0.022	-0.001	0.007	0.034	
	[0.003]	[0.102]	[0.037]	[0.243]	[0.562]	[0.129]	[0.007]	[0.035]	[0.150]	
ASSETS	0.009*	0.009*	0.009*	0.009*	0.004	0.009*	0.009*	0.009*	0.009*	0.009*
	[1.737]	[1.737]	[1.737]	[1.737]	[0.670]	[1.737]	[1.737]	[1.737]	[1.737]	[1.737]
MA/A	0.007**	0.007**	0.007**	0.007**	0.006*	0.007**	0.007**	0.007**	0.007**	0.007**
	[2.288]	[2.286]	[2.287]	[2.291]	[1.961]	[2.289]	[2.288]	[2.288]	[2.286]	[2.285]
TAX_RATE	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	[3.441]	[3.441]	[3.451]	[3.456]	[3.285]	[3.450]	[3.445]	[3.443]	[3.442]	[3.441]
NI/A	-0.171***	-0.171***	-0.171***	-0.171***	-0.151***	-0.171***	-0.171***	-0.171***	-0.171***	-0.171***
	[7.909]	[7.907]	[7.916]	[7.918]	[7.221]	[7.917]	[7.914]	[7.912]	[7.910]	[7.917]
CASH/A	-0.006	-0.006	-0.006	-0.006	0.003	-0.006	-0.006	-0.006	-0.006	-0.006
	[0.239]	[0.236]	[0.239]	[0.241]	[0.124]	[0.240]	[0.239]	[0.238]	[0.236]	[0.239]
PPE/A	0.065***	0.066***	0.065***	0.065***	0.040	0.065***	0.065***	0.065***	0.066***	0.065***
	[3.062]	[3.063]	[3.065]	[3.065]	[1.634]	[3.065]	[3.065]	[3.065]	[3.066]	[3.065]
CAPEX/A	-0.056***	-0.056***	-0.056***	-0.056***	-0.043**	-0.056***	-0.056***	-0.056***	-0.056***	-0.056***
	[3.155]	[3.147]	[3.169]	[3.173]	[2.294]	[3.170]	[3.166]	[3.164]	[3.161]	[3.167]
RD/A	-0.008	-0.008	-0.008	-0.008	0.043	-0.008	-0.008	-0.008	-0.008	-0.008
	[0.065]	[0.064]	[0.065]	[0.066]	[0.350]	[0.065]	[0.065]	[0.065]	[0.064]	[0.065]
RDD	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	[0.291]	[0.288]	[0.291]	[0.292]	[0.237]	[0.292]	[0.291]	[0.290]	[0.288]	[0.291]
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,919	8,919	8,919	8,919	7,300	8,919	8,919	8,919	8,919	8,919
Adjusted R-squared	0.580	0.580	0.580	0.580	0.571	0.580	0.580	0.580	0.580	0.580

Table 3. Determinants of leverage by deciles of firm assets.

This table presents the results of least-squares dummy variable regressions (360 in total) where the dependent variable is book leverage (DEBT/A), estimated for each decile of firm assets (A). The control variables are the same as in Table 2. See Appendix for variable definitions. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. Panel A shows the results for the full sample. Panel B presents the results for firm with DEBT/A ratio above the median in that year. Panels C and D show the results for firms with DEBT/A ratio above 75th and 90th percentile in that year, respectively. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DEBT/A									
Panel A. Full sample.										
AAA	-0.591**	0.470	0.192	-0.195	0.198	0.125	-0.650*	0.021	-0.240	-0.546**
	[2.232]	[1.518]	[0.591]	[0.498]	[0.580]	[0.476]	[1.792]	[0.064]	[0.700]	[2.248]
BAA	-0.481**	0.416	0.167	-0.054	0.032	0.224	-0.505*	-0.013	-0.228	-0.324
	[2.186]	[1.520]	[0.638]	[0.150]	[0.093]	[0.967]	[1.735]	[0.048]	[0.757]	[1.550]
FFR	-0.395**	0.170	0.098	-0.262	-0.054	0.043	-0.127	0.127	-0.027	-0.146
	[2.558]	[1.184]	[0.584]	[1.580]	[0.389]	[0.274]	[0.612]	[0.956]	[0.128]	[1.228]
T3m	-0.493**	0.179	0.167	-0.317	-0.027	0.034	-0.222	0.201	-0.079	-0.163
	[2.529]	[1.030]	[0.889]	[1.592]	[0.155]	[0.176]	[0.928]	[1.159]	[0.357]	[1.119]
T6m	-0.415	0.191	0.302	-0.169	-0.063	-0.203	-0.152	0.501**	0.135	-0.107
	[1.395]	[0.820]	[1.072]	[0.619]	[0.250]	[0.801]	[0.578]	[2.118]	[0.609]	[0.713]
T1y	-0.499**	0.282	0.195	-0.309	0.000	0.023	-0.261	0.221	-0.057	-0.161
	[2.545]	[1.519]	[0.984]	[1.409]	[0.002]	[0.121]	[1.101]	[1.169]	[0.250]	[1.129]
T3y	-0.531**	0.399*	0.215	-0.261	0.037	0.009	-0.365	0.206	-0.064	-0.245
	[2.562]	[1.852]	[0.927]	[1.000]	[0.167]	[0.046]	[1.376]	[0.901]	[0.250]	[1.553]
T5y	-0.558**	0.428*	0.214	-0.267	0.098	0.005	-0.418	0.178	-0.096	-0.319*
	[2.615]	[1.860]	[0.832]	[0.957]	[0.416]	[0.025]	[1.461]	[0.700]	[0.346]	[1.833]
T10y	-0.585**	0.439*	0.222	-0.262	0.170	-0.003	-0.527*	0.156	-0.172	-0.367*
	[2.651]	[1.793]	[0.785]	[0.868]	[0.675]	[0.013]	[1.762]	[0.566]	[0.583]	[1.906]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	7,222	6,800	6,824	6,917	7,055	7,350	7,614	7,834	8,136	8,473
Observations (otherwise)	8,870	8,394	8,403	8,494	8,687	8,998	9,324	9,541	9,825	10,126

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DEBT/A									
Panel B. If DEBT/A is above median in that year.										
AAA	-0.415	0.176	-0.151	-0.820	0.273	-0.471	-0.587	-0.672**	-0.517	-0.843***
	[0.868]	[0.352]	[0.361]	[1.650]	[0.594]	[1.534]	[1.075]	[2.311]	[1.572]	[2.747]
BAA	-0.691	0.106	0.014	-0.520	0.260	-0.254	-0.469	-0.640**	-0.452	-0.523**
	[1.661]	[0.233]	[0.040]	[1.172]	[0.545]	[1.018]	[1.117]	[2.581]	[1.683]	[2.079]
FFR	0.117	0.389	0.086	-0.346*	-0.325	-0.036	-0.090	0.097	-0.106	-0.162
	[0.415]	[1.536]	[0.393]	[1.828]	[1.429]	[0.192]	[0.299]	[0.564]	[0.512]	[1.179]
T3m	0.082	0.330	0.115	-0.443*	-0.347	-0.068	-0.133	0.156	-0.156	-0.189
	[0.229]	[1.021]	[0.450]	[1.807]	[1.087]	[0.295]	[0.363]	[0.731]	[0.634]	[1.081]
T6m	0.775	-0.111	0.327	-0.681	-0.223	-0.272	0.249	0.484*	0.186	-0.178
	[1.688]	[0.264]	[0.760]	[1.433]	[0.465]	[0.964]	[0.732]	[1.915]	[0.656]	[0.752]
T1y	-0.013	0.293	0.121	-0.519*	-0.230	-0.095	-0.161	0.097	-0.109	-0.243
	[0.039]	[0.945]	[0.454]	[2.002]	[0.726]	[0.444]	[0.446]	[0.456]	[0.444]	[1.369]
T3y	-0.100	0.238	0.065	-0.622**	-0.087	-0.206	-0.251	-0.042	-0.130	-0.386*
	[0.279]	[0.712]	[0.216]	[2.025]	[0.248]	[0.910]	[0.631]	[0.176]	[0.516]	[1.912]
T5y	-0.147	0.203	0.023	-0.696**	0.027	-0.277	-0.296	-0.174	-0.205	-0.523**
	[0.389]	[0.570]	[0.071]	[2.095]	[0.074]	[1.127]	[0.695]	[0.696]	[0.782]	[2.375]
T10y	-0.223	0.127	-0.007	-0.760**	0.192	-0.337	-0.389	-0.355	-0.321	-0.676***
	[0.535]	[0.332]	[0.021]	[2.078]	[0.515]	[1.267]	[0.867]	[1.367]	[1.205]	[2.715]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	1,529	1,924	2,095	2,435	2,920	3,593	4,523	5,060	5,495	6,164
Observations (otherwise)	2,004	2,604	2,806	3,271	3,708	4,475	5,454	5,897	6,338	7,036

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DEBT/A									
Panel C. If DEBT/A is above 75th percentile in that year.										
AAA	-1.041	0.138	-0.745	-0.962	0.606	0.643	0.174	-1.000*	-0.619	-1.617**
	[1.380]	[0.203]	[1.281]	[1.552]	[1.038]	[1.373]	[0.249]	[1.788]	[1.237]	[2.573]
BAA	-0.897	0.114	-0.420	-0.654	0.388	0.526	0.028	-0.882**	-0.700*	-1.286**
	[1.502]	[0.175]	[0.862]	[1.258]	[0.701]	[1.326]	[0.054]	[2.079]	[1.751]	[2.300]
FFR	-0.983***	0.560	-0.551*	-0.392	-0.002	0.217	0.233	0.074	-0.372	-0.033
	[3.104]	[1.684]	[2.011]	[1.339]	[0.005]	[0.735]	[0.638]	[0.411]	[1.519]	[0.129]
T3m	-1.075**	0.412	-0.627*	-0.418	0.026	0.236	0.227	0.060	-0.492	-0.060
	[2.584]	[1.028]	[1.756]	[1.065]	[0.062]	[0.660]	[0.511]	[0.259]	[1.650]	[0.190]
T6m	-0.181	0.037	-0.336	-1.154*	0.068	0.092	0.305	-0.099	-0.446	-0.047
	[0.234]	[0.082]	[0.483]	[1.968]	[0.124]	[0.226]	[0.783]	[0.255]	[1.183]	[0.123]
T1y	-1.060**	0.308	-0.562	-0.512	0.148	0.312	0.271	-0.066	-0.479	-0.143
	[2.500]	[0.815]	[1.490]	[1.238]	[0.352]	[0.926]	[0.609]	[0.255]	[1.510]	[0.415]
T3y	-0.934*	0.226	-0.553	-0.671	0.342	0.418	0.304	-0.337	-0.477	-0.409
	[1.823]	[0.524]	[1.274]	[1.483]	[0.761]	[1.221]	[0.608]	[0.994]	[1.265]	[0.964]
T5y	-0.863	0.184	-0.532	-0.760	0.451	0.497	0.324	-0.511	-0.445	-0.695
	[1.487]	[0.386]	[1.166]	[1.593]	[0.977]	[1.420]	[0.597]	[1.298]	[1.084]	[1.489]
T10y	-0.766	0.087	-0.452	-0.801	0.590	0.602	0.284	-0.733	-0.351	-1.023*
	[1.106]	[0.163]	[0.934]	[1.569]	[1.262]	[1.680]	[0.498]	[1.616]	[0.817]	[1.915]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	380	753	852	1,146	1,409	1,746	2,376	2,576	2,690	2,651
Observations (otherwise)	543	1,074	1,207	1,590	1,798	2,195	2,866	2,975	3,093	2,957

