What Determines the Structure of Corporate Debt Issues?

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July 15, 2008

Abstract

Publicly-traded debt securities differ on a number of dimensions, including quality, maturity, seniority, security, and convertibility. Finance research has provided a number of theories as to why firms should issue debt with different features; yet, there is very little empirical work testing these theories. We consider a sample of 14,867 debt issues in the U.S. between 1971 and 2004. Our goal is to test the implications of these theories, and, more generally, to establish a set of stylized facts regarding the circumstances under which firms issue different types of debt.

Our results suggest that there are three main types of factors that affect the structure of debt issues: First, firm-specific factors such as leverage, growth opportunities and cash holdings are related with the convertibility, maturity and security structure of issued bonds. Second, economy-wide factors, in particular the state of the macroeconomy, affect the quality distribution of securities offered; in particular, during recessions, firms issue fewer poor quality bonds than in good times but similar numbers of high-quality bonds. Finally, controlling for firm characteristics and economy-wide factors, project specific factors appear to influence the types of securities that are issued. Consistent with commonly stated 'maturity-matching' arguments, long-term, nonconvertible bonds are more likely to be issued by firms investing in fixed assets, while convertible and short-term bonds are more likely to finance investment in R&D.

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Firms face a complex menu of choices when making financing decisions. Managers must decide whether to finance investment projects with retained earnings, outside equity, or one of many possible types of debt. Prior research related to the choice of financing has focused mostly on the broad choice between debt and equity in general such as theories based on optimal leverage ratios, asymmetric information, and market timing. However, firms most often use debt rather than equity to finance projects; Bolton and Scharfstein (1996) observe that from 1946 to 1987, 85 percent of total U.S. external financing was raised through debt offerings, compared to only 7 percent through equity offerings. Therefore, to understand how firms finance investments, the choice between alternative types of debt financing is likely to be equally, or even more important than the choice between equity and debt.

Debt contracts differ on a number of dimensions, including maturity, security, seniority, covenants, and different types of embedded options such as convertible features and call options. These features vary both across different firms' debt issues and over time within the same firm's issues, even when institutions, regulations, taxation, and market conditions remain relatively constant. While there are many theories discussing the possible reasons why firms structure debt in particular ways, there has been surprisingly little empirical work testing the implications of these theories.

This paper attempts to fill this void by empirically investigating the structure of public debt financing. We rely on the Mergent database, which provides detailed information on the bond contracts of 14,867 publicly-traded U.S. debt issues between 1971 and 2004. We focus on five specific characteristics of bond contracts: convertibility, maturity, security, callability, and credit quality. In doing so, we have two main goals. First, we hope to establish a set of stylized facts on the use of various types of bonds by U.S. corporations over time. Second, we wish to test the predictions of theories that provide explanations for why firms will use alternative types of public debt.

The explanations we focus on for observed differences in debt contracts fall into three categories. First, corporate finance theory has argued that certain firm characteristics are likely to affect the structure of debt contracts. In particular, a firm's size, the nature of its growth options, as well as its cash flows and cash holdings are all potential determinants of the type of features included in a bond contract. In addition, the state

of the macroeconomy can also influence the characteristics of observed debt offerings. Financial constraints are likely to be exacerbated during a recession, limiting firms' ability to issue anything but the highest quality debt. Finally, holding firm characteristics and economic conditions constant, firms also potentially issue different types of debt over time as a function of the type of project the debt is used to finance. Thus, theory suggests that the properties of debt issues should be a function of firm-level, economy-level, and project-level factors.

We first summarize the various characteristics of public debt issues, and document how they have changed over time. The overall quantity of public debt issues has increased dramatically in recent years. The $2 trillion issued in the 2000-2004 period represents almost a six-fold increase in total issuance relative to the sub-period beginning only ten years earlier, 1990 to 1994. In addition, recent debt issues have become shorter-term, more likely to be convertible, and less likely to be callable than they were in the 1971-1984 period.

The main focus of the paper is on the factors that lead firms to use alternative kinds of debt. We first perform univariate comparisons of the characteristics of firms issuing different kinds of debt. These comparisons are suggestive, but do not control for other factors that are correlated with both the issuance's type and firm-level factors. We therefore use a multivariate approach to estimate the marginal effect of firm characteristics on security choice. This problem is complicated by the fact that firms can choose when and whether to issue a security at all, and by the fact that they can substitute for some security features with other characteristics. Because of these statistical issues, we use a probit model with an explicit correction for selection bias. The results are largely consistent with the univariate specification. Thus, we are relatively confident that our conclusions come from the actual economics of security choice rather than from econometric mismeasurement.

Finally, we consider the possibility that funds raised from different kinds of debt are used for different purposes. To do so, we estimate equations similar to those in Kim and Weisbach (2008), which predict the uses of an incremental dollar raised from different sources. We estimate these equations for different kinds of debt, and find that capital from different kinds of debt does in fact get used for different purposes, even when we control for other firm characteristics by including firm fixed effects in the equation.

Overall, our results suggest a number of factors that affect the structure of debt securities. Firms issuing convertible debt tend to be smaller, and have higher growth opportunities than firms issuing nonconvertible debt. In addition, firms issuing convertible debt are more likely to use the proceeds for R&D and less likely to use them for capital expenditures than firms issuing nonconvertible debt. This pattern is consistent with the arguments of Stein (1992) and Mayers (1998), suggesting that convertible debt is somewhat 'equity-like', in that it is preferable for financing projects with embedded real options, particularly in situations in which asymmetric information is likely to be severe. Finally, when we control for firm characteristics, we find that convertible bonds are more likely to be issued in a recession than in an economic boom.

The maturity of the debt issue is also an important consideration in the choice of security. A commonly stated argument by practitioners is that firms should 'match maturities' of the security it issues with the investment it finances. Our results do support this finding, in that short-maturity debt is more likely to be used to finance R&D, while long-maturity debt is more likely to finance capital expenditures. In addition, consistent with the Diamond (1991) liquidity risk arguments, short-term issuers are more likely to be larger, have lower fixed asset ratios, stronger growth opportunities, and hold more cash than otherwise similar issuers of long-term debt.

Another choice firms face when they issue debt is whether the debt should be secured or unsecured. Theoretically, it is not clear what kinds of firms we should observe using secured debt. It is possible that they could be high quality firms seeking to avoid investment inefficiencies associated with unsecured debt, as argued by Smith and Warner (1979), Stulz and Johnson (1985), and Berkovitch and Kim (1990). Alternatively, as emphasized in the banking literature (Berger and Udell (1990)), secured debt could be primarily used by low-quality firms who cannot otherwise raise capital without providing security. Our results are consistent with the arguments from the banking literature. Firms that issue secured debt tend to be much more highly levered than firms issuing unsecured debt. In addition, firms tend to issue secured debt after periods of low cash flows and poor stock performance.

Debt contracts often contain imbedded options, the most common of which are call provisions. One advantage of callability is to provide a natural hedge against interest rate risk, since firms can redeem them at

prespecified prices if interest rates fall. In addition, the corporate finance literature has argued that one potential motive for issuing callable debt is to minimize potential underinvestment or overinvestment distortions arising from the agency costs of debt. Our evidence is consistent with the interest rate hedging view, as callable bonds are more likely to be issued during periods of high interest rate volatility by firms most likely to find hedging motives useful. In contrast, we do not find support for the agency cost of debt explanations for call provisions; firms issuing callable bonds do not appear to have higher growth opportunities than firms issuing non-callable bonds.

We finally consider the bond's quality, measured by its rating. Not surprisingly, firms issuing higher-rated debt tend to be larger, with higher cash flow and market to book, and with lower stock price volatility than firms issuing lower quality debt. Perhaps more surprisingly, firms issuing higher-quality debt hold less cash and are more likely to issue in bad economic times compared to firms issuing lower quality debt. This pattern is consistent with the 'financial constraints' view, in which potential financial constraints induce firms to hold a more liquid balance sheet and lower quality firms are shut out from the capital markets during recessions.

The remainder of this paper is organized as follows: Section I summarizes some related literature and develops the main hypotheses to be tested. Section II describes the data employed in this paper and reports summary statistics. Section III presents univariate results linking debt characteristics to firm characteristics, macroeconomic conditions and different uses of funds. Section IV presents our multivariate analysis of debt structure choice. Section V examines the determinants of credit quality and section VI reports the effect of debt type on post issuance investment expenditures. Section VII concludes.

I. Hypothesis Development and Related Literature

The literature related to financing choices is vast. We focus here on prior research dealing with the specifics of debt contract design. This literature can be classified into two broad groups. The first strand of literature focuses on the demand side as a determinant of debt contract design. This research has focused mainly on firm characteristics, such as size, growth opportunities, degree of asymmetric information, and firm

risk as the primary determinants in the choice of financing. The second and more recent strand of literature focuses on the supply of debt financing as a factor in financing choice. We briefly review here some of the relevant literature on debt financing from both the demand and supply sides. The first three subsections briefly summarize literature on how firm characteristics determine the maturity, seniority and exchangeability features of debt contracts. The last subsection discusses some papers on the impact of credit supply and macroeconomic conditions on debt financing.

A. Maturity Structure

Myers (1977) originally proposed that risky debt can induce suboptimal investment incentives when a firm has valuable growth options. Managers acting in behalf of shareholders will not exercise valuable growth options if the returns to investment accrue primarily to risky debt holders. Myers argues that one way to avoid this underinvestment incentive is to issue short-term debt that matures prior to the exercise of growth options. The empirical prediction coming from this argument is that firms with high growth opportunities will tend to use shorter-term debt than firm whose value is made up primarily of fixed assets.

Flannery (1986) argues that the debt maturity choice can signal inside information about firm quality to outside investors when insiders are better informed. In the presence of transaction costs, lower-quality firms will tend to avoid short-term debt because they cannot afford the costs of frequently rolling over their debt. Diamond (1991) also presents a model of debt maturity based on private information. In his model, short-term debt exposes a firm to liquidity risk and loss of control rents. The main empirical prediction of Diamond (1991) is that borrowers with a poor credit quality have no choice but to borrow short-term via private placements and banks. Firms with intermediate credit quality will borrow long-term publicly traded debt because they face relatively high liquidity risks. Firms with high credit quality will be issuers of short-term debt, such as commercial paper. Thus, the theory predicts that firms with very high or very low credit will borrow short term (with different contracts), with long-term debt being issued by firms with credit quality somewhere in the middle.

Myers (1977), Diamond (1991) and Hart and Moore (1994) provide alternative explanations for the commonly-stated rule of thumb that the maturity of a firm's debt should match the timing of cash flows

generated by its assets. In the case of Myers (1977), matching maturities in this fashion helps alleviate the underinvestment incentive, while in Diamond (1991) it helps mitigate risk of inefficient liquidation. The matching of debt maturity to that of assets in the Hart and Moore model comes from the threat of the entrepreneur to withdraw his human capital from the financed project. Regardless of the underlying reason why it is adopted, this 'matching maturity principle' predicts that observed debt maturity should be correlated with asset maturity. We expect that investment in long-term tangible assets will be financed primarily with long-term debt, while R&D and other short-term investments will be financed with short-term debt securities.

Several papers have studied the relation between debt maturity and firm characteristics empirically. Barclay and Smith (1995b) and Stohs and Mauer (1996) find that larger, less risky firms tend to have debt with longer maturity. Using a proxy for asset maturity, they also find that firms with longer asset maturity tend to have longer debt maturity, consistent with the notion that firms match the maturities of their assets and liabilities. These papers also find mixed support for the hypothesis that debt maturity is inversely related to growth opportunities. Guedes and Opler (1996) find that larger firms with investment grade credit tend to borrow at both the long and short term of the maturity spectrum, while risky firms tend to issue debt with more intermediate maturities. This finding is consistent with Diamond's (1991) prediction that risky firms do not issue short term debt because of the risk of inefficient liquidation.

