Debt Structure and Future Financing and Investment

by

Sean Joseph Flynn

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Graduate Supervisory Committee:

Yuri Tserlukevich, Co-Chair
Mike Hertzel, Co-Chair
Luke Stein

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ABSTRACT

I study the relation between firm debt structure and future external financing and investment. I find that greater reliance on long-term debt is associated with increased access to external financing and ability to undertake profitable investments. This contrasts with previous empirical results and theoretical predictions from the agency cost literature, but it is consistent with predictions regarding rollover risk. Furthermore, I find that firms with lower total debt (high debt capacity) have greater access to new financing and investment. Lower leverage increases future debt issues and capital expenditures, and firms do not fully rebalance by reducing the use of external financing sources such as equity. Finally, my results support the view that greater reliance on unsecured debt can increase future debt financing. Overall, my paper offers new insights into how aspects of debt structure, in particular maturity, are related ex-post to firms' ability to raise new financing and invest.

DEDICATION

To my family and friends for their love and support during the doctoral program.

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Chapter 1

INTRODUCTION

I study the relation between debt structure and future external financing and investment. Theoretical models suggest that various characteristics of debt such as maturity, security, and seniority can affect firms' ability to access new debt and equity and invest. However, our understanding of how these aspects of debt are actually related to observed financing and investment is at best incomplete. This is in part because the theoretical predictions are unclear and may conflict with one another due to differences in assumptions and the specific channels they consider.[1] More importantly, the existing empirical studies on how debt structure may be related to financing and investment take an indirect, *ex-ante* approach. This literature tests whether debt structure is related to measures of growth opportunities,[2] whether debt characteristics can attenuate the negative relation between growth options and leverage,[3] and whether firms actively manage their debt structure in anticipation of investment opportunities.[4]

Despite evidence of a causal effect from growth opportunities to debt structure,

[1] For example, the seminal work of Myers 1977 predicts that greater reliance on short-maturity debt can improve access to future financing and investment because short-maturity debt mitigates debt overhang, but the recent work of He and Xiong 2012 predicts that short-maturity debt can reduce access to future financing because firms face more frequent rollover losses and a higher likelihood of default.

[2] See, e.g., Barclay and Smith 1995a and Stohs and Mauer 1996.

[3] See, e.g., Johnson 2003 and Billett, King, and Mauer 2007.

[4] See, e.g., Goyal, Lehn, and Racic 2002, Giambona, Golec, and Lopez-de-Silanes 2015, and Callen and Chy 2016.

there is scarce empirical literature on whether firms' ex-ante choices of maturity, security, and priority characteristics translate into greater *ex-post* financing and investment.[5] For example, if a firm chooses a debt structure anticipating costly underinvestment, does that debt structure actually allow them to invest more ex-post? This lack of evidence is likely due to the difficulty of establishing a causal channel from each aspect of debt structure to firm outcomes. As with any empirical capital structure question, reverse causality and omitted variable bias make it difficult to isolate a causal effect. However, the ex-post question is important because current growth opportunities do not necessarily translate into future investment. Thus, we do not know which of the theoretical predictions are borne out empirically because there is no comprehensive study on how debt structure is related to *observed* financing and investment outcomes.

Additionally, the existing empirical literature does little to separate the potential mechanisms through which debt structure can theoretically affect financing and investment. Many papers consider how debt maturity, security, and priority *may* affect agency costs of debt (over- or underinvestment) by examining how firms that anticipate agency costs change their debt structure. However, we know little about the channel through which debt structure affects firm outcomes ex-post. For example, debt maturity may affect financing and investment ex-post by mitigating the effects of debt overhang—firms with more short-maturity debt are less subject to underinvestment and are able to access new debt and equity and invest more. On the other hand, maturity may also affect financing and investment by exposing the firm to greater rollover risk—firms with more short-maturity debt may have less access to external

[5] To my knowledge, only Aivazian, Ge, and Qui 2005, Dang 2011, and Biguri 2016 address the causal effect of debt characteristics on firm outcomes. However, these papers only focus on a single aspect of debt and only consider a causal effect on investment, not financing.

financing and less investment during times when refinancing is costly. The existing literature cannot say whether the agency cost or rollover risk channel dominates ex-post and for which types of firms each channel is most important.

My paper addresses these gaps in the literature by linking debt structure to observed external financing and investment and trying to establish a causal channel. I consider the total level of debt, the maturity profile, the mix of secured and unsecured debt, and the mix of senior and junior/subordinated debt. These debt characteristics are motivated in large part by the literature on how firm debt structure can mitigate agency costs, particularly debt overhang and the associated underinvestment. Maturity, security, and priority of *current* debt directly affect a firm's ability to finance new investment with new equity and debt. Therefore, firms may rely on a greater degree of short-term debt or a greater proportion of unsecured or lower priority debt in their current capital structure if they anticipate costly agency problems.[6]

I measure access to external financing and investment using both new issues of debt and equity as well as *net* issuance (new issues net of reductions). Furthermore, I exploit large, "proactive" increases in debt and equity (as identified and defined by Denis and McKeon 2012 and McKeon 2015) to obtain additional results. These are substantial new financing transactions that indicate a large amount of new financing capacity. Furthermore, they can be tied to a particular use of funds, e.g., acquisitions or increases in internal capital expenditures. As such, they provide a unique setting for further understanding how debt structure is related to the ability of firms to finance major investment with new debt and equity.

My key results show that reliance on short-maturity debt may be associated with *lower* access to financing and investment. A greater proportion of debt maturing

[6]See, e.g., Myers 1977, Barnea, Haugen, and Senbet 1980, and Stulz and Johnson 1985.

in 1-3 years is associated with less net debt financing, a higher future cost of both debt and equity, a lower probability of large, investment-motivated debt issues, and lower capital expenditures. The relation is economically meaningful—a one standard deviation increase in the proportion of short-maturity debt is associated with 32% lower average net debt issuance. This is not driven by the presence of call options that can effectively shorten the maturity of debt that matures in more than three years, as the results are robust to an alternative measure of maturity that accounts for callability. Nor is it driven by the presence of bank debt, which typically has shorter maturity than publicly-offered bonds, as the results are robust to the inclusion of bank debt as a control variable. Therefore, short-maturity debt may actually reduce external financing capacity and investment.

Although this is consistent with a rollover risk channel, in which short-term debt can reduce future debt capacity because of a higher probability of default,[7] it contrasts with much of the theoretical literature that finds short-maturity debt may enhance future financing and investment by reducing or eliminating the effects of debt overhang.[8] Additionally, my results call into question the interpretation of previous empirical studies that show that firms ex-ante select into shorter-maturity debt structures when the cost of debt overhang increases. For example, Giambona, Golec, and Lopez-de-Silanes 2015 show that an exogenous increase in growth opportunities (which makes debt overhang costlier) results in firms shortening their debt maturity, which they interpret as firms' attempts to mitigate debt overhang. While this may

[7] See, e.g., He and Xiong 2012 and He and Milbradt 2016.

[8] See, e.g., Myers 1977, Barnea, Haugen, and Senbet 1980, Childs, Mauer, and Ott 2005, and Titman and Tsyplakov 2007.

be true, my results show that firms that maintain more short-maturity debt may ultimately have less access to new financing *ex-post*.

My results further show that the current total level of debt is strongly and negatively related to future financing and investment. A higher level of total debt is associated with lower future debt financing and investment, and a higher future cost of both debt and equity. The effects are economically meaningful, with a one standard deviation increase in book leverage implying lower net debt issuance of 4.4%, which is nearly twice the average net debt issuance. A one standard deviation increase in book leverage is also associated with 14% lower average investment. Furthermore, higher debt is associated with a lower probability of large, "proactive" increases in debt *and* equity that are motivated by the desire to increase long-term investment.