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DEBT/A									
Panel D. If DEBT/A is above 90th percentile in that year.										
AAA	1.140	-1.299	0.010	0.543	0.009	0.129	0.305	0.959*	0.757	-2.600
	[1.196]	[1.536]	[0.011]	[0.959]	[0.009]	[0.150]	[0.467]	[1.708]	[0.566]	[1.528]
BAA	1.199	-1.105	0.061	0.221	-0.055	-0.151	0.711	0.789	0.602	-2.122
	[1.393]	[1.538]	[0.085]	[0.563]	[0.071]	[0.213]	[1.558]	[1.490]	[0.481]	[1.418]
FFR	-0.041	-0.050	-0.133	0.015	0.188	0.676	0.079	0.438	-0.317	-0.749
	[0.084]	[0.122]	[0.591]	[0.045]	[0.513]	[1.282]	[0.162]	[1.182]	[0.440]	[1.114]
T3m	-0.233	-0.251	-0.314	0.117	0.059	0.744	-0.249	0.586	-0.246	-0.789
	[0.404]	[0.501]	[1.043]	[0.261]	[0.100]	[1.058]	[0.406]	[1.268]	[0.241]	[0.980]
T6m	-0.578	-0.020	-0.628	-0.061	-0.881	1.004	-1.044	1.100*	0.457	-0.305
	[0.638]	[0.025]	[1.030]	[0.099]	[1.017]	[1.214]	[1.520]	[1.867]	[0.500]	[0.335]
T1y	0.024	-0.386	-0.357	0.198	-0.017	0.683	-0.228	0.589	0.023	-0.911
	[0.046]	[0.726]	[0.996]	[0.466]	[0.026]	[1.064]	[0.408]	[1.259]	[0.022]	[1.055]
T3y	0.254	-0.659	-0.445	0.346	-0.039	0.572	-0.275	0.723	0.434	-1.243
	[0.450]	[1.080]	[0.791]	[0.774]	[0.051]	[0.901]	[0.498]	[1.372]	[0.391]	[1.125]
T5y	0.480	-0.800	-0.403	0.436	0.013	0.478	-0.245	0.785	0.558	-1.573
	[0.770]	[1.205]	[0.601]	[0.924]	[0.015]	[0.750]	[0.436]	[1.447]	[0.486]	[1.240]
T10y	0.870	-1.056	-0.268	0.566	0.037	0.266	-0.140	0.849	0.648	-2.224
	[1.233]	[1.476]	[0.337]	[1.078]	[0.041]	[0.405]	[0.239]	[1.528]	[0.536]	[1.492]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	130	380	496	749	892	1,005	1,323	1,414	1,236	944
Observations (otherwise)	178	508	667	958	1,095	1,239	1,600	1,609	1,406	1,020

Table 4. Determinants of annual changes in leverage.

This table presents the results of least-squares dummy variable regressions where the dependent variable is the first difference in book leverage (ΔDEBT/A). The control variables (also in a form of first difference) are the same as in Table 2. See Appendix for variable definitions. Interest rate measure (IR) is different for each model. For brevity, we report only the coefficient estimates and significance for IR. Panel A shows the results for the full sample. Panel B presents the results for firm with DEBT/A ratio above the median in that year. Panels C and D show the results for firms with DEBT/A ratio above 75th and 90th percentile in that year, respectively. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable: ΔDEBT/A								
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	ΔIR (Interest rate measure):								
Independent variables	ΔAAA	ΔBAA	ΔFFR	ΔT3m	ΔT6m	ΔT1y	ΔT3y	ΔT5y	ΔT10y
Panel A. Full sample.									
ΔIR	-0.278***	-0.163**	-0.094**	-0.120**	-0.154*	-0.139**	-0.183***	-0.205***	-0.227***
	[3.884]	[2.104]	[2.357]	[2.205]	[1.977]	[2.564]	[3.200]	[3.413]	[3.602]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	93,800	93,800	93,800	93,800	75,585	93,800	93,800	93,800	93,800
Adjusted R-squared	0.160	0.160	0.160	0.160	0.147	0.160	0.160	0.160	0.160
Panel B. If DEBT/A is above median in that year.									
ΔIR	-0.441***	-0.310***	-0.131**	-0.155*	-0.099	-0.197**	-0.258***	-0.286***	-0.316***
	[4.601]	[3.227]	[2.360]	[1.970]	[0.912]	[2.624]	[3.355]	[3.566]	[3.816]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,648	47,648	47,648	47,648	38,522	47,648	47,648	47,648	47,648
Adjusted R-squared	0.275	0.275	0.275	0.275	0.265	0.275	0.275	0.275	0.275
Panel C. If DEBT/A is above 75th percentile in that year.									
ΔIR	-0.517***	-0.378***	-0.097	-0.113	-0.138	-0.193*	-0.294**	-0.343***	-0.399***
	[3.626]	[3.136]	[1.312]	[1.031]	[0.912]	[1.769]	[2.547]	[2.864]	[3.307]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,355	23,355	23,355	23,355	18,855	23,355	23,355	23,355	23,355
Adjusted R-squared	0.309	0.309	0.308	0.308	0.302	0.309	0.309	0.309	0.309
Panel D. If DEBT/A is above 90th percentile in that year.									
ΔIR	-0.652**	-0.650**	0.064	0.116	-0.028	-0.108	-0.312	-0.393	-0.506*
	[2.025]	[2.399]	[0.575]	[0.755]	[0.098]	[0.565]	[1.340]	[1.586]	[1.906]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,038	9,038	9,038	9,038	7,273	9,038	9,038	9,038	9,038
Adjusted R-squared	0.327	0.327	0.326	0.326	0.322	0.326	0.327	0.327	0.327

Table 5. Determinants of annual changes in leverage by deciles of firm assets.

This table presents the results of least-squares dummy variable regressions (360 in total) where the dependent variable is the first difference in book leverage (ΔDEBT/A), estimated for each decile of firm assets (A). The control variables (in a form of first difference) are the same as in Table 2. See Appendix for variable definitions. Interest rate measure (IR) is different for each model. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. Panel A shows the results for the full sample. Panel B presents the results for firm with DEBT/A ratio above the median in that year. Panels C and D show the results for firms with DEBT/A ratio above 75th and 90th percentile in that year, respectively. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: ΔDEBT/A									
Panel A. Full sample.										
ΔAAA	-0.031	-0.246	-0.204	-0.612***	-0.043	-0.001	-0.176	-0.273	-0.431**	-0.450*
	[0.111]	[0.773]	[0.777]	[3.232]	[0.210]	[0.007]	[0.718]	[1.323]	[2.228]	[2.010]
ΔBAA	-0.038	-0.099	-0.272	-0.409**	-0.072	0.070	-0.133	-0.082	-0.263	-0.182
	[0.162]	[0.363]	[1.275]	[2.263]	[0.399]	[0.372]	[0.673]	[0.466]	[1.472]	[0.972]
ΔFFR	-0.135	-0.043	0.043	-0.228***	-0.027	0.073	-0.061	-0.042	-0.147	-0.175*
	[0.944]	[0.313]	[0.418]	[2.749]	[0.275]	[0.673]	[0.506]	[0.424]	[1.611]	[1.767]
ΔT3m	-0.243	-0.120	0.071	-0.247**	0.039	0.047	-0.112	-0.047	-0.211	-0.179
	[1.571]	[0.634]	[0.533]	[2.038]	[0.257]	[0.316]	[0.679]	[0.337]	[1.641]	[1.515]
ΔT6m	-0.150	-0.360	-0.178	-0.148	-0.087	-0.053	-0.040	0.077	-0.175	-0.136
	[0.732]	[1.550]	[1.136]	[0.882]	[0.564]	[0.223]	[0.215]	[0.364]	[1.014]	[0.880]
ΔT1y	-0.169	-0.155	-0.030	-0.289**	0.024	0.040	-0.114	-0.072	-0.236*	-0.200*
	[1.044]	[0.748]	[0.191]	[2.389]	[0.172]	[0.286]	[0.725]	[0.522]	[1.787]	[1.752]
ΔT3y	-0.093	-0.192	-0.127	-0.379***	-0.010	-0.007	-0.139	-0.137	-0.271*	-0.252*
	[0.494]	[0.831]	[0.687]	[2.944]	[0.064]	[0.047]	[0.806]	[0.908]	[1.897]	[2.010]
ΔT5y	-0.065	-0.218	-0.145	-0.438***	-0.022	-0.016	-0.136	-0.172	-0.303*	-0.289**
	[0.321]	[0.904]	[0.751]	[3.226]	[0.139]	[0.108]	[0.730]	[1.063]	[2.009]	[2.042]
ΔT10y	-0.045	-0.271	-0.165	-0.502***	-0.026	-0.038	-0.128	-0.201	-0.340**	-0.302*
	[0.206]	[1.069]	[0.816]	[3.358]	[0.144]	[0.242]	[0.630]	[1.160]	[2.141]	[1.856]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	6,246	6,952	7,240	7,522	7,688	7,818	7,914	7,961	8,026	8,218
Observations (otherwise)	7,739	8,674	9,063	9,363	9,556	9,703	9,819	9,863	9,927	10,093