B. Seniority/Security Structure

Debt contracts also differ by levels of seniority or priority. At the bottom of the priority ladder is common stock, which as a residual claim is paid only when all other claimants have been paid in full. Above common stock is preferred stock, then subordinated debt, then senior debt, and finally secured debt. Theoretically, Stulz and Johnson (1985) argued that issuing secured debt allows a firm to undertake some projects that would be rejected if financed by equity or other form of debt. Berkovitch and Kim (1990) show that the issuance of secured debt can decrease underinvestment, but increase overinvestment. Smith and Warner (1979) argue that including higher seniority provisions in the debt contract limits the firm's ability to engage in asset substitution. The empirical prediction of these models is that highly indebted firms with

relatively good growth options are more likely to have a large proportion of senior claims in their capital structures.

In contrast, Berger and Udell (1990) argue that firms issue more senior/secured debt in situations in which the firm is not doing well and providing seniority is the only way in which they are able to issue the securities. Their argument implies that firms issuing secured debt should be relatively poor performers and have low growth options. Barclay and Smith (1995a) examine this issue empirically and find results largely consistent with the agency cost view.

C. Exchangeability

Another dimension upon which debt contracts differ is the degree to which the issue can be exchanged or converted for a different security. These bonds are typically associated with an option given either to the issuer or bondholder to exchange the debt for another security. For example, callable debt gives the issuer the option to exchange cash for the outstanding debt at a pre-specified price. Convertible debt gives the bondholder the option to convert a bond into a certain number of common shares at a pre-specified conversion ratio. A third type of exchangeable debt is putable debt, which gives the bondholder the option to sell the bond back to the issuer at a pre-specified price.

There are a number of reasons that have been proposed for the use of exchangeable debt. For example, these exchangeability features of debt could potentially mitigate contracting problems; Stein (1992) makes this type of argument for convertible debt while Barnea et al. (1980) do so for callable debt. Another potential explanation for the use of callable debt was proposed by Guntay et al. (2002), who suggest that callable debt provides a hedge against interest rate risk. Finally, Mayers (1998) proposes that convertibility can lead to more efficient investment in situations in which a substantial fraction of a firm's investment is in the form of future investment options.

D. Macroeconomic Conditions and Financial Constraints

Practitioners often claim that it is difficult for lower-quality firms to receive financing during poor financial times. Bernanke and Gertler (1989) formalize this argument by presenting a model in which a firm's net worth affects its financing costs. When net worth declines, information problems are exacerbated and it

becomes relatively difficult for firms to raise capital. This increase in financing costs mainly affects firms for which information problems are relatively severe; i.e., firms facing financial constraints or unusually high costs of external financing.

An implication of this argument is that during recessions or other economic downturns, when firms tend to have lower net worth, we should observe financial constraints becoming more severe, and low-rated debt should become less frequent relative to high-quality debt. In addition, firms, especially those with high information problem, should substitute away from information-sensitive securities toward less information sensitive ones. In particular, in recessions we should observe firms substituting convertible debt for equity, shortening the maturity of the straight debt they issue, and avoiding callable debt, since the existence of the call option increases the value of asymmetric information to firms.[1]

II. Data Sources and Sample Description

A. Data Sources

We obtain data on public debt issues in the United States from the 2005 version of the Mergent Fixed Income Securities Database (FISD). This database provides comprehensive information for US corporate debt, including characteristics such as seniority, maturity and convertibility as well as total proceeds raised. Macroeconomic data are obtained from two sources. Recession/expansion dates are from the National Bureau of Economic Research (NBER) and GDP growth rates are obtained from the US Bureau of Economic Analysis (BEA).

We obtain financial information on the issuing firms by matching each issue with its corresponding firm in Compustat based on fiscal year ends and keep only those with accounting information available before and after the issue date. Accounting variables, with the exception of total assets, are winsorized at the 1% and 99% of the sample distribution for each variable. Since cash flow statement items are available in Compustat

[1] Korajczyk and Levy (2003) find evidence supporting this view. A related argument is Lamont (1995), who suggests another channel through which financial constraints can become exacerbated during times of recession. Lamont argues that as the economy moves into a recession, debt overhang becomes more binding as growth options tend to diminish and agency costs may hinder access to financing for firms with higher probabilities of default.

only after 1971, we set our sample period to start from then. In addition, we eliminate all debt issues from financial firms (SIC 6000-6999). After applying these filters, we end up with 14,867 debt issues, each occurring between 1971 and 2004.

B. Characteristics of Total Debt Issues over Time

Table I presents descriptive statistics of our public debt issuance sample. To provide a rough idea of the time-series variation in the design of debt contracts, we divide the sample into five sub-periods. For each sub-period, we report the number of issues (Panel A) and value of the proceeds raised (Panel B) for all issued bonds, as well as by each type of issue, sorted by convertibility, initial maturity, security, callability, and credit rating. The overall pattern shows an increasing trend in the use of publicly traded bonds over time. Our sample contains 947 total debt issues over the 1971 to 1984 sub-period, compared to 4,498 total issues in the much shorter 2000 to 2004 sub-period. The total proceeds raised over the sample period was $3.66 trillion, with just over 80% of that total amount raised since 1995. Overall, our sample firms raised on average $246 million per each debt issue throughout the sample period, with a corresponding median value of $125 million. As a comparison, the magnitudes of debt issues are somewhat larger than average amount raised through seasoned equity offerings.[2]

To verify that the trends reported above are material and not simply reflect the growth in the overall economy, we report in panels C and D the number of issues and the total proceeds raised scaled by number of non-financial firms in Compustat and total liabilities of non-financial firms in Compustat, respectively. The results indicate that the growth in public debt market is still pronounced even after controlling for the growth in the overall economy.

C. Debt Issues by Type and Quality

Public debt issues vary along a number of dimensions, including convertibility, maturity, security level, callability, and other features. Table I also summarizes the use of these various features over time. There has been an upward trend in the use of convertible bonds over time, although it is less monotone in terms of the

[2] The mean and median proceeds raised between 1990 and 2003 through seasoned equity offerings in the US are $100.3 million and $45.5 million, respectively, according to Thomson Financial's SDC New Issues database.

proportion of total bonds issued than the proportion of proceeds raised. Panel A demonstrates that while about 9% of total bonds (5% of the proceeds) issued during 1971 to 1984 were convertible, 24% of total bonds (19% of the proceeds) issued between 2000 and 2004 were convertible. A similar trend emerges in the use of short-term debt over time. If we define an issue as short-term when it has an initial maturity of five years or fewer, none of the issues in our sample were classified as short-term in the 1971 to 1984 sub-period. Using this definition, the proportion of total issued debt classified as short term increased rapidly, reaching 30% of all issues and 39% of total proceeds raised by the 2000 to 2004 sub-period.[3] To ensure that the lack of short-term bonds during the 1971 to 1984 period is not a data issue, we consult the SDC database and find similar patterns in the issuance of short-term debt over the sample period.

Table I also demonstrates that the vast majority of public debt issues are unsecured. Secured debt makes up only 3% of total issued bonds and 2% of the proceeds in our sample. These proportions have remained relatively stable over time. In contrast to secured debt, callable debt is much more common. However, the incidence of callability varies substantially over the sample period. During the 1971 to 1984 period, 83% of all issued bonds were callable. This figure dropped to 28% of issued bonds during 1990 to 1994. The most recent sub-period, 2000 to 2004, has seen a resurgence in the popularity of callable bonds, with these bonds making up 73% of total issues and 56% of total proceeds raised.

The last five columns of Table I summarize the number of issues and proceeds raised by bonds of various credit quality.[4] We group bonds into five different quality categories: non-rated bonds, C-rated bonds, speculative B-rated bonds (Moody's B3 to Ba1 ratings), investment grade B-rated bonds (Moody's Baa3 to Baa1 ratings), and A-rated bonds. Compared to the variation of bond types issued over time, the distribution of credit quality seems relatively stable over each of the five sub-periods. There has been a slight upward trend in the use of speculative and non-rated bonds over the sample period. Approximately 40% or all issued bonds and 29% of total proceeds raised were from speculative and non-rated bonds in the 1971 to 1984 sub-period.

[3] The typical classification of short-term vs. long-term debt is different for publicly traded bonds. For bank debt, contracts with less than one year to maturity are usually classified as short-term. For publicly traded debt, the short-term cutoff is typically considered to be five years or fewer.
[4] Credit ratings are based on *Moody's*.

During 2000 to 2004, these bonds made up 55% of total issued bonds and 40% of total proceeds raised through public debt financing.

Table II provides cross-tabulations of debt issue type for all issues during the sample period to examine patterns in the bivariate distribution of debt issues. The table provides observed two-way frequencies, percentages, and the expected frequency of bonds in each category we should observe if the two classifications were independent of each other. Looking first at convertibility and maturity, we see that of the 12,817 straight debt issues, 20.7% are short-term and 79.3% are long-term. Among the convertibles, 18.4% of the bonds are classified as short term. A chi-square test of independence between maturity and convertibility rejects the assumption that maturity and convertibility are unrelated. Specifically, convertible bonds are more likely than nonconvertible bonds to have initial maturities of more than five years.

Convertibility and security level also appear to be correlated, as only four secured bonds in our sample are also convertible. Thus, almost all secured debt issues are straight debt, which seems plausible, since holders of secured, convertible debt would lose their security upon conversion. However, there does not appear to be a significant relation between security level and initial maturity, as the initial maturity of secured bonds appears to have a similar distribution to that of unsecured bonds. In terms of callability, secured bonds appear to be more likely to have a callable feature than unsecured bonds. Slightly more than 80% of the secured bonds in our sample are also callable, compared to 57.3% of the unsecured issues.

One possibly surprising finding is that only 80.8% of convertible bonds in the sample have a callable feature. Convertible bonds are, nonetheless, much more likely to be callable than straight debt issues. In addition, there is a negative relation between initial maturity and callability. The observed frequency of short-term, callable bonds is much lower than that expected if the two categories were independent: 820 of the short-term debt issues are callable, while the expected frequency in this category under independence is 1,750.

III. Univariate Analysis

A Firm Characteristics and Debt Structure

For many reasons, different types of firms tend to issue different types of debt. Table III provides summary statistics for different firm characteristics by type of bond issued to examine how firms differ by size, growth opportunities and financial condition at the time of issuance for various types of bonds.

Since 40% of the firm-fiscal year pairs in the sample have more than one issue during a fiscal year, we assign a given firm-year to a certain type of bond as follows: We define a given firm-fiscal year as convertible if there is at least one convertible bond issued during that year. Out of all firm-years classified as convertibles, 65% had only one issue during that year and 22% had more than one issue where all of them were convertibles.[5] For maturities, we take the weighted average of the initial maturities of all debt issues during that year where the weights are the proceeds raised through each issue. Firm-years with aggregated maturity of less than or equal to 5 years are classified as short term. For the purposes of defining secured debt, we first recode the FISD's codes into numeric codes as follows: subordinate or no classification as 1, junior subordinate as 2, senior subordinate as 3, senior as 4, and senior secured as 5. We take the proceeds-weighted average of the security level and define firm-years with aggregate security level of greater than 4 as secured. Callable firm-years are defined in a similar manner as we did for convertibles. For credit ratings, we first assign numeric codes to Moody's ratings and then take a similar aggregation approach as we did for maturities.

Panel A reports average firm characteristics across the various types of debt issues offered in our sample. The first three columns compare firm-years in which any type of debt was offered to firm-years in which debt was not issued for all firms that had at least one public debt issue during the sample period. The accounting variables for issuing years are as of the fiscal year-end immediately prior to the issue. Firms tend to be larger, have more growth opportunities and better financial performance leading up to the debt issue. For this sample of issuing firms, the average annual stock return for the year just prior to the debt issuance is 26.4%, compared to 19.7% for non-issuing firm-years.[6] Stock return volatility is slightly less prior to issuing years and equity issuance tends to be lower in years when firms issue debt[7].