This is not simply the result of rebalancing, in which a firm substitutes equity for debt in order to lower its leverage ratio, because pure rebalancing would imply no change in total financing and investment. On the contrary, my results show both lower total financing and investment for firms with high leverage. Additionally, the results are unlikely to be driven by a mechanical feedback effect from growth options to leverage, whereby growth options increase the market value of the firm and depress total leverage (Berens and Cuny 1995; Tserlukevich 2008). My main measure of total debt is book leverage, which should be less sensitive to changes in growth options than market leverage, and I also conduct robustness checks using only the subsample of firms that are likely to have more valuable growth options. Both tests indicate that the presence of growth options cannot fully explain why low total debt is associated with greater future investment.

The negative relation between total leverage and future debt issuance and investment may be due to several channels. Higher debt may reduce future debt capacity, and hence the ability to finance new investment with debt, either by increasing the probability of default or by putting a firm beyond its debt capacity in the sense of Myers and Majluf 1984. Higher debt may also impose greater debt overhang (Myers 1977), which can lead firms to underinvest in positive NPV projects. The latter channel would predict lower equity issuance. Because I find future debt issuance to be more affected than future equity issuance, I conclude that the association between total debt and future financing and investment is primarily due to a debt capacity channel, as opposed to an agency cost channel.

Finally, I find that unsecured debt weakly increases future net debt issuance, but has an ambiguous effect on future investment. The relation with debt issuance is consistent with the predictions of, e.g., Stulz and Johnson 1985 and Hackbarth and Mauer 2012 who show that firms can preserve the option to issue new secured or senior debt in the future by relying on more unsecured or lower priority debt in the present. The ability to issue secured or more senior debt to finance investment mitigates the effect of debt overhang, allowing firms to increase their future issuance of debt and equity.

These results are important because they provide new insights into how current debt, and in particular its maturity, is related to future financial and real outcomes. In contrast to existing empirical literature,[9] my results show how debt maturity, security, and priority are related to *observed* financing and investment. Furthermore, none of the current studies have documented a *negative* relation between short-maturity debt and ex-post debt issuance and investment.[10] Thus my findings call into question

[9] See Barclay and Smith 1995a, Barclay and Smith 1995b, Goyal, Lehn, and Racic 2002, Johnson 2003, Billett, King, and Mauer 2007, and Giambona, Golec, and Lopez-de-Silanes 2015.

[10] Aivazian, Ge, and Qui 2005 examine how maturity is related to future investment and find a *positive* relation between short-maturity debt and investment. However, their study does not consider

the interpretation of previous empirical evidence and suggest that the rollover risk channel, not the agency cost channel, dominates on average.

The results are also important because my paper addresses potential endogeneity in a number of ways and attempts to establish a causal link between debt structure and firm outcomes. The existing literature takes an ex-ante approach primarily because establishing causality is difficult. There is the potential that reverse causality or a common, omitted factor drive an observed ex-post relation between debt structure and financing and investment.[11] I account for reverse causality by splitting my sample by ex-ante measures of growth opportunities and financial constraints, and by splitting it into core and noncore business segments.[12] I address the possibility of selection on unobservable factors by including a variety of controls and fixed effects, and by implementing the econometric test detailed in Oster 2015. I also estimate a dynamic model that allows for financing and investment to revert to a long-run target over time. Both sets of tests indicate that it is unlikely my results are driven *primarily* by either reverse causality or selection on unobservables.

As an additional method of establishing causality, I identify points at which debt structure is likely to be "suboptimal." Because firms should never select ex-ante into suboptimal debt characteristics if they expect profitable investment opportunities, a significant relation between suboptimal debt structure and financing and investment

the security and priority of debt, nor do they examine the relation between maturity and future financing.

[11]Reverse causality would arise if firms anticipate the need for financing to fund investment at time t and thus select into a particular debt structure at $t-1$. Correlation with a common, omitted factor would arise if there is some unobservable variable that is correlated with both debt structure *and* the outcome variables.

[12]The core vs. noncore split was first suggested by Lang, Ofek, and Stulz 1996 as a way to address reverse causality.

should be more indicative of a causal effect. I identify major refinancings that are motivated by the desire to change capital structure,[13] and I assume that debt structure in the years immediately preceding these refinancings is suboptimal (otherwise firms would not undertake a capital structure-motivated refinancing in the first place). I find that both total debt and short-maturity debt remain negatively related to future financing and investment at times when debt structure is suboptimal, which further suggests a causal effect of these debt characteristics.

Although more work must be done to fully account for reverse causality in particular, I argue that my results are unlikely to be driven purely by reverse causality. The existence of reverse causality would imply that firms believe debt structure can have a "causal" effect on financing and investment outcomes, otherwise they would not select a specific debt structure ex-ante. Furthermore, my results are broadly consistent with the findings of existing empirical literature that attempts to use exogenous variation in debt structure to establish causality.[14]

Finally, my results for maturity in particular are important no matter the extent to which the regression coefficients pick up ex-ante selection vs. causality. On the one hand, if the results are actually driven by reverse causality, then firms are selecting into *longer-term* debt in anticipation of the future need for financing and investment. This would run counter to the interpretation of most of the existing empirical literature. On the other hand, if the results are primarily causal, then reliance on short-maturity debt does not actually mitigate the effects of debt overhang ex-post. This would contrast with a large set of theoretical predictions regarding how short-term debt can

[13]The methodology is based on Hovakimian, Opler, and Titman 2001, Hovakimian 2004, Leary and Roberts 2005, and Korteweg, Schwert, and Strebulaev 2014.

[14]See Almeida et al. 2011 and Cohen, Katz, and Sadka 2016.

eliminate underinvestment incentives of equity holders. Thus, in either case, the novel results for maturity run counter to existing literature.

The remainder of this paper is structured as follows. Chapter 2 discusses literature and motivates the link between current debt structure and future financing and investment. Chapter 3 outlines the data and empirical methodology, Chapters 4 and 5 discuss results, Chapter 6 outlines future work and extensions, and Chapter 7 concludes.

Chapter 2

RELATED LITERATURE

A large theoretical literature shows that debt structure can enhance or detract from firms' ability to access external financing. In this paper I consider four aspects of debt structure: (1) the total level of debt, (2) the mix of short- vs. long-maturity debt, (3) the mix of secured vs. unsecured debt, and (4) the mix of senior and junior/subordinated debt. Debt contract features such as covenants and call options are additional aspects of debt that may be related to financing and investment, and although I do not focus on these in my primary empirical analysis, I discuss briefly the literature related to these aspects of debt as well.

The literature generally agrees that a higher total level of debt can reduce future financing and investment through a number of channels. As outlined in Myers and Majluf 1984 and Myers 1984, a modified pecking order view of capital structure would predict that firms have a particular "debt capacity" beyond which financing with additional debt becomes very costly. This would imply that firms that are close to or at capacity are less able to access new debt. On the other hand, firms that are far away from their debt capacity are more able to obtain new debt financing and exercise growth options. A higher level of debt may also reduce future debt capacity via a standard tradeoff theory channel of Modigliani and Miller 1963. If, as in Leland 1994, firms trade off the tax benefits of higher debt with the cost of increased risk of distress or bankruptcy, then a high level of existing debt may reduce the ability or desire to issue more debt in the future.

Finally, total debt may affect future debt *and* equity financing because existing risky debt can create debt overhang (Myers 1977). Equity holders in a firm with a large amount of outstanding debt may underinvest in positive NPV projects if they anticipate that existing debt holders will reap a large portion of the gains at their expense. This implies that higher levels of existing debt can reduce both new equity and debt issuance and thus limit a firm's ability to exercise valuable growth options. The recent work of Sunderesan, Wang, and Yang 2015 offers further support for the debt overhang channel in a dynamic setting. They show that optimal leverage is lower for firms that expect to exercise valuable growth options in the future.

From both a debt capacity and agency cost perspective, a higher level of debt is associated with lower future financing and investment. Various characteristics of debt, however, can enhance or diminish financing and investment *conditional* on a given level of total debt.

A higher proportion of short-maturity debt can affect future debt issuance because it provides a firm with more frequent opportunities to roll over or refinance. This in turn creates more frequent opportunities for a firm to increase its total debt level (by either rolling over the entire amount and also issuing new debt, or by allowing all debt to mature and issuing more), or reduce its total debt (by allowing some or all of the debt to mature). A greater ability to adjust total debt increases a firm's ability to respond to positive investment shocks or negative profitability shocks.