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: ΔDEBT/AT									
Panel B. If DEBT/A is above median in that year.										
ΔAAA	-0.407	-0.438	-0.448	-0.718**	-0.252	-0.060	-0.266	-0.654**	-0.380	-0.671***
	[0.665]	[1.069]	[1.019]	[2.220]	[0.773]	[0.231]	[0.777]	[2.417]	[1.604]	[2.888]
ΔBAA	-0.405	-0.344	-0.465	-0.523*	-0.294	-0.015	-0.175	-0.500**	-0.167	-0.326
	[0.767]	[1.011]	[1.459]	[1.854]	[1.022]	[0.056]	[0.636]	[2.218]	[0.789]	[1.491]
ΔFFR	-0.228	0.014	0.038	-0.384***	-0.079	-0.148	-0.062	0.011	-0.225*	-0.229*
	[0.885]	[0.076]	[0.213]	[2.852]	[0.457]	[1.034]	[0.346]	[0.066]	[1.839]	[2.001]
ΔT3m	-0.397	-0.027	0.029	-0.434**	-0.013	-0.186	-0.085	0.044	-0.262	-0.242*
	[1.319]	[0.107]	[0.108]	[2.063]	[0.056]	[0.945]	[0.334]	[0.198]	[1.597]	[1.736]
ΔT6m	0.070	-0.368	-0.441	-0.241	-0.117	-0.174	0.175	0.289	-0.053	-0.203
	[0.181]	[0.953]	[1.569]	[0.637]	[0.471]	[0.490]	[0.712]	[1.280]	[0.304]	[1.144]
ΔT1y	-0.398	-0.141	-0.142	-0.457**	-0.080	-0.138	-0.088	-0.047	-0.232	-0.314**
	[1.249]	[0.532]	[0.493]	[2.109]	[0.398]	[0.779]	[0.351]	[0.234]	[1.445]	[2.508]
ΔT3y	-0.337	-0.227	-0.296	-0.500*	-0.145	-0.097	-0.125	-0.216	-0.198	-0.408***
	[0.856]	[0.782]	[0.923]	[2.013]	[0.654]	[0.539]	[0.479]	[1.106]	[1.220]	[3.129]
ΔT5y	-0.300	-0.263	-0.329	-0.531*	-0.164	-0.060	-0.147	-0.300	-0.221	-0.460***
	[0.692]	[0.874]	[0.993]	[1.990]	[0.666]	[0.328]	[0.541]	[1.498]	[1.292]	[3.116]
ΔT10y	-0.291	-0.333	-0.384	-0.554*	-0.143	-0.025	-0.174	-0.394*	-0.247	-0.482***
	[0.603]	[1.054]	[1.106]	[1.947]	[0.508]	[0.130]	[0.611]	[1.827]	[1.339]	[2.740]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	1,539	2,230	2,512	2,899	3,466	4,044	4,872	5,323	5,561	6,076
Observations (otherwise)	2,017	2,998	3,382	3,895	4,419	5,098	5,938	6,298	6,529	7,074

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: ΔDEBT/AT									
Panel C. If DEBT/A is above 75th percentile in that year.										
ΔAAA	-0.152	-0.367	-1.066	-0.800	-0.094	0.088	-0.197	-0.437	-0.668	-1.617***
	[0.151]	[0.687]	[1.597]	[1.482]	[0.349]	[0.226]	[0.443]	[1.080]	[1.527]	[3.726]
ΔBAA	-0.463	-0.557	-0.897*	-0.661	-0.078	0.306	-0.163	-0.366	-0.460	-1.022**
	[0.516]	[1.248]	[1.715]	[1.349]	[0.256]	[0.857]	[0.456]	[1.066]	[1.188]	[2.130]
ΔFFR	-0.490	0.310	-0.524	-0.324	-0.024	-0.157	0.127	0.227	-0.344*	-0.191
	[1.206]	[0.942]	[1.432]	[1.382]	[0.111]	[0.823]	[0.585]	[1.185]	[1.963]	[0.823]
ΔT3m	-0.463	0.162	-0.774	-0.176	-0.081	-0.184	0.131	0.377	-0.443*	-0.240
	[0.742]	[0.450]	[1.349]	[0.487]	[0.360]	[0.680]	[0.422]	[1.280]	[1.809]	[0.812]
ΔT6m	-0.067	-0.631	-1.705***	0.245	-0.325	0.081	0.357	0.439	-0.429	-0.069
	[0.069]	[1.390]	[3.120]	[0.389]	[1.112]	[0.184]	[1.051]	[1.116]	[1.241]	[0.200]
ΔT1y	-0.435	-0.064	-0.863	-0.253	-0.182	-0.044	0.052	0.234	-0.461*	-0.435
	[0.726]	[0.171]	[1.623]	[0.711]	[0.874]	[0.183]	[0.165]	[0.913]	[1.701]	[1.490]
ΔT3y	-0.219	-0.227	-0.920*	-0.340	-0.228	0.044	-0.042	-0.004	-0.430	-0.767**
	[0.314]	[0.596]	[1.724]	[0.852]	[1.078]	[0.177]	[0.124]	[0.014]	[1.448]	[2.592]
ΔT5y	-0.098	-0.278	-0.901*	-0.423	-0.221	0.060	-0.099	-0.110	-0.454	-0.971***
	[0.128]	[0.708]	[1.694]	[1.002]	[1.004]	[0.224]	[0.284]	[0.386]	[1.415]	[3.169]
ΔT10y	0.074	-0.408	-0.891	-0.509	-0.156	0.088	-0.187	-0.230	-0.509	-1.136***
	[0.087]	[1.021]	[1.636]	[1.112]	[0.653]	[0.289]	[0.518]	[0.727]	[1.426]	[3.313]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	454	937	1,118	1,459	1,761	2,122	2,666	2,807	2,824	2,707
Observations (otherwise)	632	1,311	1,568	2,009	2,254	2,681	3,253	3,301	3,297	3,049

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: ΔDEBT/AT									
Panel D. If DEBT/A is above 90th percentile in that year.										
ΔAAA	0.233	0.494	-1.541	-1.619**	0.192	0.569	-0.667	-0.798	-0.084	-3.223**
	[0.138]	[0.493]	[1.313]	[2.268]	[0.259]	[0.946]	[1.035]	[1.272]	[0.086]	[2.118]
ΔBAA	-0.625	-0.248	-1.427	-1.429*	0.235	0.506	-0.615	-0.799	-0.047	-2.835**
	[0.341]	[0.242]	[1.466]	[2.013]	[0.346]	[0.842]	[1.010]	[1.563]	[0.056]	[2.226]
ΔFFR	0.829	0.362	-0.453	-0.736*	0.261	0.153	0.353	0.510*	0.214	-0.434
	[0.839]	[0.692]	[1.154]	[1.779]	[0.680]	[0.521]	[1.534]	[1.912]	[0.485]	[0.742]
ΔT3m	1.071	0.240	-0.462	-0.632	0.357	0.223	0.349	0.735*	0.476	-0.424
	[0.958]	[0.424]	[0.738]	[1.054]	[0.907]	[0.581]	[1.175]	[1.769]	[0.679]	[0.614]
ΔT6m	1.122	0.567	-1.508*	-0.693	0.275	0.374	0.203	0.543	0.455	-0.887
	[0.478]	[0.515]	[1.928]	[0.702]	[0.471]	[0.555]	[0.347]	[0.830]	[0.497]	[1.143]
ΔT1y	0.717	0.001	-0.636	-0.744	0.084	0.337	0.087	0.399	0.240	-0.996
	[0.630]	[0.001]	[1.024]	[1.334]	[0.198]	[0.979]	[0.245]	[1.036]	[0.340]	[1.365]
ΔT3y	0.686	-0.018	-0.810	-0.860	-0.031	0.463	-0.225	-0.055	0.142	-1.714*
	[0.552]	[0.027]	[1.129]	[1.571]	[0.062]	[1.233]	[0.495]	[0.134]	[0.201]	[1.784]
ΔT5y	0.660	0.096	-0.908	-0.978*	-0.021	0.487	-0.367	-0.235	0.047	-2.092*
	[0.510]	[0.141]	[1.157]	[1.795]	[0.039]	[1.210]	[0.742]	[0.548]	[0.066]	[1.876]
ΔT10y	0.458	0.120	-1.046	-1.125*	0.119	0.517	-0.627	-0.458	-0.089	-2.346*
	[0.336]	[0.162]	[1.190]	[2.001]	[0.201]	[1.137]	[1.152]	[1.012]	[0.116]	[1.794]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (for T6m)	69	283	400	624	744	824	1,129	1,236	1,075	879
Observations (otherwise)	106	394	567	834	953	1,070	1,419	1,453	1,272	960

Table 6. Determinants of leverage: impact of effective interest rate.

This table presents the results of least-squares dummy variable regressions where the dependent variable is book leverage (DEBT/A). The control variables are the same as in Table 2. See Appendix for variable definitions. Panels A and B show the results for EIR and EIR2, respectively. For brevity, we report only the coefficient estimates and significance for EIR and EIR2. t-statistics based on standard errors robust to clustering by firm and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. Impact of EIR.

	Dependent variable: DEBT/A											
	Full sample			If DEBT/A is above median			If DEBT/A is above 75th percentile			If DEBT/A is above 90th percentile		
	AAA, AA, BBB	AAA, AA	BBB	AAA, AA, BBB	AAA, AA	BBB	AAA, AA, BBB	AAA, AA	BBB	AAA, AA, BBB	AAA, AA	BBB
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
EIR	2.360***	-0.009	-0.565	0.528	-1.867*	-1.086**	-0.398	-3.980*	-1.609**	-0.561	-12.873**	1.292
	[3.184]	[0.011]	[1.301]	[0.796]	[1.868]	[2.235]	[0.433]	[1.816]	[2.183]	[0.251]	[2.687]	[0.604]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,766	1,331	5,422	5,092	646	4,432	2,055	159	1,888	444	46	387
Adjusted R-squared	0.705	0.746	0.704	0.679	0.769	0.688	0.641	0.745	0.643	0.635	0.642	0.681

Panel B. Impact of EIR2.

	Dependent variable: DEBT/A											
	Full sample			If DEBT/A is above median			If DEBT/A is above 75th percentile			If DEBT/A is above 90th percentile		
	All firms	Inv. grade	Non-inv. grade	All firms	Inv. grade	Non-inv. grade	All firms	Inv. grade	Non-inv. grade	All firms	Inv. grade	Non-inv. grade
Independent variable	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
EIR2	0.616***	0.612*	0.568***	0.531***	0.490	0.519***	0.495***	-0.661	0.571***	0.321***	-0.053	0.405***
	[5.098]	[1.846]	[3.174]	[4.561]	[1.182]	[3.050]	[4.413]	[1.073]	[4.010]	[3.359]	[0.036]	[3.607]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,340	6,313	6,978	11,402	4,977	6,372	6,427	1,850	4,516	2,650	401	2,226
Adjusted R-squared	0.749	0.748	0.719	0.729	0.710	0.704	0.663	0.647	0.648	0.571	0.543	0.567

Table 7. Determinants of leverage: impact of forecasted interest rate.

This table presents the results of least-squares dummy variable regressions (344 in total) where the dependent variable is book leverage (DEBT/A) in Panel A and the first difference in book leverage (ΔDEBT/A) in Panel B. The control variables are the same as in Table 2. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. Prefix "F_" means that the variable is created using forecasts from Surveys of Professional Forecasters. Suffixes "_Q0"- "_Q4" indicate the forecasts for a certain quarter: 0 is the current quarter (end of the fiscal year), 1 is the first quarter after the end of the fiscal year etc. Suffixes "_Y0" and "_Y1" indicate the forecasts for a certain year: 0 is the current fiscal year, 1 is the next fiscal year. Suffix "_Y10" shows the expected annual average rate over the next ten years. Prefix "R_" indicates real interest rate. Minus sign (–) indicates the spread between the two variables. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses.

Panel A. Models in levels.