[5] Since the percentage of convertible firm-years that is mixed with straight debt issues is only 13% of the sample, we expect the noise from these observations to be minimal.

[6] Prior stock returns in this sample of firms are higher than the long-term average of typical stocks for two reasons. First, Table III summarizes characteristics only for firms that have issued public debt and firms tend to issue after periods of

The remaining columns in Panel A summarize differences in firm characteristics across different debt structures. Convertible issuers tend to be smaller, high growth firms with lower leverage ratios and lower fixed asset ratios compared with straight-debt issuers. Convertible issuers also tend to issue after periods of high stock returns and high return volatility. They are also likely to issue equity during the same year. Firms issuing short-term debt appear to be systematically different from firms that issue long-term debt. Short-term issuers tend to be larger, have greater growth opportunities, and hold more cash on their balance sheets. This pattern is consistent with Myers (1977) in that firms with more growth opportunities are more likely to choose short-term debt to avoid potential underinvestment problems.

Firms issuing secured debt appear to be relatively financially distressed. These firms are smaller and have an average leverage to total capital ratio of 0.81. They also have relatively weak cash flows leading up to issuance compared with non-secured issuers. These comparisons are consistent with the idea that debt investors require more security when lending to financially distressed borrowers. Callable issuers are slightly smaller, have higher cash balances, and have experienced higher stock returns in the year prior to debt issuance than non-callable issuers.

Panel B of Table III reports mean firm characteristics by credit quality of the issued bonds. We divide the bonds into five categories according to their ratings: non-rated, C-rated bonds, speculative B-rated bonds, investment grade B-rated bonds, and A-rated bonds. Some clear patterns emerge from Panel B. First, there is a monotonic relationship between firm size and credit rating. Highly rated firms tend to be significantly larger than firms with high-yield ratings. They also tend to have more collateral, measured by the ratio of fixed assets to total assets. High-rated issuers have strong cash flows and lower stock return volatility compared to lower rated issuers. A consistent pattern is that firms issuing investment grade bonds have significantly lower cash holdings as a proportion of total assets than do the issuers of junk bonds. While the direct effect of cash holdings should be to increase credit quality by enhancing the amount and liquidity of collateral to the

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good returns. Second, a large proportion of the debt issues in the sample were issued between the 1996 to 2001 time period, in which the stock market in general had unusually high returns.

[7] Return volatility is calculated as follows: we first take the average of daily squared returns for each firm from the CRSP database. We then take the square root and annualize the volatility by multiplying a factor of the square root of the number of trading days in the year leading up to the bond issuance.

bondholders, an indirect effect appears to be more important: More financially constrained firms hold more cash to mitigate these constraints, as suggested by Almeida, Campello and Weisbach (2004, 2007). These constraints also cause firms to have lower bond ratings, leading to a correlation between cash holdings and bond ratings.

B. Macroeconomic Conditions and Debt Structure

One of the goals of this paper is to determine whether macroeconomic conditions have any effect on the design of public debt issues. As a first pass at this issue, we consider how the relative share of total debt issuance by various bond types changes over the business cycle. We classify economic conditions in two separate ways. The first is based on annual growth rates in US GDP. 'Low Growth' years are defined as years in which the GDP growth rate was less than 2%. 'Medium Growth' years are those with GDP growth between 2% and 3.5%, while 'High Growth' years are those with growth larger than 3.5%. As a second classification, we rely on the NBER business cycle dating, using the NBER measure of when the economy is in a recession or expansion.

Table IV reports the proportion of total bond issuance made up of various types of bonds over different economic conditions. Convertible bonds are relatively more likely to be issued during times of slow economic growth or recessions. During high growth periods, 7.7% of total issuances came from convertibles, increasing to 11.7% during low growth periods. A stronger pattern emerges for the issuance of short-term debt: 9% of all bonds issued during high growth periods were short term, compared to 22.2% during low growth periods. There is a similar pattern if we do the comparison using the NBER-defined recessions as our measure of economic activity.

The strongest correlations between economic conditions and bond types are found in the variation in credit quality across economic conditions. Investment grade bonds make up 44.1% of all issuance during high-growth years, increasing to 68.9% of the total during low growth periods. The results are similar if we look at the NBER expansion/recession classifications. Junk and non-rated bonds account for 51.6% of total debt issuance during economic expansions but only 33.7% of total issuance during recessions. This pattern is

consistent with the idea that perhaps financial constraints are exacerbated during economic recessions, leaving only the highest quality firms with access to public debt markets as suggested by Bernanke and Gertler (1989).

Figure 1 illustrates this pattern in debt issuance. The vertical axis measures the natural logarithm of proceeds raised (in millions of dollars) for each year from 1971 to 2004. Time periods classified as a recession are noted on the chart. This figure illustrates the overall upward trend in the use of public debt financing in all levels of credit quality. It also points out the differential impact of a recession on different types of issues. The quantity of capital raised by low-rated and non-rated debt issues drops significantly during recession periods, while highly-rated bonds remain relatively constant through a recession or even rise in the case of the 1989-1991 recession. It also appears that the volatility of proceeds raised over time is higher for lower-rated bonds than for highly-rated bonds.

C. Univariate Analysis of Post-Issuance Changes in Accounting Variables

Presumably, there are a number of reasons why firms differ in the type of debt securities they offer. We have seen that bond structures are correlated with certain firm characteristics and overall economic conditions. In addition, we consider the hypothesis that the type of debt issued depends on how the funds are expected to be used. Specifically, we conjecture that more equity-like debt such as convertibles and short term debt are more likely to be used for intangible investment such as R&D whereas less equity like debt such as secured debt are more likely to be used to finance tangible investment such as CAPEX.

A difficulty in testing whether the expected uses of funds matter for debt design is that we cannot directly observe management's investment plans at the time of issuance. While firms typically are required to disclose the purpose for the debt issue in the prospectus, the description of 'general purpose' is most common and does not help us identify whether the firm is going to invest in physical assets or R&D. We proxy for the intended uses of funds from a debt issue by estimating the actual uses of the funds raised in the issue during the two years following the debt issue. This approach presumes that the realized post-issuance expenditures reflect management's investment plans prior to issuance.

To minimize the impact of outliers, we focus on a logarithmic transformation of CAPEX and R&D. Since these are flow variables, we consider the log of one plus the *accumulation* in each variable since the issue, normalized by total assets prior to the issue: $\ln[(\sum_{i=1}^{t} V_i / \text{total assets}_0) + 1]$, where V is the variable being measured, and years are normalized so that year 0 is the fiscal year end just prior to the issue and year t denotes number of years after year 0.[8] The resulting distribution of each variable is more symmetric than it is without the transformation.

Table V reports the means and medians of this normalized increase for capital expenditures and R&D, broken down by debt issue type. Also included are t-statistics for comparisons of means between the various types of debt issues in the sample, as well as Mann-Whitney z-statistics for comparing medians. The first row compares changes in capital expenditures and R&D over the two years after issuance for issuing firm-years compared to non-issuing firm years. Capital expenditures are higher following a debt issue, but expenditures on R&D tend to be higher when debt is not issued, suggesting that a substantial quantity of R&D may be financed by equity or retained earnings.

The remainder of Table V compares post-issuance capital expenditures and R&D expenses for different types of debt issues. Consistent with the uses of funds hypothesis, R&D expenditures are significantly higher for firms issuing convertibles relative to firms issuing straight debt. Capital expenditures are higher after long-term debt issuance, while R&D expenditures are higher following short-term issues. Post-issuance R&D expenditures for secured debt issuers are significantly lower than those following unsecured issues. Capital expenditures are slightly higher following callable issues, but R&D expenses are statistically indistinguishable between callable and non-callable debt. Lower-rated firms tend to have higher levels of capital expenditures than highly rated firms. Finally, post-issuance R&D expenses appear to be similar across the credit ratings spectrum with the notable exception of non-rated issues, which have significantly higher post-issuance R&D than the others.

[8] R&D values are often missing in Compustat. As is typical in the previous literature, we assume that firms that do not report values for R&D actually do small quantities of R&D in their firms, so we replaced missing R&D values with zeros. We have repeated the subsequent analysis treating these values as missing, and found very similar results.

IV. Multivariate Analysis of Debt Structure Choice

The univariate results are suggestive of the hypothesis that firm and project characteristics as well as macroeconomic conditions help explain the design of debt contracts. We now utilize an econometric approach that permits us to examine the effect of these potential factors in a multivariate context.

A. Specification

We employ multivariate discrete-choice models to estimate the impact of various firm and economic characteristics on the choice of securities offered. The econometric modeling is complicated by the fact that when it issues debt, a firm is making a number of decisions simultaneously. First, the firm decides whether or not to issue a debt security in a given year. Then, given the decision to issue a corporate bond, the firm decides how to structure the issue in terms of maturity, convertibility, security, and callability, among other characteristics. Because of this issue, when we estimate the probability of using a particular type of debt, we explicitly model the probability of issuing that type, conditional on the firm having chosen to issue debt that year. The general specification for our analysis has the form:

$$\Pr(Y = j \mid \text{Debt Issue}) = F(\text{Firm Characteristics}_{it}, \text{Economy}_t) \qquad (1)$$

where j = 0, 1, 2,… indicates the type of debt being issued, F is a cumulative distribution function, whose arguments consist of current firm characteristics and economic conditions at the time of issuance. Firm characteristics include firm size, leverage, market-to-book ratio, fixed asset ratio, cash flow, and cash holdings scaled by total assets. We also control for the net issuance of equity, since other sources of funds may enter the firm during the same year as the debt issuance. Economic conditions are captured by a recession dummy variable that takes the value of one during any time period designated by the NBER as being in a recession. Year effects are added to control for year-specific characteristics such as the general level of interest rates in the economy. We also include a measure of the slope of the yield curve, measured as the difference between the yield on 10-year maturity treasury bonds and the yield on 1-year maturity treasury bonds. The variability in interest rates is measured as the monthly standard deviation of yields on 1-year maturity treasury bonds over

a given year. Industry effects are included in most specifications. All firm variables, except the dummy variables, are standardized to have zero mean and unit variance. As such, the estimated marginal effects will reflect expected changes in the probability of choosing one type of debt over the other given a one standard deviation change in the particular explanatory variable. The estimates for the recession dummy variable represent the change in predicted probabilities if the economy goes from an expansion to a recession. Only firm age, slope of the yield curve, and interest rate volatility remain in their original units.

We estimate equation (1) using a probit model with an explicit correction for selection. This method assumes that the underlying relation between debt structure and various explanatory variables is:

$$y_j = x_j \beta + \varepsilon_{1j},$$

where y_j indexes various debt features. However, y_j is only observed if the firm chooses to issue a corporate bond. A selection equation is specified in which the firm first chooses whether or not to issue a corporate bond. The selection equation is generally specified such that a firm chooses to issue a bond if

$$z_j \gamma + \varepsilon_{2j} > 0,$$

where $\varepsilon_1 \sim N(0, \sigma)$ and $\varepsilon_2 \sim N(0,1)$, with $corr(\varepsilon_1, \varepsilon_2) = \rho$. The two equations are estimated jointly by maximum likelihood.[9]

B. Convertibility

The first two columns of Table VI present the estimation results for the choice between convertible and straight debt. These results confirm that convertible issuers tend to be smaller firms with relatively low leverage ratios. Convertibles tend to be issued by firms with high market-to-book ratios, consistent with the idea that growth firms tend to choose convertible bonds to help avoid potential agency conflicts between bondholders and shareholders. These results are also consistent with the predictions of Stein's (1992) model of

[9] For more details on this estimation procedure, see Greene (2002) pages 930-933. In an earlier draft, we have also estimated equation (1) using a multinomial logit approach, as well as a conditional logit that include firm fixed effects. The results using these alternative approaches are similar to those discussed below, and they are available from the authors on request.