Short-maturity debt may also affect financing and investment by mitigating or eliminating the effects of debt overhang (see, e.g., Myers 1977; Childs, Mauer, and Ott 2005; and Titman and Tsyplakov 2007). This is possible because of the timing of when short-term debt matures relative to when the firm wants to exercise its growth option. If the short-term debt matures *prior* to when the firm wishes to invest, then shareholders can make the investment decision as if the firm was all equity financed.

They can issue new debt to fund the investment, and because the new debt will be priced such that the benefits will not accrue to debt holders, the underinvestment problem is entirely resolved. Even if the debt matures after the investment is made, short-term debt can at the very least mitigate underinvestment.

Barnea, Haugen, and Senbet 1980 argue that short-term debt can mitigate a different agency cost of debt: risk-shifting. If equity holders can benefit from shifting into a higher-risk, lower-return project at the expense of bond holders, then they may face a higher ex-ante cost of debt, as bond holders will rationally discount the price at which they are willing to purchase debt. This would imply lower debt capacity, all else equal. Barnea, Haugen, and Senbet 1980 show that short maturity can mitigate this investment distortion because the value of short-maturity debt is less sensitive to an increase in risk than the value of longer-maturity debt, hence bond holders are expropriated less. Leland and Toft 1996 also suggest risk-shifting as an explanation for the observed reliance on short-term debt. They argue that long-maturity debt allows for larger debt capacity and higher tax shields, therefore the propensity for firms to use short-term debt must be explained by the existence of bond holder-stock holder conflict over investment policy.

Despite the potential for short-maturity debt to increase firms' ability to finance growth options with new debt or equity by reducing agency costs of debt, the literature also suggests that greater reliance on short-term debt can expose a firm to more frequent rollover losses. This in turn can reduce future financing and investment. For example, the recent work of He and Xiong 2012 and He and Milbradt 2016 predict that more short-maturity debt can increase the incentive of equity holders to default early. This is because a larger amount of short-maturity debt means more frequent refinancing, and if equity holders must absorb refinancing losses (the difference between the face value of maturing bonds and the proceeds from issuing the new debt), then they choose to default sooner. This implies lower debt capacity ex-ante.

Related to maturity, the presence of covenants that allow debt to be called prior to the stated maturity date may also affect financing and investment. Call options allow firms to effectively shorten their debt maturity and can thus limit both underinvestment and overinvestment in the same way as short-term debt (Barnea, Haugen, and Senbet 1980).

In addition to maturity, the mix of secured and unsecured, or senior and junior, debt can also affect financing and investment by mitigating the effects of debt overhang. Stulz and Johnson 1985 show that the ability of firms to issue new, secured debt allows them to undertake investment opportunities they would otherwise forgo if they had to be financed with unsecured debt or equity. This is because the new debt can be secured by the investment, which limits the ability of existing unsecured debt holders to capture the benefits. In a dynamic model in which firms can issue debt and invest in multiple periods, Hackbarth and Mauer 2012 assume firms can prioritize debt issues in a way that minimizes over- and underinvestment. Like the static results of Stulz and Johnson 1985, their model predicts that issuing more senior debt today can lead to future underinvestment but can also mitigate future overinvestment. Thus, a key implication of their model is that the choice of whether to prioritize the current debt issue or future debt issues (or to make them equal priority) may impact whether the firm invests in the future.

Additional aspects of debt that may affect future financing and investment through their effects on agency costs of debt include restrictive covenants. Covenants that limit dividend payments, for example, may reduce underinvestment because they limit the ability of firms to pay out cash that otherwise would have been used for positive NPV projects (Myers 1977; Smith and Warner 1979).

Chapter 3

DATA AND EMPIRICAL METHODOLOGY

3.1 Data

My primary data sample consists of North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. I exclude utilities and financial firms.

Table 1 provides variable definitions, and Table 2 shows summary statistics. I consider four aspects of debt as constituting a firm's debt structure: the total level, the maturity structure, the security profile, and the seniority profile. I measure the total level of debt as book leverage ($Book\_lev$): book value of debt divided by book value of assets.

In line with existing empirical studies, I define maturity structure in terms of the proportion of short-maturity debt. In particular, I define $Short-maturity$ as the ratio of long-term debt maturing within the next three years to total debt. I construct the numerator by summing Compustat items $DD1$, $DD2$, and $DD3$ (the proportion of long-term debt maturing in one, two, and three years, respectively). This measure is identical to the maturity measures used in Johnson 2003 and Billett, King, and Mauer 2007.[15]

[15] This variable is the complement to the measure used in Barclay and Smith 1995a in that they use the proportion of long-term debt maturing in more than three years in the denominator.

Finally, I define security and priority structure based on the extent to which firms use unsecured or junior/subordinated debt in their current capital structure. Consistent with the previous literature, I define *Unsecured* as the ratio of unsecured debt to total debt, where unsecured debt is the difference between total debt and secured debt (Compustat item *dm*). I define *Subordinated* as the ratio of subordinated unsecured debt to total unsecured debt.

I use measures of debt and equity financing and investment as my outcomes variables. My primary measures of debt financing are new debt issuance (*dissue*), which is defined as increases in long-term debt (Compustat item *dltis*) scaled by lagged total assets, and net debt issuance (*ndissue*), which is defined as long-term debt increases net of reductions (item *dltis* minus *dltr*) scaled by lagged total assets. Similarly, my primary measures of equity financing are new equity issuance (*eissue*), which is defined as the sale of common and preferred stock (Compustat item *sstk*) scaled by lagged total assets, and net equity issuance (*neissue*), which is equal to the issue of new stock net of repurchases (item *sstk* minus *prstkc*) scaled by lagged total assets. I define two additional measures that capture total external financing: net external financing (*netexternal*), which is equal to the sum of *ndissue* and *neissue*, and new external financing (*newexternal*), which is equal to the sum of *dissue* and *eissue*. The latter measure captures the extent to which firms engage in *new* financing, whereas the former captures the net effect of changes in bond and stock issuance and reductions/repurchases. Finally, I define investment (*investment*) as capital expenditures scaled by lagged total assets.

As an alternative measure of firms' access to new financing and ability to invest, I construct three measures of large, new debt and equity issues. The ability to engage in a large new debt or equity issue to fund, e.g., a major acquisition, indicates a high degree of access to low-cost external financing. To measure large financing choices that are used primarily for long-term investment, I follow methodology derived from Denis and McKeon 2012 to define transactions that I call large, proactive increases in debt or equity ($LPIDs$ and $LPIEs$, respectively).[16] In unreported robustness tests, I also define and use a second measure of large equity increases based on McKeon 2015 which I refer to as $Sstk3$.[17] This variable indicates whether the firm issued new stock equal to 3% or more of its total equity in a given year.

As shown in Table 3, the debt structure measures are not highly correlated. The largest magnitude correlations are between total debt and the proportion of subordinated debt (0.22 Pearson and 0.30 Spearman), and between total debt and short-maturity debt (-0.23 Pearson and -0.22 Spearman). The remaining correlation coefficients are between 0.01 and 0.21 in absolute value.

3.2 Regression Model

I construct my main empirical specification to estimate the relation between debt structure and future financing and investment as defined in the previous subsection.

I estimate:

$$Y_{i,t} = \beta_0 + \beta_1 Book\_Lev_{i,t-1} + \beta_2 Short\_Maturity_{i,t-1} +$$
$$+\beta_3 Unsecured_{i,t-1} + \beta_4 Subordinated_{i,t-1} + \beta_x Cont_{i,t-1} + \epsilon_{i,t} \quad (3.1)$$

The dependent variable is one of the following: *dissue*, *eissue*, *newexternal*, *ndissue*, *neissue*, *netexternal*, or *investment*. The right-hand side variables are one-year

[16] Denis and McKeon 2012 only focus on large, proactive increases in debt. However, I use their methodology to define a symmetric transaction for increases in equity.

