DISSECTING THE LEVERAGE EFFECT ON STOCK RETURNS

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Abstract

The relation between leverage and stock returns is a fundamental issue in finance; yet this empirical relation is little understood due to conflicting evidence in the literature. This study contributes to the literature in two ways. First, we provide the first empirical evidence that this relation is masked by maturity: stocks with higher short-maturity debt earn significantly higher returns, but stocks with higher long-maturity debt earn lower returns. The opposite directions separated by maturity help explain why the relation between leverage and returns has been mixed. We further show that the positive short-maturity return spread is significant, persistent, and not explained by well-known risk factors (such as size or book to market). Second, we also provide the first theoretical model to explain the relation between maturity-related leverage and stock returns by endogenizing debt maturity; Firms optimally choose the maturity of their debt by trading off the cost of long term maturity with its financial risk on equity. Firms with lower credit quality find it more expensive to borrow long term, so they optimally have debt with shorter maturity. In equilibrium, firms with higher short-term debt or lower long-term debt are riskier firms and earn higher expected returns. We show that the empirical evidence we uncover can be consistent with theoretical predictions.

Keywords : *Leverage, debt maturity, stock returns, financial risk, investment, industry risk*

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1 Introduction

The theoretical relation between corporate leverage and stock returns is one of the most fundamental issues in finance, and, understandably, well taught in finance courses at all levels. It provides the basis for understanding important issues such as cost of equity and corporate bond pricing. By stark contrast, few people know the empirical relation between leverage and stock returns. The empirical findings are conflicting and at best inconclusive. Half a century after Modigliani and Miller (1958), financial economists are still searching for answers for the following first-order questions: what exactly is the empirical relation between leverage and stock returns, and why?

This paper provides the first comprehensive empirical study on the relation between leverage and stock returns. In particular, we examine whether stock returns are related to different leverage ratio measures including total leverage, short-term debt leverage, long-term debt leverage, short-term debt issuance, and long-term debt issuance. We find that higher stock returns are related to significantly higher short-term debt leverage, but to lower long-term debt leverage and significantly lower long-term debt issuance. In other words, the relation between stock returns and leverage goes in opposite directions depending on debt maturity. As a result, there is no relation between stock returns and total leverage.

The positive (negative) relation between stock returns and short-term leverage (long-term debt issuance) is significant. An annual sorting of ten portfolios based on short-term leverage (long-term debt issuance) generates a monthly spread of 0.78% (-0.49%). These spreads are large compared to the well-known value spread of around 0.5% per month and the size spread of around 0.2% per month. They are also robust to the well-known risk factors. For example, the return spread of short-term debt leverage remains significant at 0.70% after controlling for CAPM, 0.63% after controlling for the Fama-French three-factor model, and 0.48% after controlling for the four-factor Carhart model.

Why are stock returns related to leverage ratios? To understand this issue, we first conduct a double sorting of leverage measures and size. Interestingly, we find that the significant positive relation between stock returns and short-term leverage only exists among large firms. In contrast, the significant negative relation between stock returns and long-term debt issuance only exists among small and medium sized firms, but not among large firms. Therefore, even after controlling for size, stock returns are related to leverage (conditional on maturity) among a big chunk of firms.

Since having high leverage can make firms financially more constrained, we next explore whether financial constraints can explain the stock return-leverage relations. Following the current literature (e.g., Kaplan and Zingalas (1997) and Lamont et al. (2001)), we adopt various financial constraint measures; we find no clear relation between these measures and either short-term debt leverage or long-term debt issuance. Therefore, it seems that financial constraints might not explain the stock return-leverage relations.

Are there theories in the current literature that can explain the conditional relation between stock returns and leverage? We find that firms with higher short-term debt invest less, and firms with higher long-term debt issuance invest more. Investment-based models (e.g., Chen, Novy-Marx, and Zhang (2010)) predict that firms that invest a lot should have lower expected returns. Indeed, the Chen, Novy-Marx, and Zhang three-factor model can completely explain the conditional relation between stock returns and leverage across maturity. Therefore, the investment-based interpretation works. The limitation of this interpretation is that we still do not understand why certain firms invest more than others; nor do we know why investment decisions are related to debt maturity.

We thus proceed to develop a theoretical model to explain the relation between maturity-related leverage and stock returns by endogenizing debt maturity and investment. We show that the empirical evidence we uncover can be consistent with theoretical predictions. Our model is close to Gomes and Schmid's (2010) levered-return model. They conclude that the presence of growth options is crucial to understand the relation between leverage and stock returns.

The major difference between our model and theirs is that they do not consider debt maturity. To our best knowledge, this is the first model that studies the relation between stock returns and leverage by endogeonizing debt maturity decisions. We show that the theoretical leverage-return relation is indeed conditional on the debt maturity choice of firms. Firms optimally choose the maturity of their debt by trading off the cost of long term maturity with its financial risk on equity.[1] Firms with lower credit quality find it more expensive to borrow long term, so they optimally have debt with shorter maturity. In equilibrium, firms with higher short-term debt or lower long-term debt are riskier firms and earn higher expected returns.

Besides being consistent with the empirical evidence on the stock return-leverage relations, this interpretation is further supported by the evidence that higher business risk stocks (See Barclay and Smith (1995) and Guedes and Opler (1996)) – those belonging to the industries with higher volatility of changes in earnings – tend to have higher short-term debt or lower long-term debt.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. Section

[1]Short term debt is usually cheaper. See Landier and Thesmar, (2009) and Greenwood, Hanson, and Stein (2009).

3 explains the main empirical methodology and the primary relation between stock returns and maturity-related leverage measures. Section 4 studies various average firm fundamentals to understand the source of significant leverage-related anomalies and discusses the economic intuition behind our empirical results. Section 5 concludes the paper.

2 Literature Review

The empirical literature on the relation between leverage and stock returns is extensive, but inconclusive. A large number of studies try different definitions of expected returns to see if there is any empirical relation between leverage and equity risk. For example, Arditti (1967) finds a negative but statistically insignificant association between leverage and equity returns, which are taken as the geometric mean of returns. Hall et al (1967) uses another definition. Returns are taken to be profits after tax and the ratio of book value of equity to assets are used to measure leverage. He finds leverage has a negative relation with returns. Hamada (1972) defines returns as profits after taxes and interest which is the earnings the shareholders receive on their investments. He uses industry as a proxy for business risk. Bhandari (1988) gets inflation adjusted stock returns for all firms including financials. He uses the cross section of all firms without assuming different risk classes. He shows returns increase with leverage.

Different definitions for leverage are also implemented to understand the leverage-stock returns relation in the literature. Baker (1973) calculates financial leverage by taking the ratio of equity to total assets for the leading firms in an industry over one year. He shows that at the industry level, leverage raises industry profitability and higher leverage implies greater risks. Korteweg (2004) finds a negative association between stock returns and leverage based on pure capital structure changes such as exchange offers. Dimitrov and Jain (2005) report a negative relation between leverage and stock returns by studying changes in leverage and show that they are negatively related to current and future returns. They calculate returns as risk adjusted raw returns. They differentiate between borrowing for operations or for growth to examine the effect of leverage due to economic performance and not due to growth, mergers and acquisitions and other reasons. George et al (2006) find a negative relation between returns and leverage. They use book leverage in their tests. They argue that firms, which get affected more adversely in financial distress, have lower leverage. Penman et al (2007) investigate the book-to-price effect in expected stock returns and its relation to leverage. They divide the book to price value into an enterprise and a leverage component. These stand for the operational risk and financial risk. They show that the leverage component is negatively related to expected stock returns.

There is very little research that offers theoretical explanations to above empirical findings and proposes future empirical studies on the relation between leverage and equity risk. After the seminal work of Modigliani and Miller (1958), the most substantial theory on this subject is built by Gomes and Schmid (2010). In the former of these two studies, leverage is taken to be exogenous and the financial risk of leverage on firm's equity is noted under the assumption that there is no arbitrage in the market. In the latter study, it is recognized that leverage is endogenous and there can be a negative relation between expected stock returns and leverage since firms that have higher leverage also invest more. Through investment, these firms may exhaust their growth options, turning them into assets in place and making their total assets less risky. Hence, firms with higher leverage can have lower cost of equity.

Despite the extensive empirical literature on the relation between leverage and stock returns, there is no study examining the effect of short term or long term debt on returns. This is quite important since short term debt and long term debt are fundamentally different and they are used for different purposes, which have implications on cost of equity.

Investment is known to be related to cost of equity (e.g., Chen, Novy-Marx, and Zhang (2010)). Firms that invest more have lower cost of equity, on average. Loan maturities vary with the types of assets that are being financed. As Hart and Moore(1998) observe, assets tend to be matched with liabilities. Long term debt is often used to finance fixed assets (property, machinery, land etc.), while short term debt tends to be used for working capital purposes (mitigating seasonal imbalances, payroll, inventories etc.). In this sense, firms that invest more usually do it with longer maturity of debt.

Maturity of debt is also important for the cost of debt and hence capital structure decision of the firm. Bankruptcy is directly related to current debt situation, in other words, to short term debt. This is relevant since interest rates on debt are lower if bankruptcy costs are higher (Leland, 1994). Long term debt is affected by the existence or lack of collateral assets but short term debt is not (Pindalo, Rodriguez and de la Torre, 2006). Short term debt is also useful to banks in terms of collecting their loans back quickly in the case of bad performance of borrowers. For the entrepreneur, short term debt is better because it is cheaper. Thus, both entrepreneur and bank prefers short-term debt (Landier and Thesmar, 2009).