'back-door' equity financing, in which relatively smaller firms issue convertibles to minimize the information-induced pricing impact from issuing equity.

Controlling for firm characteristics, high prior stock returns do not significantly increase the probability of issuing a convertible bond. This finding is counter to the common argument that convertible bond issuance follows a market-timing pattern similar to that in equity issues. Unconditionally, firms tend to issue convertible debt after periods of high returns. However, once we condition on the issuance of some kind of public debt issue, prior returns do not have significant predictive power in explaining the choice between convertible and straight debt in our sample.

Conditional on the decision to issue debt, firms are more likely to issue convertible debt during times of recession. Controlling for firm characteristics, the occurrence of a recession increases the predicted probability that a firm will choose a convertible issue by almost 17%. While convertibles are relatively information sensitive compared to other debt issues, they are often claimed by practitioners to be a substitute for equity rather than debt. This finding can be interpreted in the context of the Bernanke and Gertler model as suggesting that firms substitute away from equity towards convertibles to avoid the information problems exacerbated by the recession.

The second column in Table VI presents the marginal effects when we include a measure of the slope of the yield curve, as defined by the difference between the yield on 10-year and 1-year treasury securities during the year of the issue. Including this year-specific variable requires us to omit the year fixed-effects that were included in the first specification. We find some evidence that firms are more likely to issue convertibles when the yield curve is upward sloping. Specifically, an increase of 1% (100 basis points) in the slope of the yield curve increases the expected probability of issuing a convertible by 10.4%.

C. Maturity

The third and fourth columns of Table VI report the estimates for the choice between short- and long-term debt issues. Consistent with the Diamond (1991) liquidity risk arguments, we find that short-term debt issuers tend to be larger, have lower debt levels, stronger growth opportunities, and more cash on the balance sheet than firms that choose to issue long-term debt. The large effect of growth opportunities, as measured by

the market-to-book ratio, is also consistent with Myers (1977) and Barnea, Haugen and Senbet (1980), in which firms with better growth opportunities issue on shorter term maturities to help minimize potential agency conflicts. Specifically, a one standard deviation increase in the market-to-book ratio increases the predicted probability of a short-term issue by 3.1%. The results are also largely consistent with Flannery (1986) in that short-term debt issuers seem to be of better quality than long-term debt issuers.

In terms of economic conditions, we find that firms are more likely to issue short-term debt during a recession. The model predicts that, conditional on issuance, a recession increases the probability that a firm issues a short-term bond by 4.9%. This finding is consistent with the view that firms substitute away from longer-term debt toward less information-sensitive short-term debt when financial conditions become more difficult.

The fourth column of Table VI reports results that include a measure of the slope of the yield curve (and hence necessarily omit the year effects). These estimates suggest that firms are less likely to issue on the short end of the maturity spectrum when the yield curve is upward sloping. The marginal effect suggests that an increase in the slope of 100 basis points decreases the probability that a firm issues a short-term security by 3.1%. This finding is counter to the common wisdom that firms adjust the maturity of their bond offering to minimize interest payments because of variations in the yield curve.

D. Security Level

The fifth and sixth columns of Table VI report the results of the binary choice models when the firm is choosing between secured and unsecured debt. We find evidence consistent with the 'banking' view of secured debt (Berger and Udell (1990)), in which poor quality firms have little choice but to issue secured debt as investors are more likely to require direct collateral when the firm is nearing bankruptcy. These results are in contrast with the 'corporate finance' view, in which high quality firms issue secured debt to avoid underinvestment problems associated with the priority of existing debt claims (Stulz and Johnson (1985), Smith and Warner (1979), and Berkovitch and Kim (1990)). In particular, we find that firms issuing secured debt tend to be smaller and much more highly levered than unsecured issuers. Firms also tend to issue secured debt after periods of low cash flows and stock returns. Additionally, our results suggest that firms tend to issue

secured debt when growth options are low. The estimated parameters imply that a one-standard deviation increase in the market-to-book ratio decreases the predicted probability of issuing secured debt over unsecured debt by 2.1%. Finally, it does not appear that a recession affects the probability of a firm's issuing secured debt.

E. Callability

The final two columns of Table VI summarize the estimation results for the choice between callable and non-callable debt.[10] The leading explanations for why firms issue callable debt are to mitigate agency costs (Barnea, Haugen and Senbet (1980)) and to hedge against interest rate risk (Guntay, Prabhala and Unal (2002). We find no evidence consistent with the view that firms issue callable debt to hedge against underinvestment risk, as suggested by Barnea, Haugen and Senbet (1980). Specifically, firms that issue callable debt do not have significantly different market-to-book ratios relative to firms issuing straight debt.

In contrast, our results are consistent with the view that firms use call provisions to hedge against potential interest rate movements. We find that callable issuers tend to be smaller, lower-levered firms, consistent with the arguments of Guntay, Prabhala and Unal (2002), who suggest that it is precisely the smaller firms which are most likely to hedge against interest rate risk using call provisions. In addition, the last column of Table VII confirms that firms tend to issue callable debt during periods of high interest rate volatility, again consistent with the hedging motive.

In addition, we find that a recession lowers the likelihood that a firm issues a callable bond. While this finding might seem somewhat counterintuitive, it makes sense when considered in the Bernanke and Gertler framework, in which a recession increases the costs of issuing information-sensitive securities. Since the firm, who holds call option on a callable bond, has the information advantage over the purchaser, callability is likely to increase the information sensitivity of a security. Thus the finding that callable bonds are less likely to be issued in recessions is consistent with the hypothesis that financial downturns lower the information-sensitivity of securities that are issued.

[10] Because most convertible bonds are also callable, we eliminate these bonds from the sample when we estimate this equation.

V. Multivariate Analysis of the Determinants of Credit Quality

In addition to the features of the bonds, we are also interested in the factors that affect the quality of the bond. Consequently, we estimate equations predicting the bond's quality, measured by its rating. We estimate these equations using a multinomial logit setup, in which the dependent variable has five levels of credit quality: non-rated, C-rated, speculative B-rated, investment grade B-rated, and A-rated bonds. The baseline corresponds to the firm choosing not to issue any kind of debt.[11]

Table VII reports coefficient estimates from equations predicting the credit quality of a firm's bond issue. Some of the results are not particularly surprising. For example, larger firms are much more likely to issue high-rated debt. The relation between the effects of size on the probability of issuing high quality debt is monotonic across credit rating groups. In addition, firms with higher growth opportunities and stronger cash flows are also more likely to issue investment grade debt. Finally, lower return volatility increases the probability of issuing a highly-rated bond.

A somewhat counterintuitive finding is the strong negative relation between cash holdings and the probability of issuing investment grade debt. This finding is consistent with the logic of Almeida, Campello and Weisbach (2004, 2007), who argue that more financially constrained firms are likely to save a higher percentage of cash from their cash flows. Since firms with low bond ratings are more likely to face financial constraints, they will tend to save more cash, leading to a negative relation between firms' cash holdings and the ratings of the bonds they issue.

The other striking finding from Table VII concerns the impact of recessions on bond ratings. The estimates in this table clearly indicate that a recession increases the quality of bonds that are issued. Consistent with the commonly discussed arguments of practitioners, during bad economic times, poor quality borrowers appear to be shut out of the bond market, so that the only bonds that are issued during poor economic times are

[11] An alternative specification would be an ordered probit, which would take advantage of the natural ordering of the bond ratings. We do not use this approach because it would not be clear to us where non-rated debt would fall into this ordering.

highly rated. In other words, the fact that the quality of bonds issued is strongly countercyclical is evidence consistent with the view that financial constraints are exacerbated during recessions.

There are measurement issues that potentially affect the interpretation of this result. One is simply the definition of a recession. Therefore, in separate regressions (not reported), we replace the 'recession dummy' with GDP growth and the number of months in a given year designated as being in a recession.[12] The results are similar to the ones reported in Table VII. Another possibility is that the result is being driven by the decline of the bond market in the early 1990s, which coincided with a recession. To examine this possibility, we reestimate this equation excluding the 1989 to 1992 time period; these estimates imply an effect of recessions on security issuances essentially the same as those reported in Table VII. Overall, the result that firms are more likely to issue high quality debt during recessions appears to be robust to measurement issues.

VI. The Effect of Debt Issuance on Post Issuance Investment Expenditures

Finally, we examine the extent to which different kinds of bonds are used for different purposes, explicitly taking into account the amount of funds raised in the offering. We do so because a number of theories of security issuance relate the type of security issued to the assets that are purchased with its proceeds. To evaluate these theories, we estimate the effect of bond issuances on subsequent potential uses of the capital.

A. Estimates of Uses of Funds of Different types of Debt

We use an approach similar to that used by Kim and Weisbach (2008), who estimate the uses of the proceeds from a large sample of equity offerings. This approach allows us to estimate the dollar change in various uses of funds given a one dollar increase in debt financing. In particular, we estimate the effect of new funds raised by the issuance of a particular type of debt on the measures of increases in CAPEX and R&D discussed in Section III. We also examine the effect on changes in cash holdings. Since cash is a balance sheet item and hence a stock variable, we calculate the log of one plus the *change* in the variable normalized by total

[12] These estimates are available upon request.

assets prior to the debt issue: $\ln[((V_t - V_0)/\text{total assets}_0) + 1]$. Specifically, we use the following specification:

$$
\begin{aligned}
Y = {} & \beta_1 \ln\left[\left(\frac{\text{debt issue}}{\text{total assets}_0}\right)+1\right] + \beta_2 \ln\left[\left(\frac{\text{debt issue}}{\text{total assets}_0}\right)+1\right] \times debt\_type\_dummy \\
& + \beta_3 \ln\left[\left(\frac{\text{other sources}}{\text{total assets}_0}\right)+1\right] + \beta_4 \ln\left[\left(\frac{\text{other sources}}{\text{total assets}_0}\right)+1\right] \times debt\_type\_dummy \\
& + \beta_5 \times debt\_type\_dummy + \beta_6 \ln[\text{total assets}_0] \\
& + \sum_{i=1971}^{2004} \theta_i year\_dummy + \sum_{j=0}^{21} \lambda_j credit\_ratings\_dummy + \sum_{k=1}^{38} \gamma_k industry\_dummy + \varepsilon \quad (2)
\end{aligned}
$$

where $Y = \ln[((V_t - V_0)/\text{total assets}_0) + 1]$ for V = cash holdings

$= \ln[(\sum_{i=1}^{t} V_i / \text{total assets}_0) + 1]$ for V = capital expenditure or R&D ,

other sources = $\sum_{i=1}^{t} \text{total sources of funds}_i - \text{debt issue}$

and t = 1 or 4 years after the debt issue. Total sources of funds include internally generated cash flows from the firm's continuing operations as well as other sources of funds from investment and financing activities.[13] *debt_type_dummy* represents dummy for convertibles, dummy for short term bonds, dummy for secured debt, or dummy for callable debt depending on the categorization being used. We then estimate the dollar changes in the various uses of funds implied by the regression coefficients for one and four years following the debt issue, following Kim and Weisbach (2008).[14]

Table VIII reports estimates of equation (2), omitting β_3 through β_6 and the year, credit rating, and industry fixed effects from the table for the sake of brevity. Panel A summarizes the results, breaking down

[13] Specifically, total sources of funds is the sum of funds from operations, sale of property, plant and equipment, long term debt issuances, and sale of common and preferred stock.