[17] See Appendix for a detailed explanation of how these variables are defined.

lagged levels of the four debt characteristics of interest. Control variables include firm characteristics such as market-to-book, size, tangibility, dividend paying status, R&D, cash holdings, profitability, trade credit, a rating dummy, as well as firm and year fixed effects.[18] The year fixed effects are included to control for time variation in debt structure. Custodio, Ferreira, and Laureano 2013, for example, show that the percentage of debt maturing in more than 3 years has decreased substantially from 1976 to 2008.

The relation between debt and future financing and investment may be more obvious, however, in the context of *large* financing and investment choices. Therefore, I also estimate how the debt structure measures are related to the two types of large financing transactions I discussed in the previous subsection: LPIDs and LPIEs:

$$Large_{i,t} = \beta_0 + \beta_1 Book\_Lev_{i,t-1} + \beta_2 Short\_Maturity_{i,t-1} + \\ + \beta_3 Unsecured_{i,t-1} + \beta_4 Subordinated_{i,t-1} + \beta_x Cont_{i,t-1} + \epsilon_{i,t} \quad (3.2)$$

where the dependent variable is one of two variables: (1) $LPID_{i,t}$, which is a dummy equal to 1 if firm i engages in a large, proactive increase in debt in year t, and 0 otherwise; or (2) $LPIE_{i,t}$, which is a dummy equal to 1 if firm i engaged in a large, proactive increase in equity in year t, and 0 otherwise. The independent variables of interest and controls are the same as in equation 3.1, and I use industry-by-year fixed effects. I estimate the equation as a linear probability model.

[18]These firm characteristics are widely used in the previous literature, e.g., Rajan and Zingales 1995, Frank and Goyal 2003, and Lemmon, Roberts, and Zender 2008. Consistent with the findings of Koh and Reeb 2014, I account for missing R&D expenses by replacing missing R&D equal to 0 while also including a dummy variable equal to 1 for missing R&D. Koh and Reeb 2014 illustrate the importance of including a dummy variable for missing R&D rather than simply replacing missing with 0.

3.2.1 Dynamic Panel Model

Equation 3.1 does not assume adjustment to optimal financing or investment over time, but existing literature documents that firms may adjust to an optimal capital structure over time.[19] Therefore, to ensure the robustness of the results from equation 3.1, I specify an alternative equation that allows for reversion of capital structure over time.

Following Lemmon, Roberts, and Zender 2008 and other empirical papers, I specify a dynamic model that allows for firms' external financing and investment to depend partially on adjustment to an optimal level:

$$Y_{i,t} = \beta_0 + \beta_1 Book\_Lev_{i,t-1} + \beta_2 Short\_Maturity_{i,t-1} + \\ + \beta_3 Unsecured_{i,t-1} + \beta_4 Subordinated_{i,t-1} + \beta_5 Y_{i,t-1} + \beta_x Cont_{i,t-1} + \epsilon_{i,t} \quad (3.3)$$

The inclusion of lagged financing or investment on the right-hand side of equation 3.3 (via the term $Y_{i,t-1}$) captures the tendency of the dependent variables to revert to a long-run optimal level over time. However, including a lagged dependent variable can pose problems if equation 3.1 is estimated using OLS, because $Y_{i,t-1}$ will be correlated with an individual firm effect. To account for this, I follow the GMM estimation methodology proposed by Arellano and Bond 1991 and used in several previous papers.[20] This method first differences equation 3.3 and uses all of the lagged values of the regressors $Y_{i,t}$ as instruments. In line with existing studies, I implement the GMM estimation via the Stata module *xtabond*.

[19] See, e.g., Leary and Roberts 2005, Flannery and Rangan 2006, Lemmon, Roberts, and Zender 2008, and Marchica and Mura 2010.

[20] See, e.g., Aivazian, Ge, and Qui 2005, Lemmon, Roberts, and Zender 2008, and Marchica and Mura 2010.

The GMM methodology is further justified by the fact that debt structure is persistent over time. The $AR(1)$ coefficients for the levels of the debt structure variables are 0.86 for book leverage, 0.62 for short-maturity, 0.76 for unsecured, and 0.80 for subordinated. In contrast, the *differences* of the debt structure variables exhibit $AR(1)$ coefficients of -0.1 for total debt, -0.26 for short-maturity, -0.22 for unsecured, and -0.14 for subordinated. The first-differenced data is much less persistent, indicating that the use of differences may be more suitable. Because the GMM method first-differences the data (to eliminate the firm fixed effect), it also accounts for the problems that may arise as a result of persistence in the right-hand side variables of interest.[21]

[21] See footnotes 18 and 19 in Lemmon, Roberts, and Zender 2008 for a discussion.

Chapter 4

RESULTS

4.1 Maturity

Table 4 illustrates that the primary measure of short-term debt, the proportion of total debt maturing within 1-3 years ($Short - maturity$), is associated with greater new debt financing (column 1) and total new external financing (column 3). Although these results would appear consistent with the existing empirical literature, the remaining results suggest that short-term debt may actually *reduce* future financing and investment. Column 6 shows that $Short - maturity$ is associated with lower net debt issuance, indicating that although firms issue more new debt, the simultaneous *reductions* of existing debt are larger in magnitude. The coefficient indicates that a one standard deviation increase in the proportion of debt maturing in 1-3 years is associated with an economically meaningful decrease of 32% of average net debt issuance. There is no statistically significant relation with net equity issuance and thus the effect on combined net debt and equity financing is negative and significant (column 8). Furthermore, column 9 indicates that more short-term debt is associated with less future investment—the coefficient implies a decrease of 0.2% in investment for a one standard deviation increase in $Short - maturity$

The view that short-maturity debt may actually reduce debt financing and investment is further supported by column 4 of Table 4, which shows that $Short - maturity$ is negatively associated with the probability of a large, proactive increase in debt ($LPID$). The coefficient indicates that a one standard deviation increase in the proportion of debt maturing in 1-3 years is associated with a 0.9% lower probability of engaging in a LPID, which is economically meaningful given that the unconditional probability of a LPID is 9.9%. $Short-maturity$ is not significantly related to a large, proactive increase in equity ($LPIE$) (column 5).

The results for LPIDs and LPIEs are important for two reasons. First, the debt and equity transactions used on the left-hand side are tied primarily to increases in long-term investment—acquisitions or capital expenditures—as opposed to other uses of funds. Thus, the strong, negative relation in column 4 and the statistically insignificant relation in column 5 further supports the finding that short-maturity debt may actually reduce overall external financing and investment. Second, the LPID and LPIE transactions are major financing choices that indicate *substantial* access to external financing. Although there is no way to "net" the LPIDs and LPIEs, the relative sizes of the coefficients on $Short-maturity$ in columns 4 and 5 suggest that greater reliance on short-maturity debt lowers the likelihood of a large financing transaction "on net."

One interpretation of the negative sign between short-maturity debt and future net debt issuance (column 6) is the following: firms with shorter-maturity debt are more able to *reduce* their level of debt in the face of a negative shock to profitability, which allows them to avoid financial distress (see Dangl and Zechner 2016). Firms hit with a negative shock optimally respond by lowering their net debt issuance regardless, but a greater proportion of short-term debt should allow a firm to do this more quickly. If this is the case, then the negative relation between short-maturity debt and future net debt issuance may not indicate that short-maturity debt reduces access to new debt financing.

In order to understand whether the negative relation between $Short-maturity$ and net debt issuance is driven by firms that are optimally reducing their debt in response to being close to distress, I split the sample into firms with negative profitability and firms with zero or positive profitability. Firms with negative profitability should reduce debt more than firms with nonnegative profitability, so if the debt reduction motive is driving the results, the association between maturity and net debt issuance should be stronger in the sample of negative profitability firms. Table 9 shows the results of reestimating equation 3.1 on these two subsamples. The negative relation between $Short-maturity$ and net debt remains significant in the subsample of firms with nonnegative profitability, further indicating that the negative relation is a sign of *reduced* access to new debt financing rather than an optimal response to a shock.