Independent variables	Dependent variable: DEBT/A Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile	Time period
F_AAA_Q0	0.062	-0.079	-0.206*	-0.069	1981-2014
	[0.542]	[0.933]	[1.777]	[0.362]	
F_AAA_Q1	0.04	-0.101	-0.252**	-0.098	1981-2014
	[0.324]	[1.173]	[2.255]	[0.516]	
F_AAA_Q2	0.049	-0.113	-0.292**	-0.118	1981-2014
	[0.378]	[1.227]	[2.712]	[0.646]	
F_AAA_Q3	0.064	-0.108	-0.266**	-0.105	1981-2014
	[0.499]	[1.212]	[2.445]	[0.596]	
F_AAA_Q4	0.064	-0.107	-0.267**	-0.142	1981-2014
	[0.472]	[1.105]	[2.160]	[0.698]	
F_AAA_Y0	0.046	-0.160	-0.375**	0.007	1981-2014
	[0.239]	[1.181]	[2.343]	[0.030]	
F_AAA_Y1	0.027	-0.125	-0.330***	-0.135	1981-2014
	[0.183]	[1.221]	[2.805]	[0.669]	
F_T3m_Q0	-0.002	-0.059	-0.234***	-0.192	1981-2014
	[0.027]	[0.985]	[2.849]	[1.201]	
F_T3m_Q1	0.003	-0.064	-0.258***	-0.171	1981-2014
	[0.039]	[1.017]	[3.355]	[1.072]	
F_T3m_Q2	0.013	-0.067	-0.283***	-0.193	1981-2014
	[0.139]	[0.974]	[3.616]	[1.248]	
F_T3m_Q3	0.035	-0.049	-0.277***	-0.189	1981-2014
	[0.369]	[0.689]	[3.263]	[1.285]	
F_T3m_Q4	0.039	-0.047	-0.333***	-0.222	1981-2014
	[0.360]	[0.591]	[3.515]	[1.458]	

Panel B. Models in first differences.

Independent variables	Dependent variable: ΔDEBT/A Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile
ΔF_AAA_Q0	-0.081	-0.128*	-0.294***	-0.414**
	[1.080]	[1.846]	[3.845]	[2.153]
ΔF_AAA_Q1	-0.109	-0.155**	-0.336***	-0.476**
	[1.667]	[2.630]	[5.278]	[2.625]
ΔF_AAA_Q2	-0.120*	-0.172***	-0.357***	-0.448**
	[1.921]	[3.074]	[5.412]	[2.398]
ΔF_AAA_Q3	-0.108	-0.152**	-0.326***	-0.361*
	[1.512]	[2.287]	[4.258]	[1.840]
ΔF_AAA_Q4	-0.118	-0.158**	-0.358***	-0.423**
	[1.521]	[2.318]	[4.867]	[2.171]
ΔF_AAA_Y0	-0.261***	-0.349***	-0.529***	-0.544
	[3.655]	[2.948]	[4.440]	[1.557]
ΔF_AAA_Y1	-0.128*	-0.164**	-0.362***	-0.467**
	[1.804]	[2.535]	[4.742]	[2.308]
ΔF_T3m_Q0	-0.079	-0.081	-0.202***	-0.065
	[1.128]	[1.194]	[2.922]	[0.474]
ΔF_T3m_Q1	-0.097	-0.100	-0.213***	-0.101
	[1.524]	[1.624]	[3.417]	[0.651]
ΔF_T3m_Q2	-0.100	-0.106*	-0.225***	-0.147
	[1.595]	[1.835]	[3.928]	[0.941]
ΔF_T3m_Q3	-0.083	-0.077	-0.202***	-0.128
	[1.205]	[1.254]	[3.378]	[0.845]
ΔF_T3m_Q4	-0.090	-0.073	-0.205***	-0.092
	[1.243]	[1.015]	[2.881]	[0.528]

F_T3m_Y0	-0.038	-0.135	-0.378***	-0.237	1981-2014	ΔF_T3m_Y0	-0.149*	-0.153	-0.341***	-0.117
	[0.263]	[1.274]	[3.084]	[1.249]			[1.806]	[1.662]	[2.775]	[0.464]
F_T3m_Y1	-0.036	-0.113	-0.371***	-0.216	1981-2014	ΔF_T3m_Y1	-0.120	-0.116*	-0.245***	-0.116
	[0.357]	[1.519]	[3.914]	[1.397]			[1.658]	[1.801]	[3.791]	[0.688]
F_T10y_Q0	-0.066	-0.119	-0.254	0.08	1992-2014	ΔF_T10y_Q0	-0.157**	-0.139*	-0.231***	-0.608***
	[0.529]	[1.084]	[1.412]	[0.254]			[2.584]	[1.726]	[2.886]	[3.164]
F_T10y_Q1	-0.065	-0.097	-0.217	0.106	1992-2014	ΔF_T10y_Q1	-0.161***	-0.150*	-0.244***	-0.583***
	[0.558]	[0.943]	[1.331]	[0.353]			[2.952]	[2.057]	[3.332]	[3.476]
F_T10y_Q2	-0.073	-0.123	-0.236	0.072	1992-2014	ΔF_T10y_Q2	-0.161**	-0.154**	-0.257***	-0.566***
	[0.606]	[1.210]	[1.441]	[0.237]			[2.799]	[2.102]	[3.408]	[3.314]
F_T10y_Q3	-0.040	-0.103	-0.209	0.109	1992-2014	ΔF_T10y_Q3	-0.174***	-0.166**	-0.268***	-0.585***
	[0.316]	[0.957]	[1.176]	[0.340]			[2.970]	[2.168]	[3.568]	[3.145]
F_T10y_Q4	-0.049	-0.140	-0.277	0.043	1992-2014	ΔF_T10y_Q4	-0.198***	-0.195**	-0.308***	-0.683***
	[0.358]	[1.218]	[1.361]	[0.123]			[2.958]	[2.175]	[3.732]	[3.215]
F_T10y_Y0	-0.282*	-0.367**	-0.504*	-0.212	1992-2014	ΔF_T10y_Y0	-0.374***	-0.405***	-0.529***	-1.185***
	[1.856]	[2.429]	[1.929]	[0.518]			[4.715]	[3.626]	[3.835]	[3.757]
F_T10y_Y1	-0.138	-0.184	-0.297	0.026	1992-2014	ΔF_T10y_Y1	-0.193***	-0.190**	-0.292***	-0.617***
	[1.082]	[1.683]	[1.699]	[0.085]			[3.455]	[2.628]	[3.868]	[3.712]
F_T3m_Y10	-0.414	-0.202	-0.17	-0.085	1992-2014	ΔF_T3m_Y10	-0.282	-0.214	-0.456	-0.545
	[1.304]	[0.556]	[0.404]	[0.164]			[1.188]	[0.777]	[1.404]	[0.668]
F_T10y_Y10	-0.181	-0.351	-0.213	-0.186	1992-2014	ΔF_T10y_Y10	-0.240	-0.163	-0.212	0.431
	[0.405]	[0.833]	[0.487]	[0.351]			[1.076]	[0.585]	[0.651]	[0.737]
F_R_T3m_Q0	-0.005	-0.089	-0.293***	-0.295	1981-2014	ΔF_R_T3m_Q0	-0.094	-0.128	-0.152	0.075
	[0.061]	[1.226]	[3.119]	[1.597]			[1.552]	[1.689]	[1.669]	[0.433]
F_R_T3m_Q1	0.025	-0.033	-0.276**	-0.158	1981-2014	ΔF_R_T3m_Q1	-0.100	-0.116	-0.187**	0.039
	[0.243]	[0.399]	[2.727]	[0.787]			[1.524]	[1.566]	[2.178]	[0.179]
F_R_T3m_Q2	0.037	-0.036	-0.354***	-0.258	1981-2014	ΔF_R_T3m_Q2	-0.117	-0.124	-0.245***	-0.115
	[0.314]	[0.384]	[3.127]	[1.254]			[1.651]	[1.593]	[2.793]	[0.520]
F_R_T3m_Q3	0.052	-0.042	-0.351***	-0.253	1981-2014	ΔF_R_T3m_Q3	-0.076	-0.079	-0.181*	-0.102
	[0.431]	[0.478]	[3.153]	[1.426]			[0.966]	[0.945]	[2.000]	[0.463]
F_R_T3m_Q4	0.104	0.004	-0.322***	-0.257	1981-2014	ΔF_R_T3m_Q4	-0.078	-0.087	-0.166	-0.038
	[0.825]	[0.044]	[3.200]	[1.496]			[0.901]	[1.019]	[1.688]	[0.164]
F_R_T3m_Y1	0.057	-0.029	-0.346***	-0.244	1981-2014	ΔF_R_T3m_Y1	-0.100	-0.109	-0.209**	-0.055
	[0.465]	[0.315]	[3.191]	[1.250]			[1.265]	[1.336]	[2.333]	[0.241]
F_AAA-T10y_Q0	0.075	-0.105	0.008	-0.818	1992-2014	ΔF_AAA-T10y_Q0	0.259*	-0.006	0.200	0.246
	[0.250]	[0.356]	[0.020]	[1.187]			[1.751]	[0.031]	[0.827]	[0.423]
F_AAA-T10y_Q1	0.029	-0.157	-0.027	-0.915	1992-2014	ΔF_AAA-T10y_Q1	0.276	-0.027	0.209	0.144
	[0.085]	[0.454]	[0.058]	[1.190]			[1.544]	[0.122]	[0.691]	[0.218]
F_AAA-T10y_Q2	-0.018	-0.240	-0.073	-1.021	1992-2014	ΔF_AAA-T10y_Q2	0.263	-0.042	0.164	0.167
	[0.053]	[0.684]	[0.145]	[1.248]			[1.463]	[0.178]	[0.516]	[0.245]
F_AAA-T10y_Q3	0.018	-0.218	-0.027	-1.165	1992-2014	ΔF_AAA-T10y_Q3	0.309	-0.042	0.272	0.234
	[0.046]	[0.507]	[0.046]	[1.291]			[1.441]	[0.152]	[0.751]	[0.291]