3 Empirical Results

3.1 Data

We use the merged CRSP and COMPUSTAT datasets covering 1974-2009. The CRSP data provides monthly returns and market cap for each firm; and the COMPUSTAT data provides firm fundamental information at annual frequency. The starting year of 1974 is adopted to ensure that we have a reasonable number of firms with data on short term leverage. We exclude financial firms since their leverage ratios are high by nature. Thus, firms that fall in the four-digit SIC industries coded between 6000 and 6999 are excluded. To mitigate the backfilling bias, a firm must be listed in Compustat for two years to enter our sample. (Fama and French (1993)).

We use multiple leverage measures. Short-term leverage is calculated as the total current liabilities (compustat item lct) over book value of total assets (compustat item at); long term leverage is the ratio of total long term liabilities to the book value of total assets. Long term liabilities are calculated by subtracting total current liabilities from total liabilities (compustat item lt). Total leverage is the sum of long term and short term leverage. Debt maturity is the ratio of long term liabilities to total liabilities. Our measure of net long term debt issuance is calculated as the difference between long term debt issuance (compustat item dltis) and long term debt reduction (compustat item dltr) scaled by contemporaneous book value of total assets (compustat item at). Short term debt issuance is the annual change in debt in current liabilities (compustat item dlc) scaled by contemporaneous book value of assets.

We use book leverage instead of market leverage since we want to focus on leverage decisions rather than the market valuation impact. The latter has been widely studied and documented (e.g., Fama and French (1992) and Berk (1995)). Using book values encompasses the total of all liabilities and ownership claims (Schwartz, 1959). The use of book values in defining the capital structure ensures that the effects of past financing are best represented (Rajan and Zingales, 1995). Graham and Harvey (2001) report that managers focus on book values when setting financial structures. Additionally, Barclay et al. (2006) show how book leverage is preferable since using market values in the denominator might spuriously correlate with exogenous variables.

3.2 Portfolio Method

We use a portfolio-based approach to examine the empirical relation between different measures of leverage and stock returns. We construct stock portfolios based on the leverage measures discussed earlier.

Following Fama and French (1992), we match the accounting data for the fiscal year end in calendar year t-1 with the monthly returns for July of year t to June of year t+1 for each stock. This way, we leave a minimum of six-month time interval between fiscal year ends and the returns.

Stocks are sorted into ten equally populated portfolios based on each leverage measure. Portfolios are held for twelve months till next sorting occurs. In this sense, portfolios are re-balanced annually. In the entirety of the following analysis, the tenth portfolio based on each leverage measure contains one tenth of the stocks with the highest level of the sorting measure.

3.3 Average Excess Returns

Summary Statistics

Table 1 reports the summary statistics of value-weighted portfolio excess returns, in which case excess return is defined as stock return over the risk free rate. There is a significantly positive relation between short-term debt leverage and excess returns: the return spread is 0.75% with a t-statistic of 3.56. There is also a significantly negative relation between long-term debt issuance and excess returns: the return spread is -0.34% with a t-statistic of -2.36.

Therefore, the relation between leverage and stock returns seems to depend on debt maturity. The relation is positive for short-term debt, but negative for long-term debt issuance.

What is the unconditional relation between total leverage and returns then? This relation is positive with a return spread of 0.57% and a t-statistic of 2.11. However, we also find that the return spread is only an insignificantly 0.05% if we use equal-weighted returns. The relation between excess returns and total leverage thus seems unstable.[2]

Next, we evaluate the investment implications of these findings. We check the profitability of straightforward investment styles that use short term leverage and long term debt issuance information. Figure 1 shows monthly profits from holding highest short term leverage portfolio and shorting lowest short term leverage portfolio. Monthly profits from holding lowest long term debt issuance portfolio and shorting highest long term debt issuance portfolio are also depicted. Average spreads, or monthly profits of these strategies, up to twenty-four months ahead of portfolio sorting have been graphed. We see that investing on either short term leverage or long term debt issuance information is highly profitable.

For instance, the monthly short term leverage return premium stays above 0.3% for almost 18 months after portfolio sorting. We also see that short term leverage effect is more persistent than

[2]In contrast, the relation between excess returns and short-term debt leverage and the relation between excess returns and long-term debt issuance are significant for both value- and equal-weighted portfolios.

long term debt issuance effect on returns.

In figure 2, we plot the cumulative profits up to two years ahead of portfolio construction obtained by holding the same portfolios. We see that stock portfolio strategy based on short term leverage or long term debt issuance information is quite profitable in the economic sense with 6.35% and 4.00% annual cumulative excess returns for short term leverage and long term debt issuance investing up to one year. We note that profitability of these trading strategies are quite persistent. The uniform decline of monthly profits also suggests that either short term leverage or long term debt issuance effect is not coincidental with the specific sample we use.

The opposite impact of short-term and long-term debt on total leverage can be seen in Table 2. In Panel A, firms with higher short-term debt have significantly lower long-term debt or long-term debt issuance; even though they also have higher total debt, this trend is weaker because of the conflicting impact of short-term and long-term debt. Similarly, firms with higher long-term debt issuance tend to have a bit lower short-term debt, but higher long-term debt.

In summary, the relation between leverage and stock returns can go in opposite directions depending on maturity. This conditional relation is largely masked when one uses a total leverage measure that includes both short-term and long-term debts. As a result, the relation between total leverage and stock returns seems unstable, a result that is consistent with the current literature.

Our finding is thus important in the following sense: we not only provide new evidence on the conditional relation between leverage and returns, but also provide a new empirical interpretation on why the relation between total leverage and returns is confusing in the current literature.

Factor Regressions

So far, we have identified two significant return patterns related to leverage. Naturally, we then ask whether common risk factors can explain these patterns. In particular, we regress portfolio excess returns on the CAPM market factor, the Fama-French three-factor model, and the Carhart four-factor model respectively, and see whether there is still a pattern of alphas left. The results are reported in Table 3.

In Panel A for the short-term debt portfolios, the alpha spread is 0.66% (t-statistic 3.13) after controlling for CAPM, is 0.63% (t-statistic 2.94) after controlling for the Fama-French three-factor model, and is 0.56% (t-statistic 2.55) after controlling for the Carhart four-factor model.

In Panel B for the long-term debt issuance portfolios, the alpha spread is -0.46% (t-statistic -3.26) after controlling for CAPM, is -0.35% (t-statistic -2.50) after controlling for the Fama-French three-factor model, and is -0.23% (t-statistic -1.63) after controlling for the Carhart four-factor model.

Therefore, the two leverage-return relations remain significant after controlling for the common risk factor models. While our primary goal is to conduct a comprehensive study on the leverage-return relation, we have identified new profitable "anomalies" that are robust even after controlling for some well-known risk factors.

Are the results driven by small firms?

To answer this question, we conduct a two–way independent sorting of either short-term debt leverage or long-term debt issuance with size. We use three size categories, defined as small, medium, and large using the 30th and 70th NYSE breakpoints.

The results are reported in Table 4. In Panel A, the return spread based on short-term debt leverage is only significant for large firms: the spread is 0.83% with a t-statistic of 3.45%. It is insignificant for the other two size categories.

In Panel B, the return spread based on long-term debt issuance is significant among small firms: the spread is -0.73% with a t-statistic of -6.65; the return spread is also significant for medium-sized firms with a spread of -0.32% and a t-statistic of -2.82; the spread is still negative for large firms at -0.19%, but insignificant at the 5% level (t-statistic -0.96).

We conclude that the conditional leverage-return relations are not primarily driven by small firms. In fact, the positive relation between short-term debt leverage and returns only exists for large firms.

Are the results driven by financial constraints?

Firms that are heavily levered might be financially constrained in the sense that they might find it difficult to borrow additional money. What are the roles of financial constraints in the empirical relations we have uncovered?

We have four measures of financial constraints. The first is the Kaplan and Zingales (1997) index; the second is the net cash outflows; the third is interest coverage ratio; and finally, the fourth is dividend pay-out ratio. We describe more detailed definitions in Appendix E2. Higher levels of KZ index, higher net cash outflow, lower interest coverage ratio, or lower dividend pay-out ratio means a higher level of financial constraint.

The results are reported in Table 5. In Panel A, using KZ index, net cash outflow, or dividend pay-out ratio, higher short-term debt leverage firms seem to be less financially constrained; and there is no relation using the interest coverage ratio. Therefore, financial constraints do not seem to explain why higher short-term debt firms have higher returns. In Panel B, firms with lower long-term debt issuance do not seem to be more financially constrained.

We conclude that financial constraints do not seem to be the primary reason for the conditional relations between leverage and returns.

4 Theoretical Interpretations

We have identified two leverage-related anomalies that are conditional on debt maturity. Jointly, they help explain why the current literature has found conflicting evidence on the relation between total leverage and returns. These anomalies are robust after controlling for common risk factors, and do not seem to be primarily driven by firm size or financial constraint considerations.

Given the evidence, can we find theoretical interpretations for why the leverage-return relation is conditional on debt maturity? We explore this issue in this section.

4.1 Investment-based Interpretation

Investment-based models predict that firms, which invest more, tend to have lower expected returns since a lower cost of equity is an important driver of investment. Does investment explain our empirical findings?