The maturity results contrast with the interpretation of previous empirical evidence. Much of the theoretical literature finds that short-maturity debt enhances access to future financing by reducing or eliminating the effects of debt overhang. Empirically, Barclay and Smith 1995a show that firms with higher growth opportunities have more short-term debt, and Johnson 2003 and Billett, King, and Mauer 2007 show that short maturity reduces the negative relation between growth options and leverage. Goyal, Lehn, and Racic 2002 and Giambona, Golec, and Lopez-de-Silanes 2015 provide evidence that firms ex-ante choose shorter (longer) maturity when access to future financing becomes more (less) valuable as measured by changes in future growth options.

Based on correlations between maturity and growth opportunities, or on the effect of maturity on the growth options-leverage relation, these studies conclude that short-maturity debt is used by firms to mitigate underinvestment. While it may be true that firms' maturity structure responds ex-ante to changes in expectations about future investment, my results suggest that, *ex-post*, firms' overall debt issuance and ability to engage in large, new debt financing to fund investment may not be higher. Because firms do not appear to *fully* substitute this shortfall with equity, overall, more short-term debt may be associated with a lack of access to new financing and investment.

4.1.1 Discussion

Overall, the results suggest a negative relation between short-maturity debt and future investment that contrasts with theoretical predictions regarding how short-maturity debt can mitigate debt overhang. Additionally, the results are seemingly at odds with two previous empirical studies, Aivazian, Ge, and Qui 2005 and Dang 2011, that document a negative relation between *long-term* debt and future investment. Although these papers employ a specification that is different than equation 3.1, I nevertheless check the robustness of my results by estimating the investment-cash flow sensitivity model employed in both Aivazian, Ge, and Qui 2005 and Dang 2011. The results, not reported, show that my measure of short-maturity debt remains negative although it loses significance. Because I do not find the significant positive relation between short-maturity debt and investment documented in Aivazian, Ge, and Qui 2005 and Dang 2011, I conclude that the differences in results are due to differences in specifications.

The negative relation documented in Table 4 is consistent, however, with the rollover channel described in the recent work of He and Xiong 2012 and He and Milbradt 2016. Their models predict that more short-maturity debt can increase the incentive of equity holders to default early. This is because a larger amount of short-maturity debt means more frequent refinancing, and if equity holders must absorb refinancing losses (the difference between the face value of maturing bonds and the proceeds from issuing the new debt), then they choose to default sooner. This implies lower debt capacity, and hence reduced external financing ability, ex-ante.

4.1.2 Call Provisions

My main measures of debt structure do not explicitly account for call provisions. Call provisions may shorten the effective maturity of debt because they allow firms to repurchase and retire bonds prior to their stated maturity date. Barnea, Haugen, and Senbet 1980 show that long-maturity debt with call provisions is equally as effective as short-maturity debt at mitigating agency costs. Therefore, it is possible that the positive relation between long-maturity debt and future debt issuance and investment that I observe may be driven by the presence of call provisions in long-term debt. In other words, the results in Table 4 may be entirely the result of the way I define short maturity.

I check the robustness of the maturity results by accounting for the presence of call provisions. I use bond-level data from Mergent FISD and S&P Capital IQ to measure the presence of call options in a firm's outstanding, publicly-traded debt issues. I merge this data to the Compustat data I use for the main empirical tests.

In order to understand how the presence of call provisions in long-term debt affects the relation between maturity and future financing and investment, I use the bond-level data to construct an alternative measure of "maturity" which I refer to as $Short-effective-maturity$. I take the long-term debt maturing in 1-3 years (Compustat items $DD1$, $DD2$, and $DD3$) and add to it the long-term debt that matures in more than 3 years but that is callable in 3 years or less. The rationale for this measure is that I capture not only "true" short-maturity debt, but also debt that is effectively short-maturity by virtue of the fact that it can be called within 3 years. I then scale this sum by total long-term debt. Thus, the resulting variable captures the proportion of long-term debt that either matures in 1-3 years *or* can be called in 1-3 years.

I determine the amount of long-term debt that is callable in 1-3 years in each year t by calculating the difference between the year of the next call date (Capital IQ variable $IQ\_NEXT\_CALL\_DATE$) and year t.[22] In order to avoid overlap with the main measure of maturity, $Short-maturity$, I take only debt that matures beyond 3 years relative to t. As an example, assume a bond matures at $t = 2005$ and has a next call date of $t = 2003$. Then at $t = 2000$, I would consider that bond callable within 3 years but maturing beyond 3 years. Hence, this bond would be considered long-term debt that is callable in 1-3 years but that matures beyond 3 years and would thus be included in my new measure of maturity. Mathematically, the new measure of maturity is calculated as follows:

$$\frac{DD1 + DD2 + DD3 + CallableLT}{TD}$$

where $DD1$, $DD2$, and $DD3$ are the debt maturing in 1, 2, and 3 years, respectively, $CallableLT$ is debt maturing in more than 3 years but that is callable within 3 years, and TD is total debt. In other words, this new measure is equivalent to $Short-maturity$ plus $\frac{CallableLT}{TD}$.[23]

[22]Callable bonds typically have a "protection period" during which they cannot be called. Xu 2015 suggests that it is standard practice to set the protection period to at least half of the maturity at issuance. E.g., a bond issued with maturity of ten years will have a call protection period of five years.

[23]When data for callability is missing (i.e., when the measure $Short-effective-maturity$ is

I reestimate equations 3.1 and 3.2 using the alternative measure of maturity on the right-hand side and report the results in Table 5. For the sake of brevity, I omit the results for new debt and equity and net debt and equity. The relation between the measure of effective maturity and new total financing (column 1) is positive and significant, consistent with the results in Table 4. Column 2 shows that the measure of effective maturity has a negative, albeit statistically insignificant, relation with net external financing, and column 3 illustrates a negative and significant relation with future investment. The relation between effective maturity and the probability of a LPID (LPIE) is negative (positive), albeit statistically insignificant.

Taken together, the results in Table 5 do not suggest that the presence of call options in debt that matures beyond 3 years is driving the main results for $Short-maturity$. In other words, it is unlikely that the way I define short maturity debt in the main specification is driving the negative relation between short maturity and future financing and investment. Although the new measure of short-maturity debt is statistically insignificant for net external financing and the probability of a large new debt issue, the fact that the signs are consistent with the main sample results is reassuring. If debt callability were explaining why a greater proportion of short-maturity debt is associated with lower external financing and investment, then the new measure of maturity should be positive and significant.

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missing), I replace it with the main measure of maturity, $Short-maturity$. Thus, my measure of effective maturity potentially understates the degree to which long-term debt that matures beyond 3 years is callable within 3 years.

4.1.3 Bank Debt

The main sample results do not distinguish between publicly-traded and bank debt. To the extent that bank loans in particular are likely to be shorter maturity than publicly-offered bonds, the negative relation between the proportion of short-maturity debt and future financing and investment may be the result of a correlation between bank debt and future outcomes. In order to gauge whether bank debt drives the results, I use S&P Capital IQ data, which breaks down debt types into several categories, including term loans and revolving credit. Because the granular debt data is only available beginning in 2002, the sample period is very limited relative to the full sample that uses Compustat data.

I test the sensitivity of the results by including the proportion of total debt that is term loans and revolving credit as a control in equations 3.1 and 3.2 in order to capture the impact of bank debt. If the short-term nature of term lending and/or revolving credit facilities is driving the maturity-financing/investment relation, explicitly including a measure of bank lending on the right-hand side should weaken the coefficient on $Short-maturity$. I create a new variable, $Bankdebt$, by summing the amount of term loans and withdrawn revolving credit in each year and dividing the result by total debt. The mean (median) of this measure is 21% (0%), with a standard deviation of 0.36, during the years for which I have data (2002 onward). The sample correlation between this variable and $Short-maturity$ is 0.07, which suggests that firms with more short-maturity debt do not necessarily have a larger proportion of bank debt.

Table 6 reports the results of estimating equations 3.1 and 3.2 using the measure of bank debt on the right-hand side. For the sake of brevity, I only include the measures of total financing, investment, and the probability of large debt and equity issues. The variable *Bankdebt* is positively related to new external financing and negatively related to investment, similar to $Short-maturity$. However, it is not significantly related to net external financing or the probability of large new debt issues. More importantly, including *Bankdebt* on the right-hand side does not weaken the explanatory power of the main measure of short-maturity debt. Thus, the results in Table 6 do not suggest that the maturity results are simply picking up a relation between bank debt and future financing and investment.