F_AAA-T10y_Q4	0.120	-0.141	-0.077	-1.468	1992-2014	ΔF_AAA-T10y_Q4	0.429*	0.015	0.246	0.295
	[0.264]	[0.293]	[0.119]	[1.562]			[1.898]	[0.049]	[0.550]	[0.291]
F_AAA-T10y_Y0	0.405	0.306	0.144	-1.563	1992-2014	ΔF_AAA-T10y_Y0	0.766***	0.551*	1.019**	1.793
	[0.922]	[0.651]	[0.236]	[1.631]			[3.035]	[1.815]	[2.338]	[1.413]
F_AAA-T10y_Y1	0.279	0.064	0.268	-0.902	1992-2014	ΔF_AAA-T10y_Y1	0.388*	0.052	0.208	0.104
	[0.768]	[0.166]	[0.520]	[0.948]			[1.842]	[0.174]	[0.479]	[0.134]
F_T10y-T3m_Q0	0.059	-0.009	0.102	-0.003	1992-2014	ΔF_T10y-T3m_Q0	0.013	-0.002	-0.076	-0.431**
	[0.604]	[0.083]	[0.846]	[0.011]			[0.155]	[0.019]	[0.543]	[2.096]
F_T10y-T3m_Q1	0.051	-0.003	0.137	-0.024	1992-2014	ΔF_T10y-T3m_Q1	0.023	0.006	-0.077	-0.435*
	[0.447]	[0.029]	[1.088]	[0.087]			[0.250]	[0.046]	[0.464]	[2.024]
F_T10y-T3m_Q2	0.076	0.022	0.201	0.001	1992-2014	ΔF_T10y-T3m_Q2	0.061	0.034	-0.054	-0.373*
	[0.610]	[0.183]	[1.515]	[0.004]			[0.623]	[0.236]	[0.298]	[1.835]
F_T10y-T3m_Q3	0.098	0.047	0.278*	0.085	1992-2014	ΔF_T10y-T3m_Q3	0.085	0.062	-0.033	-0.315
	[0.699]	[0.384]	[2.042]	[0.248]			[0.782]	[0.408]	[0.173]	[1.648]
F_T10y-T3m_Q4	0.098	0.015	0.266*	0.043	1992-2014	ΔF_T10y-T3m_Q4	0.088	0.065	-0.036	-0.435**
	[0.620]	[0.116]	[1.765]	[0.114]			[0.737]	[0.396]	[0.174]	[2.173]
F_T10y-T3m_Y0	0.067	-0.093	0.167	-0.087	1992-2014	ΔF_T10y-T3m_Y0	-0.097	-0.157	-0.172	-0.850**
	[0.438]	[0.472]	[0.715]	[0.234]			[0.705]	[0.785]	[0.726]	[2.421]
F_T10y-T3m_Y1	0.145	0.134	0.411**	0.087	1992-2014	ΔF_T10y-T3m_Y1	0.099	0.100	0.038	-0.319
	[1.039]	[1.103]	[2.742]	[0.237]			[0.887]	[0.669]	[0.207]	[1.525]
Control variables	Yes	Yes	Yes	Yes		Control variables	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes		Year fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes						

Table 8. Determinants of leverage by deciles of firm assets: impact of forecasted interest rate.

This table presents the results of least-squares dummy variable regressions (860 in total) where the dependent variable is book leverage (DEBT/A) in Panel A and the first difference in book leverage (ΔDEBT/A) in Panel B, estimated for each decile of firm assets (A). The control variables are the same as in Table 2. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. Prefix "F_" means that the variable is created using forecasts from Surveys of Professional Forecasters. Suffixes "_Q0"- "_Q4" indicate the forecasts for a certain quarter: 0 is the current quarter (end of the fiscal year), 1 is the first quarter after the end of the fiscal year etc. Suffixes "_Y0" and "_Y1" indicate the forecasts for a certain year: 0 is the current fiscal year, 1 is the next fiscal year. Suffix "_Y10" shows the expected annual average rate over the next ten years. Prefix "R_" indicates real interest rate. Minus sign (–) indicates the spread between the two variables. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses.

Panel A. Models in levels.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DEBT/AT									
F_AAA_Q0	-0.178	0.035	0.025	-0.215	0.396**	0.004	-0.231	0.282	-0.046	-0.166
	[1.012]	[0.169]	[0.106]	[0.903]	[2.582]	[0.024]	[1.234]	[1.495]	[0.189]	[0.967]
F_AAA_Q1	-0.211	0.047	0.045	-0.291	0.360**	-0.008	-0.267	0.295	-0.030	-0.193
	[1.113]	[0.227]	[0.181]	[1.228]	[2.087]	[0.046]	[1.439]	[1.414]	[0.118]	[1.190]
F_AAA_Q2	-0.274	0.096	0.083	-0.231	0.352*	-0.041	-0.338*	0.340	-0.035	-0.221
	[1.462]	[0.456]	[0.323]	[0.962]	[1.963]	[0.238]	[1.771]	[1.561]	[0.142]	[1.388]
F_AAA_Q3	-0.265	0.029	0.076	-0.235	0.374**	-0.087	-0.308	0.384*	-0.010	-0.187
	[1.494]	[0.135]	[0.297]	[0.985]	[2.225]	[0.510]	[1.601]	[1.760]	[0.044]	[1.159]
F_AAA_Q4	-0.228	-0.009	0.065	-0.256	0.374*	-0.078	-0.338	0.391*	0.024	-0.213
	[1.214]	[0.039]	[0.243]	[0.965]	[1.976]	[0.423]	[1.581]	[1.715]	[0.092]	[1.216]
F_AAA_Y0	-0.181	0.223	-0.104	-0.598**	0.452*	0.368	-0.292	0.305	-0.184	-0.460*
	[0.656]	[0.948]	[0.235]	[2.192]	[1.695]	[1.336]	[0.947]	[0.807]	[0.472]	[1.762]
F_AAA_Y1	-0.19	-0.065	0.062	-0.338	0.346*	-0.034	-0.332	0.343	0.010	-0.212
	[0.970]	[0.284]	[0.227]	[1.284]	[1.759]	[0.185]	[1.503]	[1.395]	[0.039]	[1.242]
F_T3m_Q0	-0.29	0.148	0.034	-0.088	0.024	-0.062	-0.289	0.345**	0.075	-0.068
	[1.512]	[0.795]	[0.213]	[0.461]	[0.129]	[0.392]	[1.636]	[2.412]	[0.522]	[0.657]
F_T3m_Q1	-0.309	0.183	0.070	-0.105	0.027	-0.077	-0.305*	0.357**	0.045	-0.085
	[1.606]	[1.012]	[0.417]	[0.539]	[0.148]	[0.503]	[1.799]	[2.491]	[0.303]	[0.836]
F_T3m_Q2	-0.309	0.186	0.050	-0.082	0.012	-0.078	-0.300*	0.375**	0.085	-0.094
	[1.577]	[0.971]	[0.276]	[0.382]	[0.062]	[0.507]	[1.734]	[2.446]	[0.547]	[0.891]
F_T3m_Q3	-0.311	0.186	0.036	-0.006	0.022	-0.07	-0.277	0.402**	0.119	-0.092
	[1.614]	[0.874]	[0.190]	[0.028]	[0.111]	[0.440]	[1.580]	[2.503]	[0.745]	[0.842]
F_T3m_Q4	-0.322	0.183	0.034	-0.009	-0.006	-0.069	-0.276	0.412**	0.201	-0.142
	[1.624]	[0.801]	[0.159]	[0.039]	[0.027]	[0.393]	[1.408]	[2.259]	[1.126]	[1.224]
F_T3m_Y0	-0.260	0.237	0.067	-0.500	0.183	-0.004	-0.314	0.288	-0.171	-0.029

	[0.918]	[0.898]	[0.190]	[1.689]	[0.711]	[0.015]	[1.118]	[1.008]	[0.634]	[0.165]
F_T3m_Y1	-0.275	0.01	0.001	-0.116	-0.012	-0.076	-0.279	0.381**	0.152	-0.176
	[1.383]	[0.049]	[0.003]	[0.541]	[0.058]	[0.467]	[1.524]	[2.323]	[0.911]	[1.397]
F_T10y_Q0	-0.149	0.299	0.053	-0.216	-0.089	-0.331	-0.309	0.003	-0.022	-0.242
	[0.596]	[1.473]	[0.194]	[0.873]	[0.347]	[1.602]	[1.390]	[0.013]	[0.120]	[0.885]
F_T10y_Q1	-0.140	0.271	0.064	-0.187	-0.154	-0.282	-0.326	0.035	-0.028	-0.217
	[0.580]	[1.435]	[0.252]	[0.749]	[0.626]	[1.472]	[1.497]	[0.175]	[0.157]	[0.834]
F_T10y_Q2	-0.134	0.238	0.086	-0.203	-0.161	-0.285	-0.339	0.035	-0.035	-0.230
	[0.528]	[1.239]	[0.322]	[0.777]	[0.604]	[1.491]	[1.452]	[0.168]	[0.199]	[0.889]
F_T10y_Q3	-0.116	0.254	0.119	-0.171	-0.138	-0.259	-0.352	0.042	-0.015	-0.269
	[0.436]	[1.273]	[0.439]	[0.644]	[0.480]	[1.302]	[1.438]	[0.189]	[0.089]	[0.946]
F_T10y_Q4	-0.135	0.293	0.083	-0.221	-0.137	-0.263	-0.33	-0.015	0.017	-0.319
	[0.469]	[1.402]	[0.265]	[0.761]	[0.436]	[1.204]	[1.224]	[0.063]	[0.095]	[0.960]
F_T10y_Y0	0.017	0.227	-0.521	-0.736	-0.379	-0.022	-0.475	-0.478	-0.428	-0.404
	[0.047]	[0.736]	[1.256]	[1.707]	[0.953]	[0.068]	[1.340]	[1.371]	[1.626]	[0.973]
F_T10y_Y1	-0.105	0.081	0.042	-0.279	-0.200	-0.226	-0.325	0.027	0.029	-0.247
	[0.416]	[0.387]	[0.149]	[0.991]	[0.678]	[1.041]	[1.288]	[0.116]	[0.162]	[0.835]
F_T3m_Y10	0.731	-0.44	-0.419	-1.553	0.845	-0.057	-0.483	-0.949	-1.120	0.256
	[0.730]	[0.812]	[0.396]	[1.667]	[1.039]	[0.086]	[0.504]	[1.393]	[1.352]	[0.672]
F_T10y_Y10	1.131	-0.456	-1.906	-1.203	-0.764*	0.394	-0.33	-1.038**	-0.568	-0.318***
	[0.869]	[0.846]	[1.699]	[1.326]	[1.995]	[0.902]	[0.292]	[2.099]	[0.526]	[20.471]
F_R_T3m_Q0	-0.262	0.225	-0.005	-0.142	0.025	-0.079	-0.149	0.361*	0.218	-0.062
	[1.242]	[1.048]	[0.024]	[0.683]	[0.126]	[0.445]	[0.787]	[2.006]	[1.233]	[0.530]
F_R_T3m_Q1	-0.329	0.212	0.087	-0.18	0.044	-0.047	-0.272	0.503**	0.131	-0.129
	[1.423]	[1.041]	[0.400]	[0.726]	[0.204]	[0.250]	[1.433]	[2.602]	[0.713]	[0.985]
F_R_T3m_Q2	-0.336	0.334	0.03	-0.114	-0.034	-0.049	-0.248	0.529**	0.201	-0.084
	[1.335]	[1.393]	[0.116]	[0.403]	[0.144]	[0.236]	[1.188]	[2.445]	[0.990]	[0.587]
F_R_T3m_Q3	-0.303	0.254	-0.051	-0.090	-0.065	-0.101	-0.218	0.501**	0.251	-0.104
	[1.296]	[1.022]	[0.197]	[0.315]	[0.265]	[0.496]	[1.081]	[2.355]	[1.213]	[0.759]
F_R_T3m_Q4	-0.282	0.289	0.095	0.060	0.017	-0.177	-0.189	0.553**	0.303	-0.156
	[1.198]	[1.106]	[0.373]	[0.217]	[0.075]	[0.871]	[0.962]	[2.519]	[1.531]	[1.147]
F_R_T3m_Y1	-0.339	0.290	0.046	-0.090	-0.007	-0.098	-0.249	0.555**	0.232	-0.125
	[1.335]	[1.171]	[0.177]	[0.314]	[0.030]	[0.471]	[1.205]	[2.545]	[1.130]	[0.888]
F_AAA-T10y_Q0	0.313	-0.283	0.034	-0.097	0.541	0.879	0.352	-0.685	-0.257	0.075
	[0.553]	[0.562]	[0.055]	[0.221]	[0.931]	[1.586]	[0.566]	[1.272]	[0.669]	[0.189]
F_AAA-T10y_Q1	0.438	-0.447	-0.011	-0.079	0.562	1.082	0.459	-0.701	-0.370	0.058
	[0.658]	[0.758]	[0.015]	[0.153]	[0.762]	[1.701]	[0.597]	[1.139]	[0.888]	[0.121]
F_AAA-T10y_Q2	0.346	-0.532	-0.09	-0.205	0.556	1.123*	0.343	-0.783	-0.407	0.047
	[0.509]	[0.858]	[0.123]	[0.414]	[0.788]	[1.764]	[0.442]	[1.220]	[0.928]	[0.094]
F_AAA-T10y_Q3	0.299	-0.478	-0.111	-0.120	0.579	1.357*	0.503	-0.614	-0.353	0.004
	[0.408]	[0.727]	[0.135]	[0.204]	[0.690]	[1.902]	[0.547]	[0.798]	[0.739]	[0.006]
F_AAA-T10y_Q4	0.421	-0.320	0.158	-0.034	0.921	1.274	0.296	-0.876	-0.391	0.083