To investigate this issue, we first examine whether the return patterns across the leverage portfolios are related to investment or profitability, the major factors in Chen, Novy-Marx, and Zhang's (2010, hereafter CNZ) investment-based three-factor model. The results are reported in Table 6.

In Panel A, firms with higher short-term debt have significantly lower capital expenditure; they also have higher profitability (ROA, return on capital), though this relation is hump-shaped rather than being monotonic. We then regress the excess returns of the portfolios on the CNZ three-factor model. The alpha spread is 0.12% (t-statistic 0.59) with the regression.

In Panel B, firms with higher long-term debt issuance have significantly higher capital expenditure; there is no relation between long-term debt issuance and profitability. We then regress the excess returns of the portfolios on the CNZ three-factor model. The alpha spread is -0.03% (t-statistic -0.24) with the regression.

Therefore, the CNZ model can completely explain the conditional leverage-return relations.

The reason is that firms with higher short-term debt invest less, suggesting that they face higher expected returns (i.e., higher cost of equity). Similarly, firms with higher long-term debt issuance invest more, suggesting that they face lower expected returns (i.e., lower cost of equity).

Two points are noteworthy here. First, even though the CNZ model can explain the conditional leverage-return relations, it does not diminish the contribution of this paper. Our primary goal is to provide a comprehensive study to understand what the leverage-return relations are and why they are so. These are important and yet unsettled questions in the current literature.

Second, the CNZ model is a partial equilibrium model. It is insightful to conjecture that firms facing higher expected returns are likely to invest less. But, the model does not explain why certain firms face higher expected returns. More importantly, it does not explain why firms with different debt maturity should have different cost of equity.

4.2 A Model Based on Industry Risk

In the following, we develop a model that is motivated by the empirical evidence on business risk. Business risk is defined as industry-level earnings variability measured as the standard deviation of annual changes in earnings before interest and taxes over book value of assets for each 3-digit standard Industrial Classification(SIC) industry. High business/industry risk implies low credit quality.[3]

Table 7 reports the summary statistics on business risk for firms sorted by their leverage measures. Firms with higher short-term leverage and lower long-term debt issuance have significantly higher business risk. Therefore, one potential interpretation is that firms with high leverage and lower credit quality (due to higher business risk) face higher long-term debt costs. So, they optimally choose to have more short-term debt. The higher returns on these firms are thus reflections of their higher business risk. Similarly, firms with lower business risk face lower long-term cost of debt. They thus optimally choose to have more long-term debt. The lower returns of these firms are reflections of their lower business risk.

We develop a formal model below that bears the above intuition. In particular, we build a real options valuation model that is based on continuous time over infinite horizon, where investment in current assets, fixed investment and maturity of debt are endogenously determined. To our best knowledge, the relation between equity risk and different maturities of leverage has not been studied either in theoretical or in empirical literature. Incorporating different maturity options of debt to

[3] See Barclay and Smith (1995), Guedes and Opler (1996).

explain equity risk, linking investment and borrowing choices both to systematic and idiosyncratic demand shocks are some of the important contributions of our model.

4.3 Model

Economy

There is a multitude of firms that are maximizing value in a perfectly competitive market. Corporate tax rate is assumed to be zero. Operating profits at time t is given with the following expression for each firm in industry i as follows:

$$CF_{ti} = Y_{ti}(K - A) \tag{1}$$

K is the total assets that are financed with debt. In this sense, higher K implies higher leverage. Initial value of firm's assets before debt financing are normalized to zero. In the following sections, we will see how leverage imposes financial risk. Leverage is exogenous in the model. So, we do not dispute the risk increasing effect of leverage. Instead, we propose there is another endogenous variable related to leverage that also has risk implications, which is debt maturity. Firm keeps some of the assets as cash, which is denoted as A. The rest of the assets are used in production and hence they are fixed assets such as plant and equipment. In this sense, K-A captures investment in the model. Y is the total demand shock in the economy and has two components.

$$Y_{ti} = X_t + Z_{ti}$$

Assumption 1. *X is the systematic component of the total demand shock and follows geometric Brownian motion.*

$$\frac{dX_t}{X_t} = \mu dt + \sigma dM_t \tag{2}$$

where M is standard Brownian motion under risk neutral measure. Existence of M is assumed in the economy.

Z is idiosyncratic industry-wide random demand shock as defined below;

$$Z_{ti} \sim N(0, \sigma_i^2) \quad ; \quad Z_{ti} \perp X_t \tag{3}$$

Z has a normal distribution with mean zero and industry specific variance σ_i^2. It is independent of X by definition and identically and independently distributed over t. We model idiosyncratic risk with industry risk instead of firm specific risk. Firms that are in the same industry compete in the same product market. Strategic interactions between them are important in their operating decisions. Their actions are similar in product and technology innovations. They behave closely in the face of changes in supply and demand conditions and regulatory environment. Moreover, their growth opportunities, investment and financing decisions are highly correlated. Since, X is a stochastic process with a drift, high level of X_t suggests high levels of future aggregate demand.

Cross sectional heterogeneity of investment behavior originates from the differences of industry risk in the economy. K is financed by an amortized bond portfolio with market value of $B(X_t, Z_{ti})$. The portfolio consists of a set of bonds with different maturities. There is no final period debt payment. Depending on the average maturity, m of the portfolio, there is an amount of debt that is being rolled over continuously. If the average maturity is low, a bigger proportion of total debt will be rolled over continuously. Debt pays coupon, c at each point in time, t. Coupon is made of a fixed payment and roll-over cost. Roll-over cost is the amount that is being transfered from borrowers to lenders by rolling over debt. Higher the amount being rolled over, higher the roll-over cost. If leverage is high than total coupon payment is also high.[4]

At time of debt issuance, there is a one time issuance cost, q. In the case of bank borrowing, issuance cost can be thought as a type of screening cost. For market borrowing, it is simply cost of debt. Issuance cost is increasing with leverage; firms that borrow more, pay more to do so. Also, this cost is increasing with debt maturity. We assume that long term borrowing is costlier. Lenders spend more resources to screen borrowers before they get into longer debt contracts. Overall, firms that want to borrow long term, need to pay a premium. Collateral value of firm's assets is also relevant for issuance cost. If collateral value is higher, then firm's debt is safer which implies that issuance cost is lower. Cash is liquid and fixed assets are not. In other words, we assume that investment in fixed assets, capital expenditures which are denoted as $K - A$ is partially irreversible. Higher cash ratio increases the liquidity of total assets, which in turn increases their collateral value. So, issuance cost decreases in cash holdings level, A.

Industry risk is captured by the volatility of industry specific demand shock, σ_i. We take industry risk as a measure of business risk, which lenders take into account to determine the issuance cost. Firms that operate in riskier industries need to pay more to be able to borrow long term. This implies that issuance cost is even higher for long term borrowing when industry risk is high.[5]

[4] $c = g(m)f(K) \qquad g_m < 0, \quad f_K > 0$

[5] $q = Q(m, K, \sigma_i, A), \quad Q_m > 0, \quad Q_K > 0, \quad (Q_m)_{\sigma_i} > 0, \qquad Q_A < 0$

Valuation

Given the above setup and assumptions, the market value of equity at time t can be written with the following Bellman equation for a given level of A and m;

$$V(y) = y(K - A) - c + \frac{E[V(Y + dY; .)]}{1 + rdt} \tag{4}$$

The expected value of next period equity value is discounted by an instantaneous risk free rate since standard Brownian motion, M is taken to be under risk neutral measure. Similarly, value of bond portfolio can be defined as follows;

$$B(y) = c + \frac{E[B(Y + dY; .)]}{1 + rdt} \tag{5}$$

boundary conditions are obtained at the default threshold. If X falls under a threshold X_D, then firm chooses to default. The default option mitigates the downside risk for the equity holders. Value matching and smooth pasting conditions give the following set of equations for equity and bond value at the default threshold.

$$\begin{aligned} V(X_D, Z_{ti}, c) &= 0 \\ V'(X_D, Z_{ti}, c) &= 0 \\ B(X_D, Z_{ti}, c) &= 0 \end{aligned} \tag{6}$$

the final equality comes from the assumption of zero recovery value of the bond at the default threshold. This assumption is made for simplicity and positive recovery value can be incorporated into the model in a straightforward way.

Using Ito's rule and boundary conditions, we derive closed formed solutions for the market value of bond and equity of the firm;

Theorem 1. *Under the given assumptions, the value of the bond portfolio is given as;*

$$B = \frac{c}{r} \times (1 - (\frac{X_D}{X})^{-\nu}) \tag{7}$$

the theorem shows that value of the bond portfolio is increasing in the coupon payment, decreasing in discount rate, r and decreasing in the default threshold. This implies that value of the bond is lower if the default threshold is higher. Since default threshold is a lower bound, higher value indicates higher probability of default. All these implications are certainly sensible and valid in standard fixed income asset pricing framework.