[14] The calculations are based on a median-sized firm in the sample. Year, industry, and credit ratings fixed effects are for 1998, two digit SIC code 48 (communications), and Aaa rated debt.. For example, the dollar changes in CAPEX for t = 1 following convertible issue is calculated as follows: Median debt amount is 200, median total sources are 363.028 and median total assets prior to the debt issue are 1,412.532 (All units are in $US million). The estimated coefficients not reported in table IX are as follows; β_3 = .0804828, β_4 = -.0442473, β_5 = .0471107 , β_6 = .0013864, and the constant term reflecting 1998 and SIC 48 fixed effects is .0635309. Using these numbers together with coefficients from Table IX yields .12880058 as the predicted value of the log transformation, implying a predicted change of 194.17126 in CAPEX. Then we add one to median debt amount (as well as total sources) and repeat the above procedure, which results in a predicted change of 194.27808 in CAPEX. The difference in the two predicted changes represents the dollar changes in CAPEX for one unit increase in debt amount, which equals 0.107.

firms between issuers of convertible bonds to those of straight bonds. The estimates imply that convertible issuers spend much less on capital expenditures than do issuers of straight bonds. We estimate that convertible issuers spend $.11 in capital expenditures for each dollar in debt financing in the first year following issuance, and $.20 per dollar after four years, compared to $.21 after one year and $.50 after four years for straight debt issuers. In contrast, firms issuing convertible debt tend to allocate more towards R&D financing and cash holdings than do straight debt issuers; per dollar raised, convertible issuers spend $.13 per dollar raised in the first year and $.50 over the four year period on R&D, compared to less than $.01 for straight debt issuers. In addition, convertible bond issuers save much more of the capital they raise as cash than do straight bond issuers; per dollar raised, convertible bond issuers save $.42 in the first year and $.25 over a four year period compared to $.20 and $.11 for straight bond issuers.

A number of theories of convertible bonds (Stein (1992) and Mayers (1998)) suggest that they will be used to finance the same type of investments as equity. Hence, for comparison purposes, we present in Panel E estimates of similar equations for seasoned equity offerings taken from Kim and Weisbach (2008). The estimates for SEOs are very close to those for convertible bonds: For CAPEX, firms spend $.08 in the first year and $.19 over four years out of a dollar raised in an SEO compared to $.11 in the first year and $.20 over four years for a dollar raised in a convertible. For R&D, firms spend $.18 in the first year and $.64 over four years out of a dollar raised in an SEO compared to $.13 in the first year and $.50 over four years for a dollar raised in a convertible. Finally, cash holdings increase by $.53 in the first year and $.32 over four years out of a dollar raised in an SEO compared to $.42 in the first year and $.25 over four years for a dollar raised in a convertible. It appears from these estimates that firms' uses of cash raised in convertible bond offerings is remarkably similar to the uses of the cash raised in an SEO.

Panel B summarizes the estimated uses of fund for issuers of different maturity debt. We see evidence of "maturity matching" (Myers (1977), Diamond (1991) and Hart and Moore (1994)) with long-term issuers increasing capital expenditures by $.19 and $.47 per dollar of debt raised in one and four years after issuance, compared to $.11 and -$.13 for short-term issues. Like convertibles, larger shares of short-term debt issuance tend to go to R&D expenditures and increases in cash holdings.

Panel C reports the results for the secured debt sample. These results imply that secured debt issuers utilize less of the funds they raise in R&D compared to unsecured issuers. Finally, Panel D summarizes the implied dollar changes in uses of funds following the issuance of callable debt. Callable debt issues are more likely to finance CAPEX over a longer period, but more likely to be held as cash over a shorter period.

Overall, the results suggest that firms do use different kinds of securities for different purposes. Convertible bonds are more 'equity-like', and consistent with the arguments of Mayers (1998) and Stein (1992), issuers of convertible bonds are more likely make similar types of investments as issuers of equity. In contrast, issuers of straight debt are more likely to make capital expenditures. In addition, there appears to be evidence of 'maturity matching'; issuers of long-term debt are more likely to make capital expenditures while shorter-term debt issuers are more likely to increase R&D.

B. Within Firm vs. Across Firm Interpretations

An interesting issue is the extent to which these findings reflect differences in the firms issuing the securities, or whether they reflect the particular projects undertaken by these firms. This issue is important, since different kinds of firms tend to issue different kinds of debt, and also are likely to make different kinds of investments. To evaluate this possibility, we reestimate Equation (2) with the addition of firm fixed effects. The fixed firm effects dramatically reduce the power of our tests, since they require us to utilize only firms that make more than one debt issue in our sample period, but, at least to the extent that firm characteristics are constant over time, do control for these characteristics. Results that hold both with and without firm effects are likely attributable to particular projects financed by the debt issue in question, while results that hold without firm effects but go away when fixed effects are added likely occur because of firm-specific factors that do not vary with particular investments.

We estimate the following model:

$$
\begin{aligned}
Y = {} & \beta_1 \ln\left[\left(\frac{\text{debt issue}}{\text{total assets}_0}\right)+1\right] + \beta_2 \ln\left[\left(\frac{\text{debt issue}}{\text{total assets}_0}\right)+1\right] \times debt\_type\_dummy \\
& + \beta_3 \ln\left[\left(\frac{\text{other sources}}{\text{total assets}_0}\right)+1\right] + \beta_4 \ln\left[\left(\frac{\text{other sources}}{\text{total assets}_0}\right)+1\right] \times debt\_type\_dummy \\
& + \beta_5 \times debt\_type\_dummy + \beta_6 \ln\left[\text{total assets}_0\right] + \beta_7 credit\_ratings \\
& + \sum_{i=1971}^{2004} \theta_i year\_dummy + \text{firm fixed effects} + \varepsilon \qquad (3)
\end{aligned}
$$

Table IX contains estimates of this equation.[15] The results comparing convertible vs. straight (nonconvertible) bonds again suggest that convertible bonds are more likely to be used to finance R&D and be held in cash, while straight bonds are more likely to be used to finance capital expenditures (at least when measured over the four-year window). These results suggest that firms finance particular projects according to their characteristics, with R&D more likely to be financed with convertibles and capital expenditures with straight debt.

The results on maturity are slightly ambiguous. Although they are not statistically significant, the point estimates indicate that long-term debt is more likely to be used to finance capital expenditures. Short-term debts are more likely to finance R&D over one-year period, but are not statistically different over four-year period. It seems likely that the effect of maturity structure on investments is partly driven by differences across firms, and partly by differences in particular projects within firms.

VII. Conclusion

Debt securities vary in many ways, including maturity, seniority, convertibility, callability, as well as the overall quality of the issue. There has been much theoretical work proposing reasons for the choice among characteristics of debt securities. Yet, there has been little empirical work studying the extent to which these theories reflect real-world issuance decisions.

[15] In this specification, we have replaced industry and credit ratings fixed effects with the firm fixed effect and non-binary credit ratings. We assign a value of zero for non-rated debt, one for C rated debt, two for Ca rated debt, and so on. The highest rated debt, Aaa, corresponds to 21.

This paper uses a large sample of U.S. public debt issues and examines the factors that lead firms to issue different kinds of debt. It has two main goals. First, it establishes a set of stylized facts about the use of various types of debt securities, how debt provisions are used with one another, and how these practices have changed over time. Second, it considers the question of why firms use different kinds of debt. We propose that there are three types of factors that potentially affect the choice of debt securities; firm characteristics, economic conditions, and the characteristics of planned investment projects.

We find that all three types of factors affect the structure of debt securities. We have a number of empirical results, which are summarized in Table X. This table indicates that small, growth-oriented firms with large R&D expenditures are more likely to issue convertible or short-term debt, while large, established firms with large investment in fixed assets are more likely to issue long-term, straight debt. In addition, recessions appear to exacerbate financial constraints in that controlling for other determinants of credit quality, firms are more likely to issue highly-rated debt during a recession.

A novel contribution of this paper is to relate post-issuance expenditures on various uses of funds to test theories suggesting that the characteristics of the firm's marginal investment opportunities have implications for the type of debt the firm will choose to issue. When a firm acquires fixed assets with steady expected cash flow streams, firms will have a tendency to issue relatively long-term, senior debt. When intangible assets are acquired, especially those with option-like payoffs, the firm is more likely to issue relatively short-term convertible debt securities.

Most theories of security design relate the security's characteristics to the nature of the projects that they finance. Yet, to our knowledge, this is the first paper to link empirically variation in debt financing with various types of investment spending. Clearly, there is much more work to be done. For example, a large fraction of investments are financed through bank or other private debt, but our sample only considers public debt issues. Future research empirically linking other types of financing choices to the uses of the funds raised is likely to be fruitful.

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Table I
Sample Descriptive Statistics

The sample includes all public debt issued in US by non-financial firms between 1971 and 2004. We divide the sample into 5 sub-periods. The first row in each sub-period presents the means and the second row provides the relative proportions in each category for each sub period. Debt issues with an initial maturity of five years or fewer are defined as short term. Panel A reports the number of debt issues by type, Panel B reports total dollar amounts raised in $US billions, Panel C reports number of issues scaled by average number of non-financial firms in Compustat, and Panel D reports total proceeds scaled by total liabilities of non-financial firms in Compustat.

		Panel A: Number of Debt Issues by Type												
sub period	Total	Convertible		Maturity		Secured		Callable		Quality				
	Number	No	Yes	Long	Short	No	Yes	Yes	No	Non Rated	C to Caa1	B3 to Ba1	Baa1	A3 to Aaa
1971-84	947	864	83	947	0	909	38	789	158	171	48	157	120	451
		(91)	(9)	(100)	0	(96)	(4)	(83)	(17)	(18)	(5)	(17)	(13)	(48)
1985-89	1,570	1,317	253	1,438	132	1,530	40	1,121	499	286	144	385	311	444
		(84)	(16)	(92)	(8)	(97)	(3)	(71)	(29)	(18)	(9)	(25)	(20)	(28)
1990-94	3,041	2,820	221	2,563	478	2,972	69	846	2,195	400	123	679	698	1,141
		(93)	(7)	(84)	(16)	(98)	(2)	(28)	(72)	(13)	(4)	(22)	(23)	(38)
1995-99	4,811	4,417	394	3,736	1,075	4,699	112	2,578	2,233	945	274	1,205	985	1,402
		(92)	(8)	(78)	(22)	(98)	(2)	(54)	(46)	(20)	(6)	(25)	(20)	(29)
2000-04	4,498	3,403	1,095	3,156	1,342	4,353	145	3,268	1,233	968	163	1,302	867	1,198
		(76)	(24)	(70)	(30)	(97)	(3)	(73)	(27)	(22)	(4)	(29)	(19)	(27)
Total	14,867	12,821	2,046	11,840	3,027	14,463	404	8,602	6,318	2,770	752	3,728	2,981	4,636
		(86)	(14)	(80)	(20)	(97)	(3)	(60)	(40)	(19)	(5)	(25)	(20)	(31)

		Panel B: Total Proceeds by Type($US bil.)												
sub period	Total	Convertible		Maturity		Secured		Callable		Quality				
	Amount	No	Yes	Long	Short	No	Yes	Yes	No	Non Rated	C to Caa1	B3 to Ba1	Baa3 to Baa1	A3 to Aaa
1971-84	97.9	92.8	5.0	97.9	0.0	95.1	2.8	91.0	6.9	10.5	3.6	13.3	15.2	55.3
		(95)	(5)	(100)	0	(97)	(3)	(93)	(7)	(11)	(4)	(14)	(16)	(56)
1985-89	230.1	200.7	29.5	210.3	19.8	226.3	3.8	165.9	64.2	30.8	15.6	65.1	51.2	67.4
		(87)	(13)	(91)	(9)	(98)	(2)	(72)	(28)	(13)	(7)	(28)	(22)	(29)
1990-94	344.9	296.5	48.4	295.6	49.3	334.3	10.6	135.8	209.0	50.0	11.7	84.3	82.9	116.0
		(86)	(14)	(86)	(14)	(97)	(3)	(39)	(61)	(14)	(3)	(24)	(24)	(34)
1995-99	985.9	891.5	94.4	784.9	201.0	961.0	24.9	594.4	391.5	246.9	63.8	257.4	208.7	209.2
		(90)	(10)	(80)	(20)	(97)	(3)	(60)	(40)	(25)	(6)	(26)	(21)	(21)
2000-04	2,002.7	1,627.5	375.2	1,223.4	779.3	1,971.6	31.1	1,127.5	871.4	362.5	41.0	399.6	397.4	802.1
		(81)	(19)	(61)	(39)	(98)	(2)	(56)	(44)	(18)	(2)	(20)	(20)	(40)
Total	3,661.4	3,109.0	552.4	2,612.0	1,049.4	3,588.3	73.1	2,114.6	1,543.0	700.6	135.6	819.7	755.5	1,250.1
		(85)	(15)	(71)	(29)	(98)	(2)	(58)	(42)	(19)	(4)	(22)	(21)	(34)