	[0.486]	[0.412]	[0.178]	[0.048]	[0.909]	[1.495]	[0.301]	[0.966]	[0.688]	[0.123]
F_AAA-T10y_Y0	1.026	-0.890	0.632	0.590	1.599	1.489	0.406	-0.342	0.042	-0.130
	[0.907]	[0.871]	[0.549]	[0.607]	[1.617]	[1.596]	[0.405]	[0.393]	[0.074]	[0.205]
F_AAA-T10y_Y1	0.684	-0.064	0.224	-0.032	0.974	0.986	0.172	-1.017	-0.606	0.166
	[0.845]	[0.102]	[0.297]	[0.054]	[1.197]	[1.444]	[0.188]	[1.381]	[1.101]	[0.275]
F_T10y-T3m_Q0	0.177	-0.087	0.160	-0.042	0.249	-0.002	0.082	-0.363*	-0.058	-0.114
	[0.655]	[0.422]	[0.874]	[0.167]	[1.424]	[0.009]	[0.385]	[1.846]	[0.378]	[0.680]
F_T10y-T3m_Q1	0.238	-0.118	0.177	-0.055	0.23	-0.015	0.113	-0.410*	-0.025	-0.141
	[0.767]	[0.489]	[0.880]	[0.192]	[1.139]	[0.055]	[0.482]	[1.809]	[0.156]	[0.770]
F_T10y-T3m_Q2	0.321	-0.117	0.274	-0.009	0.252	0.002	0.147	-0.39	-0.049	-0.116
	[0.929]	[0.408]	[1.206]	[0.028]	[1.094]	[0.008]	[0.568]	[1.554]	[0.278]	[0.570]
F_T10y-T3m_Q3	0.314	-0.175	0.337	-0.008	0.343	-0.009	0.200	-0.381	-0.093	-0.082
	[0.828]	[0.536]	[1.356]	[0.022]	[1.353]	[0.027]	[0.726]	[1.392]	[0.479]	[0.372]
F_T10y-T3m_Q4	0.327	-0.202	0.402	-0.032	0.433	0.017	0.238	-0.439	-0.164	-0.068
	[0.797]	[0.551]	[1.448]	[0.074]	[1.567]	[0.045]	[0.826]	[1.449]	[0.742]	[0.277]
F_T10y-T3m_Y0	0.113	-0.001	0.013	0.176	-0.262	0.058	0.156	-0.238	0.250	-0.340
	[0.213]	[0.003]	[0.031]	[0.384]	[0.715]	[0.138]	[0.354]	[0.564]	[0.793]	[1.141]
F_T10y-T3m_Y1	0.211	0.003	0.351	0.050	0.356	-0.018	0.212	-0.412	-0.103	0.038
	[0.558]	[0.010]	[1.298]	[0.133]	[1.331]	[0.054]	[0.725]	[1.514]	[0.518]	[0.178]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. Models in first differences.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: ΔDEBT/AT									
ΔF_AAA_Q0	0.036	-0.319*	-0.142	-0.163	0.177	-0.054	0.076	0.057	-0.224	-0.115
	[0.266]	[1.729]	[0.994]	[1.134]	[0.844]	[0.534]	[0.579]	[0.562]	[1.375]	[0.820]
ΔF_AAA_Q1	0.007	-0.375**	-0.156	-0.240*	0.178	-0.057	0.044	0.029	-0.255*	-0.131
	[0.051]	[2.048]	[1.211]	[1.885]	[0.838]	[0.533]	[0.327]	[0.255]	[1.742]	[0.945]
ΔF_AAA_Q2	0.026	-0.396**	-0.140	-0.240*	0.169	-0.078	0.009	0.024	-0.270*	-0.151
	[0.175]	[2.070]	[1.139]	[1.913]	[0.781]	[0.770]	[0.069]	[0.210]	[1.904]	[1.082]
ΔF_AAA_Q3	0.011	-0.399**	-0.104	-0.186	0.172	-0.087	0.019	0.042	-0.236	-0.170
	[0.076]	[2.056]	[0.783]	[1.357]	[0.809]	[0.797]	[0.139]	[0.377]	[1.489]	[1.169]
ΔF_AAA_Q4	0.065	-0.468**	-0.128	-0.223	0.152	-0.064	0.038	0.054	-0.230	-0.171
	[0.414]	[2.334]	[0.821]	[1.497]	[0.633]	[0.485]	[0.258]	[0.421]	[1.384]	[1.112]
ΔF_AAA_Y0	-0.153	-0.346	-0.471***	-0.528***	-0.017	0.029	0.098	-0.204	-0.464**	-0.433**
	[0.907]	[1.499]	[3.574]	[4.845]	[0.068]	[0.158]	[0.488]	[0.981]	[2.360]	[2.465]
ΔF_AAA_Y1	0.037	-0.446**	-0.176	-0.247*	0.141	-0.037	0.022	0.036	-0.265*	-0.178

	[0.227]	[2.154]	[1.220]	[1.738]	[0.610]	[0.293]	[0.143]	[0.282]	[1.721]	[1.184]
ΔF_T3m_Q0	-0.041	-0.309*	-0.098	-0.203*	0.126	-0.079	-0.001	0.053	-0.127	-0.049
	[0.425]	[1.749]	[0.780]	[1.733]	[0.708]	[0.718]	[0.010]	[0.509]	[0.949]	[0.417]
ΔF_T3m_Q1	-0.045	-0.303*	-0.087	-0.235**	0.142	-0.100	-0.045	0.034	-0.196	-0.062
	[0.459]	[1.739]	[0.782]	[2.206]	[0.813]	[1.048]	[0.361]	[0.315]	[1.646]	[0.555]
ΔF_T3m_Q2	-0.045	-0.330*	-0.114	-0.224**	0.157	-0.093	-0.044	0.026	-0.183	-0.083
	[0.422]	[1.840]	[0.969]	[2.232]	[0.913]	[0.934]	[0.349]	[0.234]	[1.479]	[0.784]
ΔF_T3m_Q3	-0.056	-0.310	-0.125	-0.160	0.177	-0.052	-0.016	0.027	-0.141	-0.098
	[0.503]	[1.640]	[0.905]	[1.478]	[1.060]	[0.468]	[0.128]	[0.231]	[0.991]	[0.928]
ΔF_T3m_Q4	-0.055	-0.304	-0.143	-0.149	0.152	0.003	-0.029	0.020	-0.134	-0.155
	[0.434]	[1.412]	[1.020]	[1.268]	[0.845]	[0.024]	[0.209]	[0.153]	[0.920]	[1.413]
ΔF_T3m_Y0	-0.157	-0.265	-0.242	-0.361**	0.000	-0.002	0.026	-0.007	-0.307	-0.107
	[1.036]	[0.988]	[1.343]	[2.512]	[0.001]	[0.012]	[0.116]	[0.040]	[1.445]	[0.872]
ΔF_T3m_Y1	-0.055	-0.351*	-0.142	-0.220*	0.124	-0.105	-0.048	0.005	-0.145	-0.155
	[0.444]	[1.864]	[1.014]	[1.934]	[0.662]	[0.923]	[0.359]	[0.040]	[1.088]	[1.405]
ΔF_T10y_Q0	0.317	-0.297	-0.243*	-0.243**	0.017	-0.204**	-0.181	0.013	-0.294***	-0.234
	[1.552]	[1.092]	[1.792]	[2.124]	[0.080]	[2.134]	[1.108]	[0.081]	[2.920]	[1.357]
ΔF_T10y_Q1	0.289	-0.334	-0.246*	-0.231**	0.012	-0.194**	-0.194	0.001	-0.292***	-0.214
	[1.524]	[1.304]	[2.054]	[2.219]	[0.058]	[2.252]	[1.295]	[0.004]	[3.116]	[1.324]
ΔF_T10y_Q2	0.305	-0.355	-0.230*	-0.214*	0.013	-0.189**	-0.212	0.012	-0.296***	-0.211
	[1.634]	[1.327]	[1.850]	[1.913]	[0.062]	[2.128]	[1.419]	[0.073]	[3.006]	[1.277]
ΔF_T10y_Q3	0.331	-0.393	-0.233*	-0.212*	0.011	-0.188*	-0.23	-0.006	-0.308***	-0.246
	[1.661]	[1.380]	[1.763]	[1.814]	[0.049]	[1.996]	[1.448]	[0.031]	[2.940]	[1.382]
ΔF_T10y_Q4	0.350	-0.417	-0.282*	-0.239*	-0.023	-0.165	-0.248	-0.018	-0.339**	-0.302
	[1.525]	[1.324]	[1.993]	[1.875]	[0.088]	[1.553]	[1.353]	[0.099]	[2.702]	[1.425]
ΔF_T10y_Y0	0.417	-0.471	-0.623***	-0.472***	-0.252	-0.189	-0.254	-0.371	-0.684***	-0.586**
	[1.152]	[1.174]	[3.469]	[3.005]	[0.774]	[1.547]	[0.721]	[1.097]	[3.275]	[2.139]
ΔF_T10y_Y1	0.317	-0.469	-0.250*	-0.242**	-0.012	-0.231**	-0.234	-0.009	-0.300**	-0.254
	[1.554]	[1.701]	[1.896]	[2.225]	[0.053]	[2.184]	[1.467]	[0.051]	[2.743]	[1.434]
ΔF_T3m_Y10	-0.076	-0.680	0.060	-0.417	-0.28	0.452	-0.086	-0.479	-0.750	-0.020
	[0.129]	[1.220]	[0.092]	[0.556]	[0.549]	[0.967]	[0.172]	[1.199]	[0.979]	[0.063]
ΔF_T10y_Y10	0.145	-0.384	-0.313	0.141	-0.513	0.307	-0.227	-0.981***	0.162	-0.346
	[0.232]	[0.609]	[0.427]	[0.238]	[1.672]	[0.701]	[0.505]	[3.022]	[0.271]	[1.084]
ΔF_R_T3m_Q0	-0.051	-0.284*	-0.086	-0.288**	0.054	-0.137	0.035	0.001	0.024	-0.08
	[0.386]	[1.705]	[0.764]	[2.366]	[0.250]	[1.078]	[0.234]	[0.007]	[0.177]	[0.651]
ΔF_R_T3m_Q1	-0.044	-0.291	-0.172	-0.348**	0.158	-0.124	0.004	0.049	-0.052	-0.073
	[0.355]	[1.413]	[1.402]	[2.552]	[0.711]	[1.021]	[0.022]	[0.322]	[0.374]	[0.571]
ΔF_R_T3m_Q2	-0.008	-0.379	-0.269*	-0.304**	0.172	-0.087	-0.031	0.059	-0.128	-0.081
	[0.053]	[1.599]	[1.897]	[2.302]	[0.774]	[0.634]	[0.181]	[0.384]	[0.844]	[0.631]
ΔF_R_T3m_Q3	0.013	-0.300	-0.253	-0.219	0.246	-0.021	0.041	0.070	-0.058	-0.148
	[0.082]	[1.355]	[1.536]	[1.617]	[1.218]	[0.142]	[0.244]	[0.431]	[0.379]	[1.161]
ΔF_R_T3m_Q4	-0.011	-0.245	-0.163	-0.159	0.227	-0.075	0.012	0.03	-0.042	-0.203