Similarly, we get closed form expressions for time t equity value for the firm.[6]

Theorem 2. *Under the relevant assumptions, the value of the equity for the firm is given as follows;*

$$V = -\frac{c}{r} + \frac{x(K-A)}{r-\mu} + A_0 x^v \quad ; \quad \nu < 0 \tag{8}$$

A_0 is positive. We see that equity values are increasing with the systematic shock and decreasing with coupon payment. Also, the effect of risk free rate is negative and the effect of the drift μ of the systematic shock is positive for the equity value.[7]

Risk and Return

We use the relative sensitivities of the equity value and systematic demand shock to find the equity beta for the stock of the firm [8];

Theorem 3. *Using equity value and systematic demand shock, real equity beta for the firm is given as follows;*

$$Beta = \frac{c}{Vr} + 1 + \frac{(v-1)A_0 x^v}{V} \tag{9}$$

The first term in equity beta captures the financial risk associated with debt. Betas are increasing with the level of coupon payment. This shows that financial risk is increasing with leverage but decreasing with maturity.[9] The second term is basically the asset risk that is normalized to one.

The last term in the equity beta is effect of default option. Since default option cuts downside risk, it lowers beta. Simply, default option makes the cash flows less correlated with the systematic demand shock by bounding the down side movement of equity value. It is also a function of leverage and maturity. The effects of leverage and maturity for default option risk mitigation and financial risk are at the opposite direction. Default option reduces some of the financial risk originating from coupon payment. Also, it makes maturity less effective in terms of decreasing beta. However, financial risk channel is stronger and high leverage and low maturity implies higher equity betas.

A straightforward one factor pricing model is obtained.[10]

Theorem 4. *Equity betas in the model have one-to-one correspondence with the factor betas of the following one factor conditional asset pricing model.*

$$E_t[R_{tj} + 1] = r + \beta_{tj}\sigma\lambda \tag{10}$$

[6] Details for the derivation are in Appendix

[7] The constants A_0 and ν are given in the Appendix

[8] $\beta = \frac{d \ln V}{d \ln X}$

[9] see definition of c

[10] see Appendix for details.

λ is a positive constant and σ is the volatility of the systematic demand shock. By this theorem, we notice that higher equity betas imply higher expected returns.

Corporate Decisions

So far, we did all the valuation and risk analysis for a given level of debt maturity, m and cash level A. Other variables are exogenous, such as assets financed by debt, K or industry risk σ_i. Firm maximizes the sum of its equity and debt value minus the issuance cost at the time of borrowing and investing by choosing the average maturity of debt and level of cash. Firm also chooses level of capital expenditure or investment in fixed assets by choosing level of cash. Following is the firm's optimization problem;

$$max \quad V + B - Q \qquad w.r.t \quad (A, m)$$

We would like to note that we have a static model. Our model has cross sectional and time series implications. One aspect of the the model is that it takes leverage as exogenous and shows how it creates financial risk for equity holders. This feature is quite standard in literature. The major contribution of the model is that it identifies and explains the effect of debt maturity on expected equity returns by taking into account that debt maturity is an endogenous choice. Making leverage endogenous will make the model more sophisticated but at the same time more complicated without obvious benefits for the economic intuition that explains our results.

4.4 Optimal Capital Structure

Under general model setup and assumptions for coupon payment c and issuance cost q, we get interior closed formed solutions for optimal maturity and cash holdings.[11] We mentioned previously that the cross sectional differences in asset values and corporate choice come from industry specific demand shock volatility since systematic demand shock is same for all firms in a given point in time.

There are two trade-offs for the firm in optimizing its total value. Firm trades off the higher issuance cost and lower roll-over cost of high maturity. When maturity is high, the amount of debt being rolled over is low which makes the firm incur less roll-over cost. Also, firm trades off higher liquidity and lower productivity of cash holdings. Higher liquidity increases the collateral value of firms assets, making issuance cost lower. Cash can not be used in production so higher amount of

[11]details are in the Appendix

cash decreases the size of productive assets. Higher cash ratio also makes cash flows to equity less correlated with the systematic shock, X, since systematic shock affects cash flows through fixed assets.

We see that optimal maturity is decreasing with industry risk[12]. Firms that operate in risky environments, have low credit quality and this makes issuance cost of long term maturity higher. This will induce firms to decrease their optimal level of average debt maturity, m. If current level of systematic demand shock X is higher, this will imply lower possibility of default and decreases the financial risk of low maturity. In this case, firms will decrease their average debt maturities, benefiting from cheap issuance of short term debt.[13]

We have the following intuition for the optimal choice of cash holdings, A. If industry risk is high, then issuance cost is high so firms will increase the collateral value of their assets to mitigate higher cost of issuance. They do this by increasing liquidity, hence by increasing cash holdings. If systematic demand shock is high, then productive or fixed assets are more valuable, so firms will decrease their cash holdings, using more of the assets financed with debt as fixed assets, K-A. Also, if discount rate r is high, then present value of cash flows is lower, making production less attractive. This will induce firms to increase optimal level of collateral value by increasing their cash holdings level.[14]

4.5 Effect of Corporate Decisions on Stock Returns

Optimal choice of debt maturity and cash holdings will affect equity betas through financial risk and default option channel. We see that higher maturity decreases beta since it imposes less financial risk and higher cash holdings decreases beta since it makes equity value less correlated with the systematic demand shock, X.

The exogenous variables in the model that create the cross sectional differences in equity betas are leverage, which is captured with assets financed with debt, K and industry risk σ_i. Firms with higher industry risk are shown to have lower maturity and higher cash holdings. This will create two opposing effects on the equity beta since lower maturity will increase beta and higher cash holdings will decrease beta. Higher industry risk alone doesn't necessarily create higher beta.

When we condition on leverage, the effect of maturity and cash holding on beta differs in magnitude. If leverage is high, then effect of maturity on beta is very strong. The intuition is that

[12]see Appendix C

[13] $\frac{d\tilde{m}}{d\sigma_i} < 0 \qquad \frac{d\tilde{m}}{dx} < 0$

[14] $\frac{d\tilde{A}}{d\sigma_i} > 0 \qquad \frac{d\tilde{A}}{dx} < 0 \qquad \frac{d\tilde{A}}{dr} > 0$

maturity will effect equity risk through leverage and if leverage is high, maturity becomes more relevant.

$$\frac{dBeta}{d\tilde{m}} < 0 \qquad |\frac{dBeta}{d\tilde{m}}|_K > 0$$

Also, if leverage is high, financial risk component of beta has more weight so risk decreasing effect coming from the default option is weaker. Consequently, the effect of cash holdings on beta is weaker.

$$\frac{dBeta}{d\tilde{A}} < 0 \qquad |\frac{dBeta}{d\tilde{A}}|_K < 0$$

4.6 Summary

The model predicts that higher short term leverage is associated with higher industry risk, higher cash holdings, lower investment, lower long term leverage, lower net long term debt issuance and higher expected stock returns (higher equity betas). Higher long term leverage and higher net long term debt issuance are associated with lower industry risk, lower cash holdings, higher investment, lower short term leverage and lower expected stock returns. Also, effect of long term leverage on expected stock returns is weaker since maturity and leverage affect equity risk in opposite direction. We conclude that our model is very successful in explaining our empirical findings mentioned in previous sections.

There are further empirical predictions developed by the model. The relation between equity risk and either short term leverage or long term debt issuance is derived by two exogenous variables, which are leverage and industry risk. We expect firms with high leverage and high industry risk to have higher expected returns than firms with low leverage and low industry risk.

4.7 Industry Risk and Leverage

To understand the relation between leverage, industry risk and equity betas further, we give specific functions for coupon payment and issuance cost. So far, we made certain assumptions for them and showed that results follow for general coupon and issuance cost functional forms. We use simple functions with the expense of losing quantitative implications and get the benefit of seeing the qualitative patterns in the cross section of returns clearly.[15] Figure 4 contains four plots. Plot 1 shows change in beta as K, asset financed by debt (leverage), changes for a fixed, medium level of industry risk. Plot 2 shows how beta changes as K increases with increasing industry risk, σ_i (both leverage and industry risk increases). Plot 3 shows how beta changes as industry risk changes when K is fixed and low. Plot 4 shows how beta changes as industry risk changes when K is fixed and high. Range for K is from 0.5 to 1.5. Range for industry risk is from 0.05 to 0.15. We interpret the plots as follows; the equity beta is quite insensitive to leverage if we don't condition on industry risk. As we increase both leverage and industry risk, equity beta increases dramatically. Leverage is also relevant. When leverage is low, equity beta does not increase with industry risk. When leverage is high, we get the strong monotonic positive relation between industry risk and equity beta. We conclude that risk implications of debt on equity is conditional on both leverage and industry risk as shown by the model.

5 Conclusion

The main reason why empirical literature failed to find a robust and clear relationship between leverage and expected returns is that leverage consists of two fundamentally different parts; short term and long term leverage, which affect expected stock returns in the opposite direction. Short term leverage is priced negatively and firms that have higher levels of short term leverage have higher expected returns. The association between expected stock returns and long term leverage, total leverage, debt maturity and short term debt issuance is insignificant. Finally, firms with higher net long term debt issuance have significantly lower expected stock returns.

We find that higher short term leverage is associated with higher industry risk, lower investment, lower long term leverage, lower net long term debt issuance and higher current assets. Higher long term leverage and higher net long term debt issuance are associated with lower industry risk, higher investment, lower short term leverage and lower current assets.

Main economic intuition behind our results is as follows; firms optimally choose the maturity of their debt by trading off the higher cost of long term maturity with its lower financial risk on equity. Firms with lower credit quality find it more expensive to borrow long term, so they optimally have debt with shorter maturity. This increases the financial risk of debt on their equity.