Table I, continued

sub period	Scaled Figures	Panel C: Number of Debt Issues by Type (Scaled by Number of Non-Financial Firms in Compustat, averages of annual numbers within each subperiod)												
		Convertible		Maturity		Secured		Callable		Quality				
		No	Yes	Long	Short	No	Yes	Yes	No	Non Rated	C to Caa1	B3 to Ba1	Baa3 to Baa1	A3 to Aaa
1971-74	0.024	0.022	0.002	0.024	0.000	0.024	0.000	0.022	0.002	0.003	0.001	0.004	0.004	0.013
		(93)	(7)	(100)	0	(99)	(1)	(93)	(7)	(11)	(4)	(15)	(15)	(54)
1975-79	0.046	0.045	0.001	0.046	0.000	0.042	0.004	0.043	0.003	0.008	0.002	0.006	0.006	0.024
		(98)	(2)	(100)	0	(91)	(9)	(92)	(8)	(17)	(5)	(13)	(13)	(52)
1980-84	0.105	0.093	0.013	0.105	0.000	0.103	0.003	0.082	0.023	0.021	0.006	0.019	0.013	0.047
		(88)	(12)	(100)	0	(97)	(3)	(78)	(22)	(20)	(5)	(18)	(12)	(45)
1985-89	0.240	0.201	0.039	0.220	0.020	0.234	0.006	0.171	0.069	0.044	0.022	0.059	0.048	0.068
		(84)	(16)	(92)	(8)	(97)	(3)	(71)	(29)	(18)	(9)	(25)	(20)	(28)
1990-94	0.436	0.404	0.032	0.367	0.068	0.426	0.010	0.121	0.314	0.057	0.018	0.097	0.100	0.163
		(93)	(7)	(84)	(16)	(98)	(2)	(28)	(72)	(13)	(4)	(22)	(23)	(38)
1995-99	0.554	0.509	0.045	0.431	0.124	0.542	0.013	0.297	0.257	0.109	0.032	0.139	0.114	0.162
		(92)	(8)	(78)	(22)	(98)	(2)	(54)	(46)	(20)	(6)	(25)	(20)	(29)
2000-04	0.604	0.457	0.147	0.423	0.180	0.584	0.019	0.439	0.165	0.130	0.022	0.175	0.116	0.161
		(76)	(24)	(70)	(30)	(97)	(3)	(73)	(27)	(22)	(4)	(29)	(19)	(27)
Total	2.296	1.980	0.316	1.828	0.467	2.233	0.062	1.329	0.967	0.428	0.116	0.576	0.460	0.716
		(86)	(14)	(80)	(20)	(97)	(3)	(58)	(42)	(19)	(5)	(25)	(20)	(31)

sub period	Scaled Figures	Panel D: Total Proceeds by Type (Scaled by Total Liabilities of Non-Financial Firms in Compustat, averages of annual numbers within each subperiod)												
		Convertible		Maturity		Secured		Callable		Quality				
		No	Yes	Long	Short	No	Yes	Yes	No	Non Rated	C to Caa1	B3 to Ba1	Baa3 to Baa1	A3 to Aaa
1971-74	0.013	0.013	0.001	0.013	0.000	0.013	0.000	0.013	0.000	0.001	0.000	0.001	0.001	0.009
		(96)	(4)	(100)	0	(99)	(1)	(97)	(3)	(5)	(3)	(11)	(10)	(71)
1975-79	0.020	0.020	0.000	0.020	0.000	0.019	0.001	0.020	0.001	0.002	0.001	0.002	0.003	0.014
		(99)	(1)	(100)	0	(96)	(4)	(97)	(3)	(8)	(3)	(8)	(13)	(67)
1980-84	0.027	0.025	0.002	0.027	0.000	0.027	0.001	0.025	0.003	0.003	0.001	0.004	0.005	0.014
		(93)	(7)	(100)	0	(97)	(3)	(91)	(9)	(13)	(4)	(16)	(17)	(50)
1985-89	0.061	0.053	0.008	0.056	0.005	0.060	0.001	0.044	0.017	0.008	0.004	0.017	0.014	0.018
		(87)	(13)	(91)	(9)	(98)	(2)	(72)	(28)	(13)	(7)	(28)	(22)	(29)
1990-94	0.058	0.050	0.008	0.050	0.008	0.057	0.002	0.023	0.035	0.008	0.002	0.014	0.014	0.020
		(86)	(14)	(86)	(14)	(97)	(3)	(39)	(61)	(14)	(3)	(24)	(24)	(34)
1995-99	0.113	0.103	0.011	0.090	0.023	0.111	0.003	0.068	0.045	0.028	0.007	0.030	0.024	0.024
		(90)	(10)	(80)	(20)	(97)	(3)	(60)	(40)	(25)	(6)	(26)	(21)	(21)
2000-04	0.158	0.128	0.030	0.096	0.061	0.155	0.002	0.089	0.069	0.029	0.003	0.031	0.031	0.063
		(81)	(19)	(61)	(39)	(98)	(2)	(56)	(44)	(18)	(2)	(20)	(20)	(40)
Total	0.707	0.601	0.107	0.505	0.203	0.693	0.014	0.409	0.298	0.135	0.026	0.158	0.146	0.241
		(85)	(15)	(71)	(29)	(98)	(2)	(58)	(42)	(19)	(4)	(22)	(21)	(34)

Table II
Cross-Tabulation of Debt Issues – 1971 to 2004

This table reports two-way classification tables of US public debt issues by type over the 1971 to 2004 period. Each cross-tabulation contains three statistics; first, the number of bonds falling within each two-way category. Second, we report the percentage of bonds having a particular column characteristic relative to the row total. For example, 20.7% in the 'short-term' column and 'straight' row means that 20.7% of straight bonds are short-term. Third, we report the number of bonds in each category we would expect to observe if the two characteristics were independent. Finally, we include p-values from chi-square tests of independence.

		Short-Term	Long-Term	Secured	Unsecured	Callable	Noncallable	Row Total
Straight	Frequency	2,649	10,168	399	12,418	6,951	5,866	12,817
	Percent	20.7%	79.3%	3.1%	96.9%	54.2%	45.8%	
	Expected Frequency	2,608.25	10,208.75	347.59	12,469.41	7,419.37	5,397.63	
Convertible	Frequency	375	1,668	4	2,039	1,651	392	2,043
	Percent	18.4%	81.6%	0.2%	99.8%	80.8%	19.2%	
	Expected Frequency	415.75	1,627.25	55.41	1,987.59	1,182.63	860.37	
p-value			0.016		0.000		0.000	
Short-Term	Frequency			83	2,941	820	2,204	3,024
	Percent			2.7%	97.3%	27.1%	72.9%	
	Expected Frequency			82.01	2,941.99	1,750.50	1,273.50	
Long-Term	Frequency			320	11,516	7,782	4,054	11,836
	Percent			2.7%	97.3%	65.7%	34.3%	
	Expected Frequency			320.99	11,515.00	6,851.50	4,984.50	
p-value					0.901		0.000	
Secured	Frequency					324	79	403
	Percent					80.4%	19.6%	
	Expected Frequency					233.28	169.72	
Unsecured	Frequency					8,278	6,179	14,457
	Percent					57.3%	42.7%	
	Expected Frequency					8,368.72	6,088.28	
p-value							0.000	
Column Total		3,024	11,836	403	14,457	8,602	6258.000	

Table III
Firm Characteristics

This table presents summary statistics of firm characteristics for firm-years in which various types of bonds were issued in US over the period 1971 to 2004. The sample represents all non-financial firms that issued at least one public debt during the sample period. Return volatility is calculated as follows: we first take the average of daily squared returns for each firm. Then we take the square root and annualize the volatility by multiplying a factor of the square root of the number of trading days in the year leading up to the bond issuance. Boldface numbers indicate statistical differences in means at the 95% confidence level.

Panel A: Firm Characteristics by Issue Type

	All Debt Issues			Convertible			Maturity			Secured			Callable		
	Issuing Years	Non-Issuing Years	Diff.	Yes	No	Diff.	Short	Long	Diff.	Yes	No	Diff.	Yes	No	Diff.
N	6,828	34,755		1,577	5,251		753	6,075		264	6,564		5,070	1,758	
ln[Total Assets]: $US mil	7.074	5.888	**1.186**	6.048	7.382	**-1.334**	7.368	7.038	**0.331**	6.271	7.106	**-0.835**	6.842	7.744	**-0.903**
Leverage	0.634	0.608	**0.026**	0.546	0.661	**-0.115**	0.630	0.635	-0.005	0.810	0.627	**0.183**	0.630	0.645	**-0.015**
Fixed Asset Ratio	0.401	0.362	**0.038**	0.296	0.433	**-0.137**	0.333	0.409	**-0.076**	0.512	0.396	**0.116**	0.394	0.420	**-0.025**
Market-to-Book	2.800	2.268	**0.532**	3.370	2.615	**0.755**	3.718	2.684	**1.033**	2.249	2.816	**-0.567**	2.809	2.773	0.036
Cash	0.092	0.109	**-0.018**	0.192	0.061	**0.131**	0.136	0.086	**0.050**	0.083	0.092	-0.009	0.097	0.075	**0.022**
Cash Flow	0.070	0.064	**0.006**	0.031	0.082	**-0.051**	0.041	0.074	**-0.032**	0.006	0.073	**-0.067**	0.067	0.081	**-0.014**
Prior 12-Month Stock Return	0.264	0.197	**0.067**	0.443	0.205	**0.238**	0.206	0.271	**-0.065**	0.071	0.269	**-0.198**	0.287	0.199	**0.087**
Return Volatility	0.421	0.441	**-0.021**	0.569	0.372	**0.197**	0.506	0.410	**0.096**	0.612	0.416	**0.196**	0.443	0.359	**0.083**
Net Equity Issuance	0.022	0.028	**-0.006**	0.067	0.009	**0.058**	0.024	0.021	0.002	0.037	0.021	0.016	0.026	0.010	**0.016**

Panel B: Firm Characteristics by Issue Credit Quality

	Non-Rated	C to Caa1	B3 to Ba1	Baa3 to Baa1	A	Invest. Grade	Junk Bonds	Diff.
Net Equity Issuance	1,437	671	2,042	1,224	1,454	2,678	2,707	
ln[Total Assets]: $US mil	5.636	6.216	6.789	8.069	8.455	8.278	6.647	**1.631**
Leverage	0.584	0.709	0.679	0.633	0.586	0.607	0.687	**-0.079**
Fixed Asset Ratio	0.311	0.397	0.399	0.435	0.465	0.451	0.399	**0.052**
Market-to-Book	3.102	2.510	2.298	2.794	3.342	3.078	2.348	**0.730**
Cash	0.196	0.098	0.069	0.052	0.052	0.052	0.076	**-0.024**
Cash Flow	0.013	0.031	0.072	0.100	0.118	0.109	0.062	**0.048**
Prior 12-Month Stock Return	0.361	0.390	0.287	0.184	0.160	0.172	0.311	**-0.139**
Return Volatility	0.584	0.533	0.444	0.325	0.274	0.299	0.465	**-0.166**
Net Equity Issuance	0.066	0.046	0.019	-0.005	-0.008	-0.006	0.026	**-0.032**

*Differences shown in bold face type are significantly different from zero at the 95% confidence level.