	[0.072]	[1.030]	[1.048]	[1.280]	[1.193]	[0.486]	[0.083]	[0.190]	[0.265]	[1.666]
ΔF_R_T3m_Y1	-0.015	-0.327	-0.229	-0.279**	0.215	-0.083	0.007	0.055	-0.074	-0.135
	[0.096]	[1.373]	[1.506]	[2.089]	[0.961]	[0.569]	[0.043]	[0.342]	[0.468]	[1.037]
ΔF_AAA-T10y_Q0	-0.649	0.589	0.106	0.339	0.169	0.730**	0.225	-0.062	0.266	0.385
	[1.588]	[1.331]	[0.221]	[1.083]	[0.589]	[2.177]	[0.576]	[0.134]	[0.899]	[1.530]
ΔF_AAA-T10y_Q1	-0.685	0.610	0.042	0.356	0.191	0.742*	0.362	-0.131	0.263	0.406
	[1.447]	[1.228]	[0.074]	[0.964]	[0.546]	[1.866]	[0.783]	[0.238]	[0.768]	[1.397]
ΔF_AAA-T10y_Q2	-0.707	0.519	0.077	0.379	0.177	0.680*	0.290	-0.089	0.232	0.420
	[1.398]	[1.001]	[0.142]	[1.058]	[0.476]	[1.851]	[0.628]	[0.161]	[0.618]	[1.365]
ΔF_AAA-T10y_Q3	-0.893	0.571	0.010	0.475	0.071	0.848*	0.432	0.009	0.288	0.527
	[1.644]	[0.912]	[0.016]	[1.139]	[0.167]	[1.967]	[0.759]	[0.014]	[0.672]	[1.426]
ΔF_AAA-T10y_Q4	-0.946	0.881	0.193	0.490	0.201	1.059*	0.317	-0.015	0.431	0.894**
	[1.421]	[1.236]	[0.263]	[1.026]	[0.379]	[2.073]	[0.497]	[0.020]	[0.896]	[2.089]
ΔF_AAA-T10y_Y0	-0.905	1.081	0.769	1.080*	0.751	1.187***	0.611	0.28	1.323**	0.830*
	[1.009]	[1.292]	[0.930]	[1.965]	[1.336]	[2.918]	[0.814]	[0.326]	[2.288]	[2.071]
ΔF_AAA-T10y_Y1	-0.536	0.818	0.261	0.507	0.214	0.936*	0.152	-0.121	0.199	0.619
	[0.807]	[1.408]	[0.468]	[1.313]	[0.447]	[1.968]	[0.292]	[0.185]	[0.470]	[1.699]
ΔF_T10y-T3m_Q0	0.194	0.021	0.072	-0.121	0.019	0.031	0.043	-0.038	-0.004	-0.021
	[0.969]	[0.082]	[0.505]	[0.862]	[0.158]	[0.170]	[0.324]	[0.235]	[0.028]	[0.114]
ΔF_T10y-T3m_Q1	0.233	0.023	0.140	-0.129	-0.010	0.014	0.090	-0.060	0.039	-0.026
	[1.003]	[0.076]	[0.954]	[0.815]	[0.072]	[0.068]	[0.627]	[0.316]	[0.230]	[0.122]
ΔF_T10y-T3m_Q2	0.298	0.099	0.208	-0.095	-0.019	0.033	0.109	0.006	0.062	0.016
	[1.113]	[0.308]	[1.318]	[0.529]	[0.124]	[0.138]	[0.711]	[0.030]	[0.325]	[0.069]
ΔF_T10y-T3m_Q3	0.286	0.121	0.27	-0.075	-0.050	0.051	0.136	0.056	0.097	0.043
	[0.985]	[0.329]	[1.588]	[0.389]	[0.305]	[0.186]	[0.806]	[0.235]	[0.456]	[0.172]
ΔF_T10y-T3m_Q4	0.267	0.063	0.257	-0.059	-0.066	0.093	0.143	0.101	0.050	0.068
	[0.910]	[0.155]	[1.310]	[0.265]	[0.329]	[0.318]	[0.763]	[0.384]	[0.214]	[0.257]
ΔF_T10y-T3m_Y0	0.328	-0.137	-0.208	-0.188	-0.099	-0.104	0.006	-0.152	0.059	-0.312
	[0.878]	[0.301]	[0.913]	[0.659]	[0.411]	[0.416]	[0.027]	[0.657]	[0.224]	[1.125]
ΔF_T10y-T3m_Y1	0.313	0.040	0.262	-0.031	-0.005	0.136	0.120	0.076	0.094	0.091
	[1.094]	[0.113]	[1.472]	[0.147]	[0.030]	[0.494]	[0.688]	[0.311]	[0.456]	[0.388]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9. Determinants of firms' leverage across different phases of business cycle.

This table presents the results of least-squares dummy variable regressions (72 in total) where the dependent variable is book leverage (DEBT/A). The control variables are the same as in Table 2. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. t-statistics based on standard errors robust to clustering by firm and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable: DEBT/A							
	Recession (OECD trough method)				Non-recession (OECD trough method)			
Independent variables	Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile	Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile
AAA	-0.841**	-0.428**	-0.013	0.148	-0.170	-0.277	-0.586*	-0.457
	[2.205]	[2.272]	[0.042]	[0.311]	[0.373]	[1.237]	[1.774]	[1.052]
BAA	-0.682*	-0.357*	-0.007	0.288	0.046	-0.020	-0.419	-0.519
	[1.976]	[1.747]	[0.023]	[0.615]	[0.118]	[0.101]	[1.138]	[1.192]
FFR	-0.388*	-0.194**	0.085	-0.006	-0.137	-0.025	-0.109	0.182
	[1.870]	[2.770]	[0.591]	[0.027]	[0.392]	[0.124]	[0.532]	[0.531]
T3m	-0.498*	-0.252**	0.057	-0.003	-0.127	-0.045	-0.191	0.201
	[1.850]	[2.777]	[0.316]	[0.013]	[0.365]	[0.232]	[1.018]	[0.601]
T6m	-0.708**	-0.003	-0.003	-0.54	0.174	0.170	-0.112	0.493*
	[2.460]	[0.011]	[0.010]	[0.997]	[0.604]	[1.279]	[0.548]	[1.869]
T1y	-0.576*	-0.260**	0.073	0.03	-0.121	-0.069	-0.217	0.037
	[2.082]	[2.343]	[0.374]	[0.113]	[0.389]	[0.422]	[1.371]	[0.137]
T3y	-0.716**	-0.321**	0.039	0.068	-0.117	-0.095	-0.282	-0.069
	[2.349]	[2.245]	[0.171]	[0.212]	[0.386]	[0.587]	[1.463]	[0.252]
T5y	-0.739**	-0.354**	0.002	0.073	-0.150	-0.149	-0.338	-0.135
	[2.293]	[2.347]	[0.010]	[0.205]	[0.465]	[0.887]	[1.527]	[0.453]
T10y	-0.723**	-0.385**	-0.059	0.061	-0.205	-0.241	-0.412	-0.222
	[2.100]	[2.445]	[0.215]	[0.155]	[0.570]	[1.288]	[1.530]	[0.657]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 10. The determinants of leverage: impact of the probability of a decline in real GDP (The Anxious Index, ANX1).