4.2 Total Level of Debt

Table 4 illustrates that a higher level of book leverage is associated with a significantly lower probability of engaging in large, proactive increases in debt or equity. The -0.31 coefficient indicates that a one standard deviation increase in book leverage is associated with a 7.6% lower probability of a LPID, which is large relative to the unconditional probability of 9.9% and as such is economically meaningful. The negative association between total debt and large, proactive increases in *equity* (column 5) suggests that, although higher leverage may have a positive effect on new equity issuance (column 2), it has a significant negative effect on future large equity issues.

Finally, Table 4 shows that book leverage is significantly and negatively related to future net debt issuance (column 6), and positively related to future net equity issuance (column 7), although the effect on equity is much smaller. The coefficient indicates that a one standard deviation increase in book leverage in the previous year is associated with a roughly 4.5% decrease in net debt issuance, whereas a one standard deviation increase is only associated with a 1.2% increase in net equity. Furthermore, total debt is also negatively related to net external financing (column 8), indicating that combined debt and equity financing is lower following a period of higher leverage. Finally, total debt is negatively related to investment, indicating that firms invest less relative to their average in a period following higher leverage. The coefficient indicates that a one standard deviation increase in book leverage is associated with a decrease in investment of about 1% relative to average. Given average investment of 6.8%, this is economically meaningful and equivalent to a decrease of 14% of average investment.

An obvious explanation for the negative relation between current debt and future debt and equity financing is rebalancing: a firm with higher-than-optimal leverage may reduce its leverage by lowering its debt and increasing equity. Although this is likely part of the story, the results do not suggest it is the primary driver. Pure rebalancing, in which the firm substitutes equity for debt, should result in *no* change in total financing or investment. The fact that both investment and total net financing decrease following a high level of debt indicates that the result cannot be driven entirely by rebalancing. Furthermore, the evidence for large debt and equity issues suggests that significant increases in *both* types of financing are less likely following a period of high total debt, which would further indicate that it is not purely rebalancing.

Given that rebalancing is likely not the primary channel, the results are consistent with the total amount of debt reducing financing and investment through either a debt capacity channel or an agency cost channel. In the former, more debt reduces future new debt capacity, leading to a lower ability to fund investment with new debt. In the latter, higher debt is associated with lower future debt *and* equity financing and investment. The two channels are not mutually exclusive, and the results suggest that both are likely at work. The positive relation between past debt and future equity financing supports the debt capacity channel, because if investment is lower primarily due to debt overhang, then equity issuance should be *negatively* affected. On the other hand, total debt is also associated with a significantly lower probability of a new large equity issue, which would support the debt overhang channel.

One possible alternative interpretation of the negative relation between total debt and future investment is the mechanical effect of growth options. Because options contribute positively to the value of the firm, they result in lower leverage ratios (see, e.g., Berens and Cuny 1995, and Tserlukevich 2008). Therefore, it may appear that the low-leverage firms raise more external financing and also invest more in the future. However, my measure of total debt, book leverage, should be less sensitive to growth options than market leverage, because the denominator is the book value, not the market value, of assets. To further address this possbility, though, I reestimate equation 3.1 on subsamples of firms that likely have more valuable options. In particular, I measure yearly sales growth and define firms above the median to be "high growth" firms.[24] If the negative total debt and financing/investment relation is driven primarily by the presence of growth options, then the effect should become insignificant in a sample of firms that all have low growth opportunities. However, I find that higher total debt is still associated with lower future net financing and investment for low-growth firms, as shown in Table 8. Although the magnitude of the coefficients is smaller than for the subsamples of high-growth firms, the effects are still statistically significant, indicating that the feedback effect cannot be the primary driver of the results.

[24]Billett, King, and Mauer 2007 advocate the use of sales growth as a measure of growth opportunities that is an alternative to market-to-book ratio.

4.3 Security and Priority

Table 4 illustrates that greater reliance on unsecured debt is negatively associated with new financing but positively associated with net debt issuance (column 6) and the probability of a LPID (column 5). The coefficient on unsecured debt in column 6 implies an increase of roughly 16% of average net debt issuance for a one standard deviation increase. This finding is consistent with the predictions of Stulz and Johnson 1985 and Hackbarth and Mauer 2012, who show that firms can "preserve priority" for future debt in a way that facilitates future issues and minimizes over- and underinvestment. More precisely, consistent with my results, relying primarily on unsecured debt provides an option to issue both more unsecured and new senior debt in the future, making effective costs smaller and debt issues more frequent. Additionally, because existing risky debt creates debt overhang, secured debt allows firms to undertake investment opportunities they would otherwise forgo if they had to be financed via unsecured debt or equity. Finally, unsecured debt also encourages new debt financing because issuing more senior debt dilutes the value of the claims of existing debt holders. The resulting agency conflict however, has a potential to distort investment and can result in lower firm value.

Despite this, greater reliance on unsecured debt is also associated with somewhat lower net equity issuance and is negatively, albeit insignificantly, related to investment. Thus, I cannot conclude that unsecured debt has a strong or robust relation with future financing and investment.

Similarly, the priority structure of unsecured debt also does not appear to be robustly related to future financing and investment. Table 4 illustrates that having more subordinated debt is associated with higher net equity financing, but *Subordinated* is statistically insignificant for the net debt financing and investment variables.

4.4 Dynamic Panel Results

As a robustness check on the results discussed in Chapters 4.1-4.3, I estimate equation 3.3 using GMM and report the results in Table 7. I report coefficient estimates for the one-period lags of the dependent variables (those variables with a "L." prefix), in addition to the other variables in equation 3.3. The statistical significance of the lagged dependent variables illustrates the dynamic nature of financing and investment.

Consistent with the results in Table 4, a higher level of total debt is negatively associated with total net financing (column 2) and investment (column 3). The economic magnitudes of the coefficients are qualitatively similar to those in Table 4. Furthermore, the results for the proportion of short-maturity debt are also qualitatively unchanged relative to Table 4. Column 1 shows that greater short-maturity debt is associated with greater new external financing, but column 2 shows that it is associated with less net external financing. Finally, column 3 shows that short-maturity debt remains negative but loses significance in the investment equation.

Overall, the results in Table 7 show that, even after allowing for reversion in debt and equity financing and investment over time, the measure of short-maturity debt is negatively associated with net external financing and investment (although the relation with investment is insignificant). Furthermore, total debt is negatively and significantly associated with both measures of total external financing and investment.

Thus, the key results are unchanged after allowing for adjustment behavior of the dependent variables over time.

Chapter 5

ROBUSTNESS

The full sample analysis in Chapter 4 suggests that a higher level of total debt and a greater proportion of short-maturity debt are associated with lower future financing and investment. The following chapter further investigates how these aspects of debt are related to future outcomes and discusses how endogeneity may affect the interpretation of the results.

5.1 Subsample Analysis

The full-sample results are for the *average* firm. In order to ensure that the results are not being driven by a specific subset of firms, the following section examines whether debt structure has a differential effect for certain types of firms relative to others. I estimate equation 3.1 on three subsamples: (1) higher-growth firms, (2) lower-profitability firms, and (3) financially constrained firms. Higher-growth firms should value access to future financing more because more of their firm value is embedded in growth options. Therefore, the cost of forgone investment is higher for these firms. Low-profitability firms should value access to financing more because, all else equal, they should be closer to financial distress than higher-profitability firms. Financially constrained firms should value access to financing more because they have lower ex-ante access to external sources of financing.

Given the greater value these types of firms should place on access to future financing, the relation between debt structure and future debt, equity, and investment may be stronger for these three subsamples of firms. If these types of firms completely drive the relation observed in the full sample (Table 4), then the coefficients should be insignificant for the other set of firms. For example, if the only reason we observe a negative maturity-investment relation *on average* (i.e., in the full sample) is because ex-ante financially constrained firms exhibit this relation, then there should be no significant relation between maturity and investment for ex-ante unconstrained firms.