Table IV

Macroeconomic Conditions and Debt Design

This table summarizes the proportion of total debt proceeds by bond characteristics over various states of the economy. High GDP growth is defined as years in which GDP growth exceeded 3.5%. Medium growth is defined as years in which the GDP growth rate was between 2% and 3.5%. Low growth is defined as years in which the annual rate of GDP growth was less than 2%. Time periods are classified as being in either an expansion or a recession based on NBER business cycle dating procedures. The sample period is from 1971 to 2004.

	Proportion of Total Proceeds Raised			Proportion of Total Proceeds Raised	
GDP Growth	High Growth	Medium Growth	Low Growth	Expansion	Recession
Issue Characteristics					
Convertibility					
Straight	0.923	0.888	0.883	0.887	0.871
Convertible	0.077	0.112	0.117	0.116	0.129
Security Level					
Secured	0.030	0.046	0.037	0.038	0.012
Unsecured	0.970	0.954	0.963	0.962	0.988
Maturity					
Less than 5 Years	0.090	0.119	0.222	0.191	0.311
More than 5 Years	0.910	0.881	0.778	0.809	0.689
Callability					
Callable	0.628	0.534	0.609	0.574	0.623
Noncallable	0.372	0.466	0.391	0.426	0.377
Credit Quality					
Investment Grade	0.441	0.511	0.689	0.481	0.662
Junk	0.352	0.330	0.189	0.327	0.236
Not Rated	0.194	0.147	0.116	0.189	0.101

Table V
Project Characteristics and Types of Debt Issues

This table presents summary statistics for post-issuance capital expenditures and R&D expenditures by issue type. The expenditure variables are calculated as the natural logarithm of the sum of the respective expenditure over the two years following the debt issuance, scaled by total assets. Test statistics for testing differences in the mean and median expenditure amounts across bond types are included. Differences shown in bold face type are significantly different from zero at the 95% confidence level. The sample period is from 1971 to 2004.

			ln[(CAP EX over next 2 years / Total Assets)+1]			ln[(R & D over next 2 years / Total Assets)+1]		
			N	mean	median	N	mean	median
Non Issuing Firm-Years			32,316	0.19	0.13	17,074	0.12	0.05
Debt Issuing Firm-Years			6,150	0.20	0.14	3,186	0.09	0.04
testting the difference	t-stat/z-stat			**4.09**	**5.55**		**-7.86**	**-7.04**
		Straight	4,839	0.20	0.14	2,382	0.05	0.03
		Convertibles	1,311	0.22	0.14	804	0.18	0.11
	testing the difference	t-stat/z-stat		**2.78**	0.31		**25.01**	**15.81**
		Long Term	5,501	0.21	0.14	2,788	0.08	0.04
		Short Term	649	0.15	0.11	398	0.13	0.06
	testing the difference	t-stat/z-stat		**-5.27**	**-7.69**		**7.03**	**6.78**
		Unsecured	5,911	0.20	0.14	3,083	0.09	0.04
		Secured	239	0.23	0.14	103	0.04	0.01
	testing the difference	t-stat/z-stat		1.76	-1.02		**-3.61**	**-5.44**
		Noncallable	1,623	0.17	0.14	881	0.08	0.04
		Callable	4,528	0.21	0.14	2,305	0.09	0.04
	testing the difference	t-stat/z-stat		**5.72**	**2.31**		1.49	-1.88
		Non Rated	1,240	0.22	0.13	692	0.17	0.08
		C's(C to Caa1)	608	0.27	0.15	232	0.06	0.01
		Speculative B's (B3 to Ba1)	1,807	0.20	0.13	853	0.05	0.02
		Investable B's (Baa3 to Baa1)	1,125	0.17	0.13	547	0.06	0.04
		A's (A3 to Aaa)	1,370	0.18	0.16	862	0.07	0.05
	C's vs. Speculative B's	t-stat/z-stat		**-4.75**	**-4.93**		-0.82	**2.44**
	Speculative B's vs. Investable B's	t-stat/z-stat		**-3.61**	0.62		0.02	**4.74**
	Investable B's vs. A's	t-stat/z-stat		**2.31**	**6.04**		**4.01**	**4.89**

Table VI
Multivariate Analysis: Probit Model with Selection

This table reports coefficient estimates and marginal effects for two-stage probit models with selection. In the first stage, the probability of issuing any type of corporate bond is modeled as a function of firm size, leverage, fixed asset ratio, market-to-book, operating income, a dummy indicating whether the firm has a debt rating, a dummy variable taking a value of 1 if the firm's Altman Z-score is below the sample median and year dummies. This table reports estimates from the second-stage debt design probit regressions where the dependent variable equals one if the debt is convertible, short term, secured, or callable, respectively. t-statistics based on robust standard errors are reported in parentheses. The sample period is from 1971 to 2004.

	Convertible vs. Straight		Short-Term vs. Long-Term		Secured vs. Unsecured		Callable vs. Noncallable	
	dF/dX	dF/dX	dF/dX	dF/dX	dF/dX	dF/dX	dF/dX	dF/dX
Firm Age	0.000	0.001	0.001	0.001	-0.001	-0.001	-0.001	-0.001
	(0.10)	(1.26)	(0.66)	(1.04)	(-0.56)	(-0.77)	(-4.35)	(-4.71)
ln[Total Assets]	-0.032	-0.150	0.090	0.092	-0.040	-0.014	-0.063	-0.015
	(-4.31)	(-8.28)	(4.89	(5.53)	(-3.60)	(-2.86)	(-9.73)	(-3.29)
Leverage	-0.020	-0.057	-0.022	-0.027	0.033	0.034	-0.002	0.001
	(-5.32)	(-5.53)	(-2.44)	(-3.12)	(5.51)	(5.64)	(-0.66)	(0.23)
Fixed Asset Ratio	-0.013	-0.051	-0.029	-0.032	0.020	0.010	0.005	0.023
	(-4.13)	(-6.25)	(-3.76)	(-4.94)	(3.62)	(4.32)	(1.45)	(5.59)
Market-to-Book	0.027	0.029	0.031	0.025	-0.021	-0.019	-0.001	0.002
	(2.24)	(2.79)	(3.77)	(4.48)	(-2.26)	(-2.21)	(-0.55)	(0.75)
Cash Flow	0.478	1.337	-0.121	-0.124	-0.018	-0.017	-0.815	-0.720
	(2.45)	(2.40)	(-0.12)	(-0.41)	(-4.41)	(-4.52)	(-2.83)	(-3.16)
Cash	0.029	0.085	0.033	0.028	-0.001	-0.001	-0.010	-0.020
	(7.58)	(8.61)	(2.61)	(3.96)	(-0.19)	(-0.33)	(-1.99)	(-2.10)
Stock Return	0.004	0.004	-0.004	-0.010	-0.021	-0.009	0.000	0.001
	(1.54)	(0.61)	(-1.59)	(-1.80)	(-4.25)	(-4.30)	(0.02)	(0.14)
Return Volatility	0.022	0.094	0.072	0.059	0.025	0.011	0.011	0.020
	(6.12)	(10.06)	(6.91)	(8.44)	(4.93)	(4.99)	(1.73)	(3.11)
Net Equity Issuance	0.151	0.199	0.009	0.016	-0.023	-0.004	0.337	0.321
	(1.40)	(0.63)	(0.05)	(0.13)	(-0.19)	(-0.09)	(0.95)	(0.80)
ln[Offer Size]	0.008	0.050	-0.045	-0.065	0.010	0.005	0.040	0.058
	(2.5)	(5.75)	(-6.46)	(-10.13)	(1.71)	(1.84)	(12.37)	(12.71)
Recession Dummy	0.169	0.187	0.049	0.044	-0.006	0.004	-0.058	-0.030
	(6.04)	(7.12)	(2.13)	(2.47)	(-0.45)	(0.56)	(-5.77)	(-4.89)
Yield Curve Slope		0.104		-0.031		0.002		-0.007
		(11.56)		(-4.71)		(0.96)		(-1.73)
Interest Rate Volatility		0.009		-0.072		0.000		0.056
		(0.47)		(2.80)		(0.00)		(2.61)
Year Fixed Effects	Yes	No	Yes	No	Yes	No	Yes	No
Observations	36,238	36,238	36,238	36,238	36,238	36,238	35,069	35,069

Table VII
Determinants of Debt Quality

This table reports estimated coefficients from a multinomial logit regression. The dependent variable has five categories, non rated, C-rated bonds, speculative B-rated bonds, investment grade B-rated bonds, and A-rated bonds where the baseline case is no debt issues. t-statistics based on robust standard errors are reported in parentheses. The sample period is from 1971 to 2004.

Explanatory Variables	Not Rated	C to Caa1	B3 to Ba1	Baa3 to Baa1	A3 to Aaa	Investment Grade vs. Junk Bonds
Firm Age	-0.027	-0.019	-0.016	0.006	0.022	0.090
	(-6.43)	(-6.98)	(-7.14)	(1.80)	(5.01)	(11.72)
ln[Total Assets]	0.192	-0.129	0.409	1.147	1.639	2.314
	(2.87)	(-2.80)	(11.53)	(26.26)	(33.65)	(20.90)
Leverage	0.300	-0.106	0.122	0.012	-0.596	-0.899
	(6.10)	(-2.40)	(3.69)	(0.21)	(-7.35)	(-6.97)
Market-to-Book	0.002	0.022	-0.048	0.028	0.344	0.394
	(0.05)	(0.78)	(-1.57)	(0.65)	(8.24)	(4.50)
Fixed Asset Ratio	0.233	-0.010	0.135	0.156	0.008	-0.194
	(4.54)	(-0.28)	(4.53)	(3.84)	(0.18)	(-2.10)
Cash Flow	-0.503	-1.983	0.673	31.416	40.706	73.93
	(-0.24)	(-1.50)	(0.13)	(5.99)	(5.13)	(5.86)
Cash	-0.116	0.142	-0.343	-0.619	-0.885	-1.189
	(-1.91)	(4.60)	(-7.38)	(-6.59)	(-8.13)	(-6.96)
Net Equity Issuance	3.083	2.304	2.891	-8.666	-8.942	-25.887
	(3.08)	(2.68)	(3.20)	(-1.06)	(-0.92)	(-1.91)
Stock Return	0.115	0.064	0.146	0.051	-0.018	-0.292
	(3.96)	(2.55)	(6.03)	(1.00)	(-0.28)	(-2.93)
Return Volatility	0.109	0.095	-0.041	-0.277	-0.524	-0.965
	(3.05)	(3.72)	(-1.27)	(-4.55)	(-6.49)	(-8.12)
Recession Dummy	-0.554	-0.537	-0.122	0.353	0.443	2.011
	(-2.88)	(-5.19)	(-1.50)	(3.84)	(5.37)	(7.59)
Year Fixed Effects	Yes					
Observations	29,572					
Pseudo R-Squared	0.149					

Table VIII
The Effects of Debt Issuance on Subsequent Increases in Assets and Expenditures

The dependent variable for CAPEX and R&D is $Y = \ln[(\sum_{i=1}^{t} V_i / A_0) + 1]$ and for cash holdings is $Y = \ln[((V_t - V_0)/A_0) + 1]$. Independent variables are new debt raised, other sources of funds - both of which are normalized by total assets and interacted with debt type dummy – and ln[*total assets*]. All regressions include year, credit ratings, and industry fixed effects. Dollar changes are the implied change in the dependent variable when each debt type is increased by one dollar. Debt type dummy reflects convertibles, short-term, secured, and callable debt in panels A through D, respectively. Panel E is taken from Kim and Weisbach (2008). Bold letters indicate statistical significance at the 5% level, using robust standard errors. The sample period is from 1971 to 2004.