This table presents the results of least-squares dummy variable regressions (107 in total) where the dependent variable is book leverage (DEBT/A). For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. t-statistics based on standard errors robust to clustering by firm and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable: DEBT/A											
	ANX1 ≤ 0.1				ANX1 ≥ 0.25				ANX1 ≥ 0.5			
Independent variables	Full sample	DEBT/A is above median.	DEBT/A is above 75^{th} percentile	DEBT/A is above 90^{th} percentile	Full sample	DEBT/A is above median.	DEBT/A is above 75^{th} percentile	DEBT/A is above 90^{th} percentile	Full sample	DEBT/A is above median.	DEBT/A is above 75^{th} percentile	DEBT/A is above 90^{th} percentile
AAA	0.135	0.139	-0.564*	-0.661	-0.988*	-0.533**	0.000	0.099	-3.733**	-1.113	0.999	3.598
	[0.319]	[0.390]	[1.795]	[0.875]	[2.030]	[2.490]	[0.001]	[0.200]	[3.036]	[0.908]	[0.646]	[1.330]
BAA	0.435	0.395	-0.525	-0.686	-0.790*	-0.429	-0.017	0.094	-2.684**	-0.708	0.751	2.338
	[0.811]	[1.200]	[1.517]	[0.918]	[1.923]	[1.698]	[0.050]	[0.180]	[2.924]	[0.791]	[0.628]	[1.220]
FFR	0.488	0.569	-0.07	0.026	-0.493**	-0.262**	0.002	0.106	-2.336***	-1.671*	-0.293	2.981
	[0.970]	[1.140]	[0.182]	[0.041]	[2.233]	[2.866]	[0.018]	[0.565]	[3.856]	[2.296]	[0.291]	[1.811]
T3m	0.790	0.826*	-0.034	-0.09	-0.586**	-0.314**	-0.013	0.087	-3.348**	-2.334*	-0.332	5.695*
	[1.577]	[1.780]	[0.085]	[0.127]	[2.164]	[2.746]	[0.083]	[0.380]	[3.185]	[2.022]	[0.219]	[2.101]
T6m	0.415	0.741*	0.061	0.609	-1.597***	-0.010	-0.669	-2.018*	18.867*	-5.591	-3.149	
	[0.820]	[1.827]	[0.140]	[0.769]	[3.394]	[0.015]	[1.035]	[2.040]	[2.453]	[0.344]	[0.220]	
T1y	0.588	0.574	-0.144	-0.283	-0.638**	-0.303**	0.014	0.112	-3.649**	-2.299	0.004	6.678*
	[1.397]	[1.695]	[0.479]	[0.496]	[2.244]	[2.351]	[0.077]	[0.448]	[2.732]	[1.734]	[0.002]	[2.156]
T3y	0.515	0.488*	-0.237	-0.397	-0.794**	-0.367**	0.019	0.100	-4.212**	-1.819	0.718	5.831
	[1.203]	[1.747]	[0.867]	[0.708]	[2.251]	[2.304]	[0.088]	[0.312]	[2.816]	[1.293]	[0.416]	[1.733]
T5y	0.396	0.38	-0.324	-0.477	-0.860*	-0.417**	0.022	0.092	-4.268**	-1.62	0.787	5.013
	[0.940]	[1.485]	[1.219]	[0.827]	[2.113]	[2.424]	[0.094]	[0.255]	[3.006]	[1.184]	[0.464]	[1.571]
T10y	0.157	0.179	-0.425	-0.621	-0.941*	-0.491**	0.018	0.058	-4.232**	-1.273	1.046	4.427
	[0.442]	[0.741]	[1.603]	[1.000]	[1.964]	[2.586]	[0.066]	[0.136]	[3.017]	[0.939]	[0.612]	[1.428]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11. The determinants of net debt issues and net equity issues.

This table presents the results of least-squares dummy variable regressions (72 in totals) where the dependent variable is either net debt issues scaled by book value of assets (DI/A) or net equity issues scaled by book value of assets (EI/A). The control variables are the same as in Table 2 plus lagged leverage. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable: DI/A				Dependent variable: EI/A			
Independent variables	Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile	Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile
AAA	-0.030	-0.299*	-0.323	-0.640	0.083	0.204**	0.104	0.326
	[0.228]	[1.709]	[1.104]	[1.130]	[0.843]	[2.056]	[0.757]	[1.538]
BAA	0.013	-0.218	-0.226	-0.549	-0.043	0.112	-0.005	0.108
	[0.119]	[1.395]	[0.840]	[1.017]	[0.390]	[1.333]	[0.037]	[0.520]
FFR	-0.015	-0.055	-0.072	0.041	0.158**	0.108**	0.117**	0.118
	[0.299]	[0.840]	[0.552]	[0.154]	[2.058]	[2.565]	[2.257]	[1.259]
T3m	0.011	-0.051	-0.072	0.142	0.228**	0.141**	0.140**	0.153
	[0.190]	[0.612]	[0.471]	[0.493]	[2.431]	[2.636]	[2.186]	[1.288]
T6m	0.092	0.022	-0.185	0.251	0.350***	0.138*	0.152	0.072
	[1.088]	[0.163]	[0.879]	[0.571]	[2.950]	[1.716]	[1.408]	[0.437]
T1y	0.039	-0.030	-0.026	0.120	0.233**	0.148**	0.126*	0.159
	[0.601]	[0.337]	[0.173]	[0.422]	[2.696]	[2.607]	[1.728]	[1.292]
T3y	0.048	-0.073	-0.052	-0.001	0.252**	0.173**	0.132	0.230
	[0.623]	[0.673]	[0.298]	[0.004]	[2.677]	[2.444]	[1.433]	[1.651]
T5y	0.040	-0.116	-0.086	-0.101	0.241**	0.182**	0.130	0.268*
	[0.452]	[0.935]	[0.430]	[0.270]	[2.495]	[2.329]	[1.255]	[1.785]
T10y	0.028	-0.162	-0.096	-0.217	0.202**	0.186**	0.115	0.289*
	[0.270]	[1.149]	[0.420]	[0.510]	[2.157]	[2.108]	[0.937]	[1.708]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 12. The determinants of net debt issues and net equity issues by deciles of firm assets.

This table presents the results of least-squares dummy variable regressions (180 in totals) where the dependent variable is either net debt issues scaled by book value of assets (DI/A) or net equity issues scaled by book value of assets (EI/A), estimated for each decile of firm assets (A). The control variables are the same as in Table 2 plus lagged leverage. For brevity, we report only the coefficient estimates and significance for interest rate measures. In the regression models, we include one interest rate measure at a time; thus, each column in the table shows the results of several regressions rather than the results of a single regression. See Appendix for variable definitions. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. Determinants of net debt issues by deciles of firm assets.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: DI/A									
AAA	-0.191	0.188	0.436	0.355	0.191	0.399	-0.707**	-0.160	-0.370	-0.582**
	[0.629]	[0.738]	[1.328]	[0.866]	[0.546]	[1.544]	[2.382]	[0.579]	[1.658]	[2.063]
BAA	-0.037	-0.006	0.25	0.305	0.099	0.333	-0.442	-0.195	-0.362*	-0.326
	[0.180]	[0.027]	[0.928]	[0.921]	[0.338]	[1.432]	[1.679]	[0.775]	[1.912]	[1.554]
FFR	-0.097	0.137	0.312*	0.206	0.027	0.076	-0.134	0.211*	-0.020	-0.076
	[0.628]	[1.076]	[1.954]	[1.283]	[0.211]	[0.461]	[0.754]	[1.913]	[0.160]	[0.659]
T3m	-0.168	0.187	0.436**	0.295	0.110	0.174	-0.143	0.281*	-0.072	-0.109
	[0.970]	[1.231]	[2.484]	[1.500]	[0.684]	[0.955]	[0.639]	[1.905]	[0.457]	[0.732]
T6m	-0.098	0.198	0.442	0.22	0.023	0.188	0.294	0.500**	0.185	-0.133
	[0.505]	[0.892]	[1.679]	[0.789]	[0.099]	[0.798]	[1.266]	[2.342]	[0.973]	[0.665]
T1y	-0.206	0.198	0.453**	0.296	0.133	0.201	-0.113	0.298*	-0.057	-0.117
	[1.223]	[1.213]	[2.450]	[1.411]	[0.764]	[1.138]	[0.522]	[1.913]	[0.375]	[0.770]
T3y	-0.258	0.269	0.482**	0.341	0.173	0.260	-0.216	0.220	-0.090	-0.217
	[1.327]	[1.474]	[2.280]	[1.282]	[0.766]	[1.423]	[0.915]	[1.166]	[0.545]	[1.184]
T5y	-0.273	0.296	0.497**	0.329	0.198	0.292	-0.325	0.139	-0.144	-0.324
	[1.240]	[1.522]	[2.149]	[1.077]	[0.758]	[1.510]	[1.307]	[0.651]	[0.822]	[1.550]
T10y	-0.276	0.307	0.539**	0.281	0.231	0.346	-0.453*	0.03	-0.259	-0.443*
	[1.077]	[1.455]	[2.065]	[0.785]	[0.762]	[1.630]	[1.732]	[0.126]	[1.332]	[1.772]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. Determinants of net equity issues by deciles of firm assets.

	Decile of A:									
	1	2	3	4	5	6	7	8	9	10
Independent variables	Dependent variable: EI/AT									
AAA	0.393	-0.037	-1.091***	0.391	0.246	0.020	0.672**	0.035	0.322*	0.146
	[1.109]	[0.130]	[3.654]	[1.114]	[0.837]	[0.080]	[2.411]	[0.198]	[1.806]	[0.873]
BAA	0.033	-0.429	-1.087***	0.122	0.066	-0.002	0.482**	-0.080	0.208	0.011
	[0.088]	[1.642]	[4.179]	[0.380]	[0.241]	[0.010]	[2.027]	[0.552]	[1.258]	[0.070]
FFR	0.371**	0.157	-0.155	0.400**	0.326**	0.243**	0.245*	0.105	0.242**	0.113
	[2.183]	[0.958]	[1.066]	[2.346]	[2.177]	[2.219]	[1.831]	[1.164]	[2.398]	[1.129]
T3m	0.517**	0.315*	-0.127	0.523**	0.376*	0.317**	0.382**	0.137	0.336***	0.145
	[2.261]	[1.744]	[0.714]	[2.448]	[1.885]	[2.275]	[2.669]	[1.143]	[2.820]	[1.108]
T6m	0.745**	0.377	-0.186	0.837**	0.556*	0.396*	0.357**	0.325*	0.520***	0.225
	[2.173]	[1.339]	[0.625]	[2.505]	[2.023]	[1.738]	[2.049]	[1.694]	[4.585]	[1.468]
T1y	0.613**	0.253	-0.240	0.541**	0.350*	0.283*	0.406***	0.177	0.364***	0.168
	[2.593]	[1.444]	[1.315]	[2.386]	[1.785]	[2.003]	[2.895]	[1.403]	[3.161]	[1.418]
T3y	0.709**	0.285	-0.381*	0.591**	0.358	0.270	0.497***	0.201	0.390***	0.202
	[2.451]	[1.460]	[1.756]	[2.188]	[1.567]	[1.599]	[2.872]	[1.323]	[3.073]	[1.598]
T5y	0.719**	0.279	-0.498**	0.608**	0.347	0.243	0.543***	0.177	0.377***	0.219
	[2.231]	[1.351]	[2.114]	[2.088]	[1.404]	[1.313]	[2.735]	[1.107]	[2.802]	[1.623]
T10y	0.666*	0.231	-0.690**	0.601*	0.268	0.166	0.609**	0.137	0.349**	0.208
	[1.898]	[1.057]	[2.693]	[1.897]	[1.012]	[0.800]	[2.600]	[0.813]	[2.414]	[1.395]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 13. Determinants of leverage: impact of principal components.

This table presents the results of least-squares dummy variable regressions where the dependent variable is book leverage (DEBT/A). The control variables are the same as in Table 2. For brevity, we report only the coefficient estimates and significance for PC1 and PC2. See Appendix for variable definitions. t-statistics based on standard errors robust to clustering by firm-decade and year are reported in parentheses. ** and * indicate significance at 5% and 10% levels, respectively.

	Dependent variable: DEBT/A			
Independent variables	Full sample	DEBT/A is above median.	DEBT/A is above 75th percentile	DEBT/A is above 90th percentile
PC1	-0.002	-0.003**	-0.003*	0.000
	[1.054]	[2.589]	[1.977]	[0.034]
PC2	0.002	-0.002	-0.002	0.001
	[0.901]	[0.867]	[0.559]	[0.270]
Control variables	Yes	Yes	Yes	Yes
Firm-decade fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	101,102	49,213	23,675	8,919
Adjusted R-squared	0.792	0.716	0.664	0.580