One future research idea related to this paper is the effect of maturity on bond returns. Bonds with different maturities will have different cash flow streams to debt holders and different default

[15] Details and parameters are given in the appendix.

risk. Understanding the relevance of maturity on cost of debt is valuable for investors, managers and financial researchers.

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A Valuation

We begin with the valuation Bellman equation for the equity of the firm;

$$V(X_t, Z_{ti}, c) = (X_t + Z_{ti})(K - A) - c + \frac{E[V(X + dX; .)]}{1 + rdt} \tag{11}$$

since X and Z are independent, for given value of c, we can separate the Bellman equation using the linearity of expectation function:

$$V(X, Z) = F(X) + G(Z) \tag{12}$$

where

$$F(X) = X_t(K - A) - c + \frac{E[F(X + dX)]}{1 + rdt} \tag{13}$$

$$G(Z) = Z_{ti}(K - A) + \frac{E[G(Z)]}{1 + rdt} \tag{14}$$

since X and Z are independent, Z is identically and independently distributed over time and the expected value of Z is zero, we have the following equality;

$$G(Z) = Z_{ti}(K - A) \tag{15}$$

since Z_{ti} is only a constant at time t and Z is not in the expectation anymore so ex-dividend stock value can be found using F;

$$F(X) = X_t(K - A) - c + \frac{E[F(X + dX)]}{1 + rdt} \tag{16}$$

again, we used the fact that Z has mean zero to change the expectation. Using Ito's lemma, F can be shown to be the solution of an ordinary differential equation through following steps;

$$\begin{aligned} F(x) &= a + bx + \frac{E[F(X + dX)]}{1 + rdt} && (17) \\ &= \pi(x) + \frac{E[F(X + dX)]}{1 + rdt} && (18) \end{aligned}$$

where $a = -c, \quad b = K - A$ and $\pi(x) = a + bx$

$$F(x_0) \approx \pi(x_0)\Delta t + \frac{E[F(X(0 + \Delta t)|X(0) = x_0]}{1 + r\Delta t} \tag{19}$$

we multiply by $1 + r\Delta t$, subtract $F(x_0)$ and divide by Δt as follows;

$$\begin{aligned} (1 + r\Delta t)F(x_0) &\approx \pi(x_0)\Delta t(1 + r\Delta t) + E[F(X(0 + \Delta t)|X(0) = x_0] && (20) \\ r\Delta t F(x_0) &\approx \pi(x_0)\Delta t(1 + r\Delta t) + E[\Delta F|X(0) = x_0] && (21) \\ rF(x_0) &\approx \pi(x_0)(1 + r\Delta t) + \frac{E[\Delta F|X(0) = x_0]}{\Delta t} && (22) \end{aligned}$$

as $\Delta t \to 0$;

$$rF(x_0) = \pi(x_0) + \frac{E[dF|X(0) = x_0]}{dt} \tag{23}$$

by Ito's Lemma, we know that

$$E[dF] = \frac{1}{2}\sigma^2 x^2 \frac{d^2F}{dx^2}(x) + \mu x \frac{dF}{dx}(x) \tag{24}$$

using above information and writing $\pi(x)$ explicitly, we obtain the following ordinary differential equation;

$$\frac{1}{2}\sigma^2 x^2 \frac{d^2F}{dx^2}(x) + \mu x \frac{dF}{dx}(x) + a + bx = rF(x) \tag{25}$$

This is a type of Euler-Cauchy second order linear differential equation.The general solution is given as follows;

$$F(x) = C_0 x^{\nu_0} + C_1 x^{\nu_1} + \frac{a}{r} + \frac{bx}{r-\mu} \tag{26}$$

where

$$\nu_0 = \frac{-\mu + \frac{\sigma^2}{2}}{\sigma^2} + \sqrt{\frac{(\mu - \frac{\sigma^2}{2})^2 + 2\sigma^2 r}{\sigma^2}} > 1 \tag{27}$$

$$\nu_1 = \frac{-\mu + \frac{\sigma^2}{2}}{\sigma^2} - \sqrt{\frac{(\mu - \frac{\sigma^2}{2})^2 + 2\sigma^2 r}{\sigma^2}} < 0 \tag{28}$$

The value of the equity is bounded below due to default option. So, the value can not fall below zero. This gives us a boundary condition captured by the default threshold. This boundary condition will be studied later in the appendix. There is another boundary condition. As the demand goes up, the probability of default diminishes and this makes the effect of default option on the equity value smaller. The default option value approaches to zero so, the total equity value approaches to the present value of continuous cash flows. Formally,

$$as \quad X_t \to \infty, \qquad F \to \frac{a}{r} + \frac{bX}{r-\mu}$$

This limit condition implies that C_0 is equal to zero.

Using the expressions above and natural boundary conditions for the general solution; we find that the F value for the firm as follows;

$$F(X_t, Z_{ti}, c) = \frac{-c}{r} + \frac{X_t(K-A)}{r-\mu} + A_0 X^{\nu} \tag{29}$$

the constant A_0 and the default boundary, X_D can be found using value matching smooth pasting conditions at default;

$$X_D = \frac{c}{r} \times \frac{r-\mu}{(K-A)} \times \frac{\nu}{\nu-1} \tag{30}$$

$$A_0 = \frac{(K-A)}{(\mu-r)\nu} \times X_D^{1-\nu} \tag{31}$$

B Risk and Return

To find real (theoretical) betas, we use the demand elasticity of equity value. We show that our equity betas correspond to a conditional one factor pricing model beta. We begin with the construction of the conditional model and eventually reach our equity betas;

$$1 = E_t[M_{t+1}(1 + R_{i,t+1})] \tag{32}$$

where M_{t+1} is the stochastic discount factor (SDF) and $R_{e,t+1}$ is the return on the unobservable mean variance efficient frontier. We assume the following relation between the SDF and R_e, which gives the essence of the linear factor pricing argument;

$$M_{t+1} = a_t + b_t R_{e,t+1} \tag{33}$$

Here, we also assumed the existence of the SDF and mean variance efficient return. It is straightforward to show that for an asset i;

$$E_t[R_{i,t+1}] = R_{0,t} - b_t \times R_{0,t} \times var_t[R_{e,t+1}] \times \beta_{it} \tag{34}$$

where $R_{0,t}$ is the return on a zero-beta portfolio and

$$b_t = \frac{E_t[R_{e,t+1}] - R_{0,t}}{R_{0,t} \times var_t[R_{e,t+1}]} \tag{35}$$

and the beta has the following explicit form;

$$\beta_{it} = \frac{cov_t[R_{e,t+1}, R_{i,t+1}]}{var_t[R_{e,t+1}]} \tag{36}$$

Now, we can apply this general setting to our model. We take $R_{e,t+1} = \frac{dX_t}{X_t}$ and $R_{i,t+1} = \frac{dV_t}{V_t}$. X_t is the only state variable in the economy. Since industry shocks are idiosyncratic and can be diversified away, we can assume SDF is a linear function of the return on X_t. So, $R_{e,t+1}$ is on the mean variance efficient frontier. Then, we have the following equalities;

$$E_t[R_{e,t+1}] = E_t[\frac{dX_t}{X_t}] = E_t[\mu dt + \sigma dM_t] = \mu dt$$

$$var_t[R_{e,t+1}] = E_t[(\frac{dX_t}{X_t} - E\frac{dX_t}{X_t})^2] = E_t[(\sigma dM_t)^2] = \sigma^2 E_t[(dM_t)^2] = \sigma^2 dt$$

Above, we use the properties of Brownian motion;

$$E_t[dM_t] = 0 \qquad and \qquad E_t[(dM_t)^2] = dt$$

we also take $R_{0,t} = r$ since there is a risk free rate in the economy. We further simplify the factor pricing model as follows;

$$\begin{aligned}
E_t[R_{i,t+1}] &= R_{0,t} - (\frac{E_t[R_{e,t+1}] - R_{0,t}}{R_{0,t} \times var_t[R_{e,t+1}]}) \times R_{0,t} \times var_t[R_{e,t+1}] \times \beta_{it} && (37)\\
&= r - \frac{\mu - r}{r \times \sigma^2} \times r \times \sigma^2 \times \beta_{it} && (38)\\
&= r + \beta_{it} \times (r - \mu) && (39)\\
&= r + \beta_{it} \times \sigma \times \frac{(r - \mu)}{\sigma} && (40)
\end{aligned}$$

we take $\lambda = \frac{(r-\mu)}{\sigma}$. Finally, we have the following conditional one factor pricing model;

$$E_t[R_{i,t+1}] = r + \beta_{it} \times \sigma \times \lambda \tag{41}$$

here

$$\beta_{it} = \frac{cov_t[R_{e,t+1}, R_{i,t+1}]}{var_t[R_{e,t+1}]}$$

so it the OLS regression coefficient for the following regression model;

$$R_{i,t+1} = \tilde{\beta}_{it} \times R_{e,t+1} + \epsilon_{it}$$

which implies $R_{i,t+1} = \beta_{it} \times R_{e,t+1}$ so,

$$\beta_{it} = \frac{R_{i,t+1}}{R_{e,t+1}} = \frac{\frac{dV_t}{V_t}}{\frac{dX_t}{X_t}} = \frac{dlog(V_t)}{dlog(X_t)}$$

C Optimal Corporate Structure

First order conditions for the optimization problem are given as;

$$g(\tilde{m}) = \frac{r}{f(K)}(\frac{Q_m r}{(1-v)x^v C_m G})^{-1/v}, \qquad where \quad G = \frac{v}{1-v}(\frac{v(r-\mu)}{(v-1)(K-A)})^{-v}$$

$$Q_{\tilde{A}} = \frac{-x}{r-\mu}$$

g is assumed be decreasing with m. C_m and G are negative. Q_m is positive. These imply that optimal level of maturity decreases with industry risk σ_i. Also, we see that optimal level of cash holdings, A increases with industry risk since we assume $(Q_A)_{\sigma_i}$ is negative and Q is convex in A.