Dependent Variable:			Explanatory Variables						
ln[((Vt-V0)/Asset)+1]	t=1,4	N	ln[(Debt/Asset)+1]		ln[(Debt/Asset)+1]		Dollar Changes		R-Squared
ln[(∑Vt/Asset)+1]					*Debt Type Dummy				
			Panel A: Straight vs. Convertible Debt Issues						
			Coef	t stat	Coef	t stat	Straight	Convertible	
∑CAPEX	1year	3,602	**0.217**	**4.11**	**-0.110**	**-2.21**	0.21	0.11	0.38
	4years	1,614	**0.444**	**5.44**	**-0.290**	**-2.78**	0.50	0.20	0.59
∑R & D	1year	3,645	0.002	0.49	**0.141**	**7.57**	0.00	0.13	0.47
	4years	1,648	0.003	0.23	**0.564**	**6.98**	0.00	0.50	0.55
ΔCash	1year	3,144	**0.241**	**4.45**	**0.283**	**3.76**	0.20	0.42	0.38
	4years	1,361	0.121	1.69	0.174	1.77	0.11	0.25	0.37
			Panel B: Long vs. Short Term Debt Issues						
			Coef	t stat	Coef	t stat	Long-Term	Short-Term	
∑CAPEX	1year	3,596	**0.193**	**4.34**	**-0.086**	**-2.09**	0.19	0.11	0.37
	4years	1,613	**0.404**	**5.35**	**-0.512**	**-3.69**	0.47	-0.13	0.59
∑R & D	1year	3,639	**0.030**	**4.42**	**0.141**	**4.75**	0.03	0.15	0.43
	4years	1,647	**0.143**	**2.80**	**0.354**	**3.34**	0.13	0.46	0.43
ΔCash	1year	3,138	**0.289**	**6.21**	**0.286**	**3.06**	0.24	0.45	0.37
	4years	1,360	**0.138**	**2.10**	**0.239**	**2.46**	0.12	0.32	0.32
			Panel C: Unsecured vs. Secured Debt Issues						
			Coef	t stat	Coef	t stat	Unsecured	Secured	
∑CAPEX	1year	3,602	**0.182**	**4.42**	-0.009	-0.12	0.18	0.17	0.37
	4years	1,614	**0.362**	**4.55**	0.048	0.55	0.42	0.50	0.58
∑R & D	1year	3,645	**0.048**	**4.52**	-0.011	-0.62	0.04	0.03	0.37
	4years	1,648	**0.173**	**3.30**	**-0.121**	**-2.26**	0.16	0.05	0.42
ΔCash	1year	3,144	**0.343**	**7.09**	**-0.128**	**-2.99**	0.28	0.17	0.33
	4years	1,361	**0.146**	**2.31**	**0.229**	**2.24**	0.13	0.33	0.32
			Panel D: Non-Callable vs. Callable Debt Issues						
			Coef	t stat	Coef	t stat	Non-Callable	Callable	
∑CAPEX	1year	2,256	**0.183**	**2.38**	0.047	0.56	0.18	0.23	0.40
	4years	1,104	-0.167	-0.87	**0.690**	**3.40**	-0.18	0.58	0.61
∑R & D	1year	2,285	0.008	1.37	-0.001	-0.22	0.01	0.01	0.31
	4years	1,131	0.039	1.01	-0.043	-1.13	0.03	0.00	0.51
ΔCash	1year	1,918	**0.101**	**2.26**	**0.139**	**2.17**	0.09	0.21	0.29
	4years	909	-0.016	-0.25	0.144	1.41	-0.01	0.11	0.25

			Panel E: Seasoned Equity Offerings						
ln[((Vt-V0)/Asset)+1]	t=1,4	N	ln[(Equity/Asset)+1]		ln[(Other Sources/A)+1]		Fresh	Other	R-Squared
ln[(∑Vt/Asset)+1]			Coef	t stat	Coef	t stat	Equity	Sources	
∑CAPEX	1year	6,890	**0.081**	**3.88**	**0.108**	**3.88**	0.08	0.09	0.20
	4years	3,539	**0.136**	**4.18**	**0.370**	**6.99**	0.19	0.18	0.54
∑R & D	1year	3,669	**0.192**	**4.98**	-0.019	-1.28	0.18	-0.01	0.35
	4years	1,739	**0.523**	**5.63**	**0.094**	**2.98**	0.64	0.04	0.49
ΔCash	1year	6,889	**0.594**	**23.34**	**0.077**	**3.68**	0.53	0.06	0.42
	4years	3,540	**0.327**	**6.12**	**0.176**	**8.20**	0.32	0.06	0.25

Table IX
The Effects of Debt Issuance on Subsequent Increases in Assets and Expenditures: Within Firm

The dependent variable for CAPEX and R&D is $Y = \ln[(\sum_{i=1}^{t} V_i / A_0) + 1]$ and for cash holdings is $Y = \ln[((V_t - V_0)/A_0) + 1]$. Independent variables are new debt raised, other sources of funds - both of which are normalized by total assets and interacted with debt type dummy – ln[*total assets*], and numerical scores for credit ratings (0 to 21). All regressions include year and firm fixed effects. Dollar changes are the implied change in the dependent variable when each debt type is increased by one dollar. Debt type dummy reflects convertibles, short-term, secured, and callable debt in panels A through D, respectively. Bold letters indicate statistical significance at the 5% level, using robust standard errors. The sample period is from 1971 to 2004.

Dependent Variable: ln[((Vt-V0)/Asset)+1] ln[(∑Vt/Asset)+1]	t=1,4	N	Explanatory Variables: ln[(Debt/Asset)+1]		ln[(Debt/Asset)+1] *Debt Type Dummy		Dollar Changes		R-Squared
Panel A: Straight vs. Convertible Debt Issues									
			Coef	t stat	Coef	t stat	Straight	Convertible	
∑CAPEX	1year	2,680	**0.113**	**3.04**	0.008	0.21	0.11	0.12	0.24
	4years	1,120	**0.237**	**2.97**	**-0.338**	**-2.81**	0.30	-0.13	0.64
∑R & D	1year	2,712	0.003	1.21	**0.056**	**4.90**	0.00	0.05	0.10
	4years	1,143	0.012	0.76	**0.261**	**2.13**	0.01	0.26	0.23
ΔCash	1year	2,348	**0.206**	**3.21**	**0.383**	**3.72**	0.18	0.51	0.32
	4years	952	0.164	1.50	0.308	1.17	0.16	0.43	0.35
Panel B: Long vs. Short Term Debt Issues									
			Coef	t stat	Coef	t stat	Long-Term	Short-Term	
∑CAPEX	1year	2,678	**0.121**	**3.72**	-0.039	-1.16	0.12	0.08	0.24
	4years	1,120	**0.177**	**2.37**	-0.587	-1.35	0.22	-0.51	0.63
∑R & D	1year	2,710	**0.016**	**3.42**	**0.040**	**2.99**	0.01	0.05	0.07
	4years	1,143	0.050	1.38	-0.385	-1.58	0.05	-0.33	0.16
ΔCash	1year	2,346	**0.275**	**4.64**	0.116	1.18	0.24	0.34	0.26
	4years	952	0.182	1.59	**-1.039**	**-2.40**	0.18	-0.83	0.32
Panel C: Unsecured vs. Secured Debt Issues									
			Coef	t stat	Coef	t stat	Unsecured	Secured	
∑CAPEX	1year	2,680	**0.117**	**3.69**	0.000	0.01	0.12	0.11	0.24
	4years	1,120	**0.167**	**2.25**	0.437	0.97	0.21	0.74	0.63
∑R & D	1year	2,712	**0.018**	**3.71**	**-0.014**	**-2.43**	0.02	0.00	0.06
	4years	1,143	0.058	1.39	0.000	0.00	0.06	0.06	0.11
ΔCash	1year	2,348	**0.287**	**4.78**	-0.089	-1.63	0.25	0.17	0.25
	4years	952	0.199	1.67	-0.312	-1.65	0.19	-0.11	0.28
Panel D: Non-Callable vs. Callable Debt Issues									
			Coef	t stat	Coef	t stat	Non-Callable	Callable	
∑CAPEX	1year	1,666	0.005	0.10	**0.125**	**2.47**	0.00	0.13	0.25
	4years	764	0.167	1.67	0.094	0.78	0.20	0.31	0.64
∑R & D	1year	1,688	**-0.006**	**-2.80**	**0.007**	**2.63**	-0.01	0.00	0.05
	4years	781	-0.012	-1.05	0.003	0.25	-0.01	-0.01	0.13
ΔCash	1year	1,421	**0.186**	**2.95**	0.010	0.12	0.17	0.18	0.24
	4years	631	-0.025	-0.40	0.198	1.22	-0.02	0.16	0.30

Table X
Summary of the Empirical Results and Implications for Theories on Debt Contract Design

This table summarizes the major empirical results and relates them to various theories on debt contract design.

Bond Characteristics	Firm/Maco/Project Characteristics	Empirical Results	Implications
Convertibles (vs. Non-Convertibles)	Firm/Issuer level	Issuers are smaller, have lower leverage and fixed asset, higher market-to-book, higher return volatility	Consistent with 'back door' equity financing (Stein 92) and 'matching' financing and investment options (Mayers 98)
	Macroeconomy level	issued more during recessions	Consistent with Bernanke & Gertler (1989)
	Project level	used more for R&D and held as cash, less for CAPEX	Consistent with Stein (92), Mayers (98)
Short -term (vs. Long-term)	Firm/Issuer level	Issuer are larger, have lower fixed asset, higher market-to-book, and higher cash holdings	Consistent with liquidity risk (Diamond 91), avoiding underinvestment (Myers 77, Barnea, Haugen, and Senbet 80), and signaling (Flannery 86)
	Macroeconomy level	issued more during recessions	Consistent with Bernanke & Gertler (1989)
	Project level	used more for R&D and held as cash, less for CAPEX	Consistent with 'maturity matching' (Myers 77, Diamond 91, Hart and Moore 94)
Secured (vs. Unsecured)	Firm/Issuer level	Issuers are smaller, have higher leverage, lower market-to-book, weaker cash flows, and poor past stock performance	Consistent with 'banking' view (Berger and Udell 90) Inconsistent with 'corporate finance' view (Stulz and Johnson 85, Smith and Warner 79, Berkovich and Kim 90)
	Macroeconomy level	-	-
	Project level	less likely to be used for R&D	Consistent with Mayers (1998)
Callable (vs. Non-callable)	Firm/Issuer level	Issuers are younger, smaller, have less cash holdings	Consistent with interest rate risk hedging (Guntay, Prabhala, and Unal 02) Inconsistent with mitigating agency costs (Barnea, Haugen, and Senbet 80)
	Macroeconomy level	issued less during recessions issued more when interest rate volatility is high	Consistent with Bernanke & Gertler (1989)
	Project level	-	-
Investment grade (vs. Speculative)	Firm/Issuer level	Issuers are largers, have lower leverage, higher market-to-book, lower stock return volatility, stronger cash flows, and lower cash holdings	Consistent with financial constraints (Almeida, Campello, Weisbach 04, 07)
	Macroeconomy level	issued more during recession or periods of low economic growth	Consistent with Bernanke & Gertler (1989)
	Project level	Non-rated bonds finance more R&D than rated bonds	

Figure 1

Time-Series Distribution of Debt Issues by Credit Rating

This figure presents the log of proceeds raised in real terms (constant 2000 $US millions) by debt issues with various credit ratings for each year from 1971 to 2004.