I define the subsamples as follows. For high-growth firms, I take the set of firms with yearly sales growth above the median. For low-profitability firms, I consider firms with negative profitability. For financially constrained firms, I compute the financial constraint index in Hadlock and Pierce 2010, which is a function of firm size and age. The index is constructed as

$$SA_{i,t} = (-.737 * size_{i,t}) + .042 * (size^2_{i,t}) + (-.040 * age_{i,t})$$

where size is the log of book assets and age is the number of years for which the firm has appeared in Compustat relative to year t. For example, if the firm has appeared since 2000, and $t = 2005$, then age is equal to 5. A higher value of the index indicates a more constrained firm. I use firms above the median value of the SA index as the constrained subsample.

5.1.1 Results

Tables 8-10 show the results. I only include results for total new external financing, total net external financing, and investment. In Table 8, I compare high- vs. low-growth firms, where growth is defined in terms of yearly sales growth. Firms above the median sales growth are considered high-growth firms. The effect of book leverage on total net financing and investment is stronger for the subsample of high-growth firms, consistent with costlier agency conflicts for these firms. The primary measure of short maturity, as shown in Table 8, continues to be significantly associated with lower investment, and the effect is stronger in the high-growth subsample. As an alternative to sales growth, I also partition the sample by market-to-book ratio (MTB), and consider firms above the median to be high-growth firms. The results, not shown, are qualitatively similar to the results for the sales growth partition.

In Table 9, I compare the relation between debt structure and future financing and investment for firms with negative profitability against firms with zero or positive profitability. Unlike in the high- vs low-growth subsamples, the differential impact of total leverage is less pronounced. All else equal, negative profitability firms should benefit more from reducing leverage, as they are closer to financial distress. However, the coefficient magnitudes for negative profitability firms are essentially the same compared to positive profitability firms.

Finally, Table 10 shows results for the subsample of constrained vs unconstrained firms, where constrained firms are defined as having a value of SA greater than the median. Again, there are no meaningful differences in the signs or magnitudes of the coefficients for the two types of firms.

Overall, the analysis of these three subsamples of firms is broadly consistent with the full sample analysis. Although the coefficients for total leverage and maturity differ slightly across subsamples of firms, they are qualitatively the same. Therefore, it is unlikely that particular subsets of firms are driving the average relation observed in Table 4.

5.2 Causality and Selection

My empirical strategy does not allow me to cleanly estimate a causal effect of debt structure. There are two potential sources of endogeneity that may bias my regression coefficients and lead me to overstate the true causal effect. First, there is reverse causality, which would arise if firms select into a particular debt structure ex-ante based on their expectations about the need to fund investment with external financing in the future. If, for example, firms anticipate profitable investment opportunities in the future, they may choose a particular level of debt and/or maturity profile that will allow them to undertake the investment. Second, there is correlation with a common, unobservable factor. This would arise if both debt structure and financing and investment are correlated with a common variable that is not included as a control in my regression.

In the following subsection, I address both potential sources of endogeneity by modifying my empirical methodology and by implementing an econometric test for the presence of selection on unobservables.

5.2.1 Reverse Causality

Despite the potential for reverse causality bias, it is difficult to believe that firms can anticipate investment, and hence the need for financing, so far in advance. Therefore, it is unlikely that the coefficients in Table 4 are *primarily* the result of firms selecting ex-ante into debt structure based on expectations about future investment.

Consistent with this conjecture, my results remain significant when I separate the sample by ex-ante measures of growth options, as I discuss in Chapter 5.1.1. Table

8 illustrates that the relation between total debt and investment and between the measure of short-maturity debt and investment is negative and significant for both high- and low-growth firms. Were the coefficients being driven primarily by reverse causality, I would not expect the relation to remain negative and significant in the sample of low-growth firms. This is because such firms should have less incentive to select ex-ante into a debt structure that allows them to undertake profitable investments in the future.

As an additional robustness check for reverse causality in the investment equation, I follow Lang, Ofek, and Stulz 1996 and Aivazian, Ge, and Qui 2005 and separate my sample into core and noncore business segments. Lang, Ofek, and Stulz 1996 study the effect of total debt on investment. In order to account for the possibility that firms select low leverage anticipating profitable growth opportunities, they estimate the relation between leverage and investment in diversified firms' core and noncore segments. They argue that the growth opportunities of divisions of a firm that are removed from the core of the firm should not have much impact on capital structure. Therefore, if leverage is related to investment *primarily* due to ex-ante selection, then the relation should be much stronger for core divisions. On the other hand, if there is a causal relation between leverage and investment, then there should be little difference in the relation between leverage and investment across core and noncore segments.

Following the logic in Lang, Ofek, and Stulz 1996, if the coefficient estimates in column 9 of Table 4 are primarily the result of firms selecting into a particular debt structure anticipating investment opportunities, then they should be much stronger for firms' core segments. On the other hand, if the estimates pick up a causal effect of debt structure, then they should be qualitatively similar in the noncore segments, because the reverse causality concerns are mitigated in the sample of noncore segments.

I identify firms' core and noncore segments using the Compustat segments data. I consider a core segment to be one with a two-digit SIC code that matches the two-digit SIC code of the firm. The full dataset contains 116,873 core and 33,195 noncore segment-years. Following Lang, Ofek, and Stulz 1996, I measure segment-level investment in two ways. First, I divide segment-level capital expenditures by segment-level total assets (Compustat item *capxs* divided by item *ias*) and call this measure Inv_seg1. Second, I subtract segment-level depreciation (Compustat item *dps*) from capital expenditures and divide by segment-level total assets, and I call this measure Inv_seg2.

I regress both measures of segment-level investment on the debt structure variables and controls from equation 3.1. I use firm-level, as opposed to segment-level, controls because most of the controls are only observable at the firm level. Table 11 reports the results. Total debt and the measure of short-maturity debt are negative and significant for both core and noncore investment as measured by either Inv_seg1 (columns 1-2) or Inv_seg2 (columns 3-4). The magnitude of total debt is qualitatively similar across types, and the short-maturity coefficient is actually stronger for noncore segments. This indicates that a higher level of debt and a greater reliance on short-maturity debt are negatively related to *both* core and noncore investment, the latter of which should be less sensitive to growth opportunities. Therefore, it is unlikely that the relation between total debt and maturity and investment is driven primarily by ex-ante selection.

5.2.2 Selection on Unobservables

I address the second potential source of endogeneity by testing how sensitive the debt structure coefficient estimates are to omitted variables. I implement the econometric test outlined in Oster 2015,[25] which tests whether the inclusion of additional unobservable variables could drive the cross-sectional relation between debt structure and financing and investment to zero (i.e., produce a β statistically indistinguishable from 0). As described in Dietrichson and Ellegard 2015, the Oster 2015 paper shows that if the relation between the variables of interest and the control variables included in the estimation is proportional to the relation between the variables of interest and the *omitted* variables (proportional selection), then the magnitudes of changes in the coefficients of interest and the R^2 after including controls are informative about the size of the omitted variable bias.[26]

Oster 2015 suggests reporting the value of δ for a maximum R^2 ("R^2_{max}") of $1.3 * \tilde{R}$, where $\tilde{R}$ is the fully-controlled R^2.[27] Conceptually, δ represents the degree of selection on unobservable characteristics relative to observables that would be required to explain away a result (i.e., drive the coefficient estimate to zero). For example, a δ value of 2 means that unobservables would have to be twice as important as the observables to produce a coefficient estimate equal to 0 *were* the unobservables to be included in the regression. Thus, a value of δ greater than 1 means that unobservables

[25] I use the State module "psacalc."

[26] A number of recent papers have implemented this test to understand how sensitive the main results are to omitted variables. See, e.g., Dietrichson and Ellegard 2015, Galletta 2015, and Graham, Miller, and Strom 2016.

[27] For further details and formal derivation of δ, see Oster 2015.

would have to be *more* important than observables to produce a coefficient estimate of 0, and Oster 2015 suggests showing a δ greater than 1 as a "robustness reporting standard."