D Comparative Statistics

We give specific functions for the coupon and issuance cost to do cross sectional comparative statistics. Our aim is to see the relation between maturity and cash holdings and equity betas in the cross section.

D.1 Model Specifics

Following functions satisfy the assumptions made for coupon and issuance cost, previously. For the purpose of this section, functions are representative and constructed to capture qualitative patterns.

Coupon

$$c = (P - m) \times K \times z$$

Issuance Cost

$$Q = m \times \sigma_i \times K - \sigma_i \times log[A]$$

D.2 Optimal Maturity and Cash Holdings

σ_i also shows lack of credit worthiness. Cost of issuance is an increasing function of σ_i since high industry risk implies low credit quality and hence higher cost of borrowing and higher cost of long term maturity. Given the specific functions for the total coupon payment and issuance cost, we see that closed form explicit functions for optimal maturity and cash holdings can be calculated as follows;

Maturity;

$$m = P - \frac{r}{K \times z} \times (\frac{\sigma_i \times K \times r}{G \times z \times K \times x^v \times (v-1)})^{\frac{-1}{v}}$$

Constant in m;

$$G = \frac{v}{1-v} \times (\frac{v \times (r - \mu)}{(v-1) \times (K - A)})^{-v}$$

Cash Holdings;

$$A = \sigma_i \times \frac{r - \mu}{x}$$

D.3 Parameters

We use the following values for the parameters in the model. Drift of the systematic shock is taken to be zero for simplicity. The value of systematic shock, x is taken as constant since the comparative statistic is aimed to understand cross sectional patterns.

Risk free rate, $r = 0.05$
Drift of systematic shock, $\mu = 0$
Standard deviation of systematic shock, $\sigma = 0.2$
Upper bound of maturity, $P = 36$
Systematic demand shock, $x = 0.25$
Constant in coupon, $z = 0.01$

E Empirical Measures

The variables used in the paper are given with corresponding Compustat and CRSP data item names.

E.1 Definitions for Raw Data Variables

lt: total liabilities.
at: total assets.
lct: current liabilities.
prc: stock price.
shrout: number of shares outstanding.
prcc-f: fiscal year closing price.
cshpri: common shares used to calculate earnings per share.
dlc: debt in current liabilities.
dltt: debt in long term liabilities.
pstkl: preferred stock.
txditc: deferred taxes and investment tax credit.
act: total current assets.
ni: net income.
pi: funds provided by operations.
ebit: earnings before interest and taxes.
ib: income before extraordinary items.
dp: depreciation and amortization.
ppent: net property, plant and equipment.
txdb: deferred taxes.
dvc: dividends common.
dvp: dividends preferred.
che: cash and short term investments.
capx: capital expenditures.
xint: total interest and related expenses.
prstkc: purchase of common and preferred stock.
csho: common shares outstanding.
adjex-c: cumulative adjustment factor.
dltis: long term debt issuance.
dltr: long term debt reduction.
invt: total inventories.
rect: total receivables.

E.2 Formulas for Constructed Variables

Short term leverage, (SLEV) = lt / at.

Long term leverage, (LLEV) = (lt - lct) / at.

Total leverage, (TLEV) = lt / at.

Debt maturity, (DEBTMAT) = (lt - lct) / lt.

Market value, (SIZE) = prc * shrout.

Total assets, (AT) = at.

Market-to-Book Asset, (MB) = (prcc-f * cshpri + dlc + dltt + pstkl - txditc) / at.

Business risk, (BUSRISK) = cross sectional standard deviation of annual changes in earnings over assets (ebit/at) by three-digit SIC industry.

Kaplan-Zingales Index, (KZ) = -1.002((ib + dp)/ ppent) + 0.0283((at + prrc-f * cshpri - ceq - txdb) / at) + 3.139((dltt + dlc) / (dltt + dlc + seq)) - 39.368((dvc + dvp) / ppent) - 1.314(che / ppent).

Net cash outflow, (NETCASHFLOW) = (capx - ib - dp) / ppent.

Interest coverage ratio, (INTCOV) = (ib + xint) / xint.

Dividend payout ratio, (DIVPAYOUT) = (dvc + prstkc) / ni.

Capital expenditure ratio, (CapEx) = capx / at.

Cash holdings, (CASH) = che / at.

Profitability, (ROA) = ib(t) /at(t-1).

Net long term debt issuance ratio, (LONGDEBT) = (dltis - dltr) / at.

Net short term debt issuance ratio, (SHORTDEBT) = [dlc(t) - dlc(t-1)] / at.

Table 1 : AVERAGE EXCESS RETURNS

This table reports average excess returns for portfolios built on short term leverage (SLEV), long term leverage (LLEV), total leverage (TLEV), debt maturity (DEBTMAT), long term debt issuance (LONGDEBT) and short term debt issuance (SHORTDEBT). Sample period is from 1974 to 2009. Leverage portfolios are constructed using previous fiscal year's annual leverage data for stocks in July of the current year up to June of the following year. Portfolios are re-balanced every twelve months. Columns represent different leverage measures. All returns are in percentages.

Value Weighted Returns

	SLEV	LLEV	TLEV	DEBTMAT	LONGDEBT	SHORTDEBT
P1	0.22	0.72	0.26	0.69	0.68	0.70
P2	0.47	0.37	0.62	0.52	0.90	0.70
P3	0.58	0.54	0.49	0.77	0.75	0.63
P4	0.45	0.72	0.62	0.75	0.66	0.66
P5	0.52	0.60	0.55	0.55	0.73	0.85
P6	0.66	0.72	0.60	0.67	0.95	0.32
P7	0.65	0.65	0.63	0.69	0.29	0.36
P8	0.65	0.59	0.70	0.54	0.51	0.65
P9	0.80	0.61	0.64	0.48	0.56	0.62
P10	0.97	0.59	0.83	0.50	0.34	0.44
P10-P1	0.75	-0.12	0.57	-0.19	-0.34	-0.26
Annualized	9.02	-1.50	6.85	-2.23	-4.12	-3.06
t	3.56	-0.45	2.11	-0.67	-2.36	-1.83

Table 2 : MEASURES OF LEVERAGE

This table reports average short term leverage (SLEV), long term leverage (LLEV), total leverage (TLEV), debt maturity (DEBTMAT), short term debt issuance (SHORTDEBT) and long term debt issuance (LONGDEBT) for short term leverage and long term debt issuance portfolios. Sample period is from 1974 to 2009. Please see the Appendix for detailed explanation of the fundamentals.

PANEL A : Short Term Leverage

	SLEV	LLEV	TLEV	DEBTMAT	SHORTDEBT	LONGDEBT
P1	7.32	39.24	46.58	75.59	-0.93	2.98
P2	11.37	37.65	49.04	69.89	-0.80	1.94
P3	14.83	35.07	49.92	63.60	-0.80	1.84
P4	17.91	30.21	48.08	55.46	-0.66	1.38
P5	20.95	25.33	46.16	47.92	-0.56	0.96
P6	24.16	25.87	50.02	47.21	-0.38	1.12
P7	27.82	23.72	51.53	42.16	-0.01	0.81
P8	32.54	22.90	55.40	38.48	0.43	0.81
P9	39.52	21.30	60.80	32.52	1.44	0.68
P10	53.93	18.26	72.01	23.28	4.21	0.56
Total	25.04	27.96	52.95	49.61	0.19	1.31
P10-P1	46.61	-20.98	25.43	-52.32	5.14	-2.42
t	361.86	-48.29	54.50	-130.00	62.83	-26.9

PANEL B : Long Term Debt Issuance

	SLEV	LLEV	TLEV	DEBTMAT	SHORTDEBT	LONGDEBT
P1	28.76	26.07	55.34	43.73	-1.84	-14.10
P2	27.20	25.19	52.74	44.76	-0.10	-3.89
P3	26.35	22.61	49.26	42.08	0.35	-1.72
P4	25.57	17.99	43.88	36.01	0.52	-0.66
P5	23.58	10.41	34.27	23.83	0.23	-0.12
P6	25.37	14.65	40.25	30.13	0.53	0.18
P7	25.67	25.00	51.24	45.36	0.88	1.03
P8	25.25	29.80	55.49	51.60	0.81	3.04
P9	24.72	32.43	57.63	55.31	0.66	7.54
P10	23.67	40.17	64.20	62.20	0.43	21.85
Total	25.63	24.93	50.95	44.17	0.22	1.38
P10-P1	-5.09	14.10	8.86	18.47	2.26	35.95
t	-52.90	70.85	48.93	94.94	13.32	138.59

Table 3 : FACTOR REGRESSIONS

This table reports alphas from various factor regression models for short term leverage and long term debt issuance portfolios. Sample period is from 1974 to 2009. CAPM is capital asset pricing model. FF is Fama-French three factor model. CARHT is Carhart four factor model. Market, size, value and momentum factors are taken from French Kenneth's data library. Alphas and corresponding t statistics are reported. Values are in percentages.

PANEL A : Short Term Leverage

	CAPM	FF	CARHT
P1	-0.32	-0.31	-0.21
P2	-0.12	-0.11	-0.14
P3	-0.02	0.00	-0.03
P4	-0.15	-0.04	0.02
P5	-0.07	0.02	0.10
P6	0.11	0.15	0.11
P7	0.09	0.15	0.11
P8	0.08	0.13	0.13
P9	0.20	0.22	0.19
P10	0.34	0.32	0.35
P10-P1	0.66	0.63	0.56
Annualized	7.88	7.58	6.70
t	3.13	2.94	2.55

PANEL B : Long Term Debt Issuance

	CAPM	FF	CARHT
P1	0.07	-0.02	-0.09
P2	0.32	0.24	0.18
P3	0.19	0.23	0.20
P4	0.09	0.17	0.11
P5	0.01	0.25	0.27
P6	0.13	0.27	0.31
P7	-0.18	-0.13	-0.09
P8	-0.01	-0.03	-0.02
P9	-0.02	-0.07	-0.08
P10	-0.39	-0.37	-0.32
P10-P1	-0.46	-0.35	-0.23
Annualized	-5.49	-4.17	-2.71
t	-3.26	-2.50	-1.63

Table 4 : LEVERAGE AND SIZE

Table reports average excess returns for portfolios that are two-way independently sorted respect to short term leverage, long term debt issuance and market size. Sample period is from 1974 to 2009. For portfolio months from July of year t up to June of year t+1, we take market size as the price per share times shares outstanding at the end of June of calendar year t. Portfolios are re-balanced every twelve months. Size portfolios are designated as small, medium and large, using NYSE break points at 30th. and 70th. percentiles. Monthly spreads are also annualized and t statistics for spreads are given. All returns are in percentages.

PANEL A : Short Term Leverage

Value Weighted Returns

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	Annualized	t
All FIRMS	0.22	0.47	0.58	0.45	0.52	0.66	0.65	0.65	0.80	0.97	0.75	9.02	3.56
SMALL	0.53	0.63	0.93	1.13	1.01	0.95	1.14	1.15	0.92	0.79	0.27	3.24	1.75
MEDIUM	0.51	0.71	0.78	0.76	0.87	0.84	0.91	0.89	1.00	0.60	0.09	1.06	0.49
LARGE	0.20	0.46	0.52	0.41	0.49	0.63	0.61	0.62	0.78	1.03	0.83	9.95	3.45

PANEL B : Long Term Debt Issuance

Value Weighted Returns

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	Annualized	t
All FIRMS	0.68	0.90	0.75	0.66	0.73	0.95	0.29	0.51	0.56	0.34	-0.34	-4.12	-2.36
SMALL	1.01	1.20	1.16	1.10	0.84	1.40	0.65	0.93	0.79	0.28	-0.73	-8.81	-6.65
MEDIUM	0.88	1.00	0.96	0.86	0.68	0.86	0.50	0.78	0.75	0.56	-0.32	-3.82	-2.82
LARGE	0.55	0.85	0.69	0.65	0.77	0.96	0.39	0.49	0.55	0.37	-0.19	-2.22	-0.96

Table 5 : FINANCIAL CONSTRAINTS

This table reports various financial constraint variables for short term leverage and long term debt issuance portfolios. Sample period is from 1974 to 2009. We calculate average Kaplan-Zingales index value (KZ), net cash outflows (NETCASHFLOW), interest coverage ratio (INTCOV) and dividend pay-out ratio (DIVPAYOUT). Please see the Appendix for detailed explanation of the variables.

PANEL A : Short Term Leverage

	KZ	NETCASHFLOW	INTCOV	DIVPAYOUT
P1	-2.73	0.20	11.02	45.40
P2	-1.58	-0.03	17.90	46.33
P3	-1.92	0.11	17.98	47.92
P4	-2.49	-0.17	24.41	52.11
P5	-3.71	-0.35	19.14	54.58
P6	-2.98	-0.23	12.27	58.83
P7	-3.51	-0.28	13.74	62.50
P8	-4.05	-0.23	12.89	54.01
P9	-3.61	-0.27	14.12	66.48
P10	-4.49	-0.27	13.80	56.66
Total	-3.11	-0.17	15.73	54.48
P10-P1	-1.76	-0.47	2.78	11.26
t	-13.22	-17.02	1.26	7.21

PANEL B : Long Term Debt Issuance

	KZ	NETCASHFLOW	INTCOV	DIVPAYOUT
P1	-2.35	0.40	0.14	0.20
P2	-1.97	0.22	0.93	0.26
P3	-2.76	0.33	-1.79	0.30
P4	-4.83	0.47	-0.42	0.30
P5	-10.68	0.90	15.31	0.29
P6	-7.88	0.50	13.59	0.30
P7	-2.47	0.27	0.43	0.34
P8	-1.45	0.25	0.29	0.37
P9	-0.95	0.23	1.26	0.37
P10	-1.56	0.77	-0.81	0.34
Total	-3.49	0.43	2.40	0.31
P10-P1	0.78	0.37	-0.95	0.14
t	9.04	16.96	-6.15	23.90

Table 6 : INVESTMENT

This table reports various average firm fundamentals and Chen, Novy-Marx and Zhang three factor model alphas for short term leverage and long term debt issuance portfolios. Sample period is from 1974 to 2009. CapEx is total capital expenditures. ROA is return on assets. CASH is cash holdings. Investment and profitability factors are obtained from Chen, Novy-Marx, Zhang (2010). Please see the Appendix for detailed explanation of the fundamentals.

PANEL A : Short Term Leverage

	CapEx	CASH	ROA	ALPHA
P1	8.86	11.90	1.05	0.14
P2	9.21	9.85	5.42	0.12
P3	9.14	9.93	6.87	0.13
P4	8.85	11.07	8.14	0.07
P5	8.64	12.38	9.99	0.09
P6	8.43	10.55	9.53	0.09
P7	7.89	11.49	9.53	0.07
P8	7.74	10.00	9.36	-0.01
P9	6.82	11.00	8.62	0.12
P10	5.66	14.45	6.49	0.26
P10-P1	-3.21	2.55	5.44	0.12
t	-34.54	6.87	9.85	0.59

PANEL B : Long Term Debt Issuance

	CapEx	CASH	ROA	ALPHA
P1	6.40	-1.83	11.55	-0.08
P2	6.04	-0.35	11.71	0.23
P3	6.05	-0.82	14.21	0.20
P4	6.14	-0.66	18.18	0.19
P5	6.29	-2.20	26.14	0.19
P6	6.76	1.53	19.28	0.20
P7	7.74	0.25	11.77	-0.15
P8	8.48	0.66	9.37	-0.07
P9	10.16	0.39	8.26	-0.05
P10	12.85	-5.72	11.19	-0.11
P10-P1	6.46	-3.89	-0.35	-0.03
t	47.37	-16.17	-3.30	-0.24

Table 7 : BUSINESS RISK

This table reports average business/industry risk (BUSRISK) for short term leverage, long term leverage, total leverage, debt maturity, long term debt issuance and short term debt issuance portfolios. Sample period is from 1974 to 2009. Please see the Appendix for detailed explanation of the variables. Values are in percentages.

	SLEV	LLEV	TLEV	DEBTMAT	LONGDEBT	SHORTDEBT
P1	8.83	21.76	20.91	21.60	15.83	16.09
P2	8.59	16.92	16.56	17.20	12.37	12.77
P3	9.94	16.43	15.05	15.69	13.13	12.90
P4	11.63	14.38	14.68	14.23	13.29	14.51
P5	13.50	12.93	12.76	13.04	16.09	11.50
P6	10.99	12.35	12.27	12.37	13.33	11.37
P7	10.17	11.60	11.46	11.06	12.32	12.94
P8	16.93	10.83	16.35	10.78	11.66	12.05
P9	36.13	8.44	9.60	10.32	11.76	12.50
P10	42.10	9.03	15.16	9.96	11.19	16.06
P10-P1	33.28	-12.73	-5.75	-11.65	-4.64	-0.03
t	8.72	-40.29	-14.54	-44.55	-9.38	-0.15

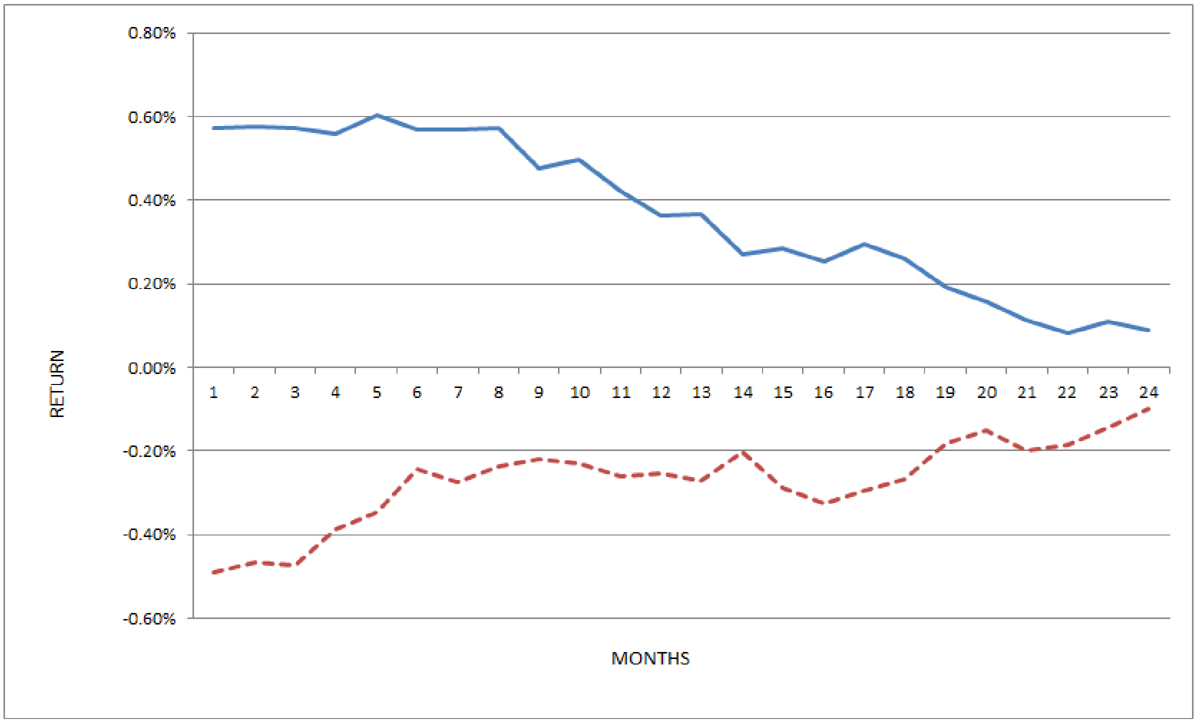

Figure 1 Spread

This figure shows monthly short term leverage premium (solid line) and long term debt issuance discount (dashed line). Sample period is from 1974 to 2009. Average monthly spreads between extreme portfolio average excess returns up to twenty-four months after portfolio sortings are graphed.

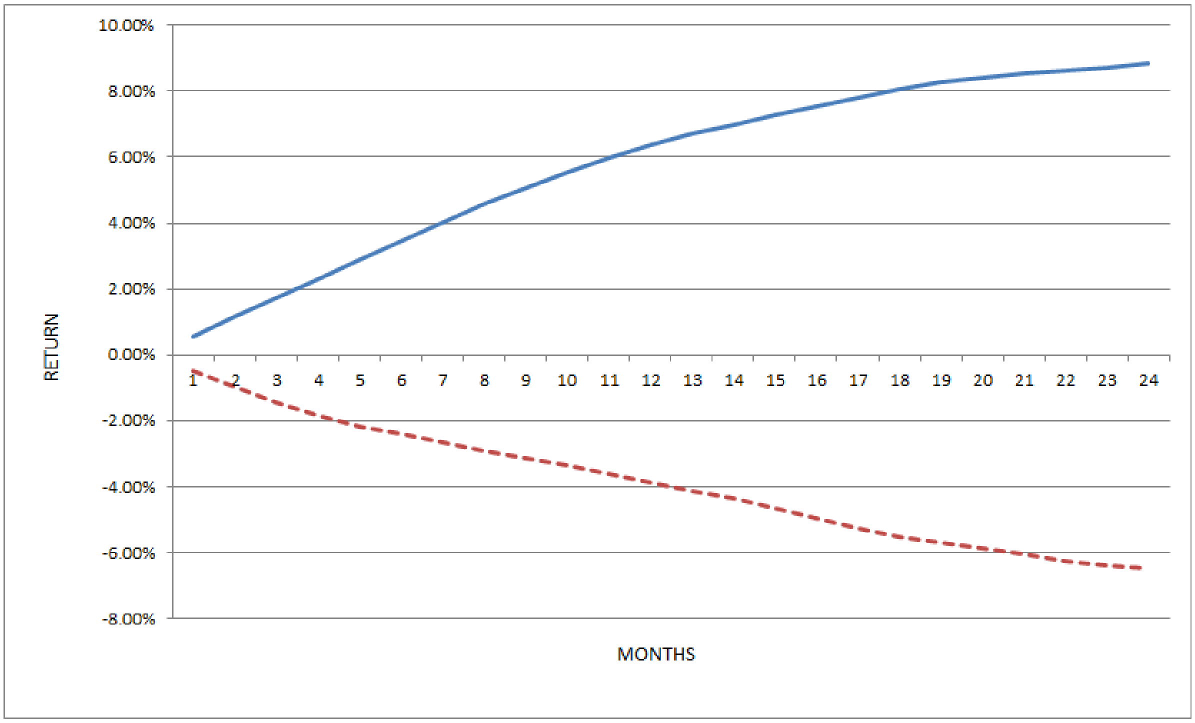

Figure 2 Cumulative Spread

This figure shows cumulative monthly short term leverage return premium (solid line) and long term debt issuance return discount (dashed line). Sample period is from 1974 to 2009. Cumulative spreads up to twenty-four months are graphed.

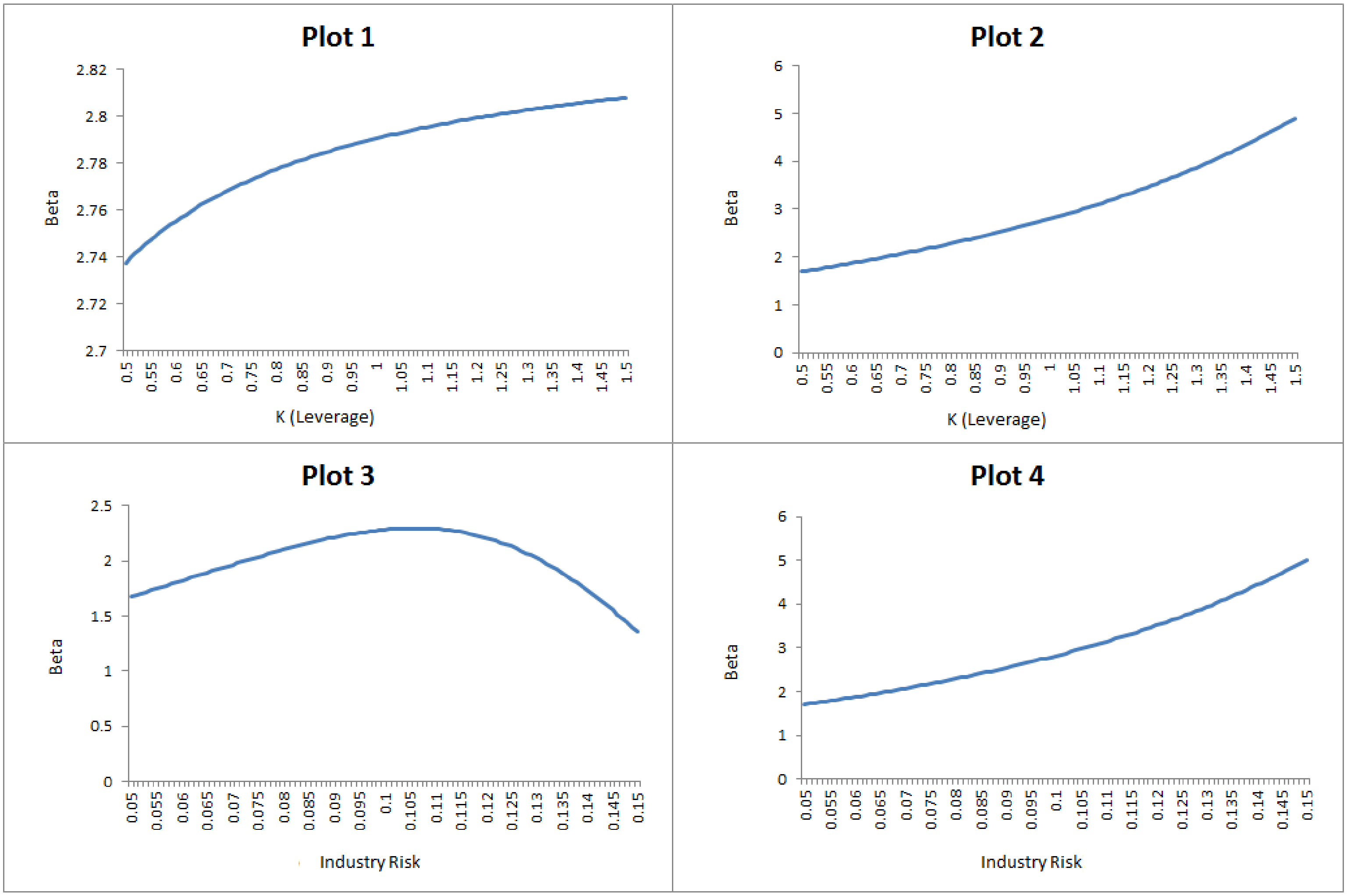

Figure 3 Comparative Statistics

Plot 1 shows the change in equity beta as K, assets financed by debt (leverage), changes for a fixed, medium level of industry risk. Plot 2 shows how beta changes as K increases with increasing industry risk, σ_i (both leverage and industry risk increases). Plot 3 shows how beta changes as industry risk changes when K is fixed and low. Plot 4 shows how beta changes as industry risk changes when K is fixed and high. Range for K is from 0.5 to 1.5. Range for industry risk is from 0.05 to 0.15.