Table 12 reports the values of δ for each of the debt structure variables for the specifications that use total new financing, total net financing, investment, and LPID/LPIE as the dependent variables. I use the estimated R^2 from each specification as $\tilde{R}$ (the fully-controlled R^2). In other words, I take the R^2s reported in Table 4, multiply them by 1.3, and use those values as the value of R^2_{max} in the Oster 2015 test.

Overall, the results of the test do not indicate omitted variables are driving the main results. For most specifications, the the values of δ for the debt structure variables either exceed 1 or are negative. Values of δ that exceed 1 indicate that unobservables would have to be more important than observables to produce a coefficient estimate equal to 0. For example, the δ of 4.21 for total debt in the investment equation (row 1 of column 3) indicates that unobservables would have to be 4.21 times as important as observables in order to drive the observed coefficient to 0 *were* they to be included.

Values of δ that are negative indicate that the coefficient increases in magnitude when controls are added. For example, the δ of -4.57 for $Short-maturity$ in the investment equation indicates that the coefficient on $Short-maturity$ is larger in magnitude when the full set of controls is included compared to the coefficient when only $Short-maturity$ is included on the right-hand side. Although negative δs make this method uninformative about the size of the potential omitted variable bias, Graham, Miller, and Strom 2016 argue that negative deltas indicate that results are unlikely to be driven by omitted variables. This is because going from zero controls to the full set of controls *strengthens* the coefficients of interest when delta is negative.

Overall, these results suggest that selection on unobservables is unlikely to be driving the main results for the total level of debt and maturity. When the δs are positive, they are mainly greater than 1, indicating that if the unobservables were to be included in the regressions, the estimated coefficients would not be driven to 0. Additionally, negative values of δ indicate that inclusion of controls *strengthens* the estimated coefficients, making it unlikely that including additional unobservables would drive the coefficients to 0.

5.2.3 Discussion

Although the results of the dynamic panel estimation in Table 7 and the results in Tables 8, 11, and 12 reduce concerns about reverse causality and endogeneity more generally, I am ultimately unable to rule out reverse causality. However, three additional points should be noted. First, the existence of reverse causality would *support* a causal channel—firms should not select into, e.g., short-maturity debt unless they believe short-maturity debt will *cause* future debt overhang to be less severe.

Second, although sparse, existing literature that uses exogenous changes in aspects of debt structure generally agree with my results. While there is no paper, to my knowledge, that identifies exogenous changes in the proportion of short-maturity debt, existing literature does suggest that greater reliance on short-term debt can have a causal effect on investment during times of heightened rollover risk. Almeida et al. 2011 show that firms with more of their long-term debt maturing during the onset of the financial crisis cut investment more than otherwise similar firms whose debt was not maturing until later. In other words, firms that rely more heavily on short-maturity debt may be less able to invest during times when it is difficult to roll over or refinance existing debt. This is broadly consistent with my results for maturity, despite the fact that their findings are limited to a small time period and do not exploit *changes* in reliance on short-maturity debt.

In terms of total leverage, Cohen, Katz, and Sadka 2016 show that firms increase their total debt in response to an exogenous increase in debt capacity. That is, higher debt capacity is associated with an increase in total debt. Although their results do not indicate that firms increase investment following an increase in debt capacity, their particular sample period (2007-2009) makes it difficult to draw a broad conclusion. Thus, their findings are not inconsistent with my results and support that lower total debt (high debt capacity) increases future external financing. Finally, in terms of unsecured debt, Biguri 2016 shows that exogenous increases in access to unsecured debt lead to greater investment. The relation between unsecured debt and investment that I document is negative, but statistically insignificant, therefore my results are not inconsistent with this finding.

Third, and most importantly, the results on maturity in particular are informative regardless of the extent to which ex-ante selection of debt structure drives the results. If reverse causality is the primary driver, then my results suggest firms select into longer-maturity debt in anticipation of the need for financing and investment. This would run contrary to the existing empirical evidence which concludes that firms select short-maturity debt in order to mitigate future underinvestment incentives. On the other hand, if the regression coefficients primarily pick up a causal effect of debt structure, then my results suggest that short-maturity debt does not actually increase future financing capacity or mitigate debt overhang, which contrasts with many theoretical predictions.

5.3 Cost of External Financing

The main results consider only the *quantity* of debt and equity, but the *price* of debt and equity can also provide insight into how debt structure is related to the ability of firms to access new financing. Therefore, as a robustness check, I estimate the relation between debt structure and the cost of future financing.

I measure the cost of debt financing in two ways. First, I follow Maehlmann 2009 and use the *realized* cost of debt (*realcost*), measured as the ratio of a firm's interest expense in year t to interest-bearing debt outstanding in year t. Although this is not a market-based measure, it still directly measures the cost of debt a firm faces. Additionally, it is the only measure available from Compustat for firms without publicly-traded debt.

Second, I measure the cost of publicly-offered debt using the Mergent FISD data. In particular, I measure the weighted average offering yield for all of a firm's bonds in the year of issue, where the weights are based on the offering amount. I then compute the difference between the weighted average yield and the yield of comparable-maturity Treasuries and call this measure *spread*. This variable therefore measures the cost at issue of a firm's publicly-traded debt.

For the cost of equity, I compute the PEG ratio derived in Easton 2004. This is the price-earnings ratio scaled by the short-term earnings growth rate and is a commonly used *heuristic* measure of the cost of equity.[28] Although there are many other potential measures, such as the implied cost of equity in Gebhardt, Lee, and Swaminathan 2005, the analysis in Botosan and Plumlee 2005 suggests that the PEG ratio is one of the most consistently related to firm-specific risk.

[28] See Easton 2004 for an in-depth derivation and discussion.

Following Easton 2004, I compute the PEG ratio as follows:

$$peg_{i,0} = \sqrt{\frac{eps_{i,2} - eps_{i,1}}{p_{i,0}}}$$

where $eps_{i,t}$ is firm i's median long-run earnings-per-share forecast for year t and p_0 is the stock price at year 0. The data for EPS forecasts comes from I/B/E/S and the stock prices from Compustat.

Summary statistics for the *realcost*, *spread*, and *peg* are found in Table 2. In order to estimate the relation between debt structure and cost of debt, I estimate equation 3.1 using *realcost*, *spread*, and *peg* as dependent variables, and I report the results in Table 13. Total debt is positively related to the balance sheet (realized) cost of debt, the offering spread, and the cost of equity. This is consistent with a higher level of debt being associated with a lower *quantity* of total net financing as shown in Table 4.

The measure of short-maturity debt is positively related to all three costs of financing. Although the positive relation with the realized cost of debt is consistent with the negative relation between $Short-maturity$ and the quantity of total *net* financing in Table 4, the fact that $Short-maturity$ is positively related to the offering spread is puzzling. This is because $Short-maturity$ is associated with a greater quantity of *new* debt financing, and the offering spread is essentially the cost of new public debt issues. The fact that the quantity of debt in column 1 of Table 4 includes all debt, and not just public debt, may explain this. The measure of unsecured debt is not significantly related to the cost of either new debt or equity financing.

Overall, the results for the cost of debt and equity in Table 13 are broadly consistent with the results for the quantity of debt and equity. A higher level of debt and a greater reliance on short-maturity debt are associated with a lower quantity of future external financing, and also a higher cost.

Chapter 6

EXTENSIONS AND FUTURE WORK

The following chapter details future work. In particular, there are two main avenues through which the paper can be improved: better addressing endogeneity, and adding additional aspects of debt structure.

6.1 Approaches to Endogeneity

There are few empirical papers that offer convincing sources of exogenous variation in all aspects of debt structure. Cohen, Katz, and Sadka 2016 use exogenous variation in total leverage, but not in any other aspects of debt. Almeida et al. 2011 use exogenously determined maturity structure to study how maturity affects investment, but their study only exploits cross-sectional heterogeneity in maturity at a given time, rather than within firm variation over time. Additionally, they only consider maturity. Similarly, Biguri 2016 uses exogenous variation in the amount of unsecured debt, but does not consider maturity or priority.

An ideal test of causality in my paper would require a source of exogenous variation in all aspects of debt structure at the same time. I.e., variation in total debt *and* maturity *and* security *and* priority. As a second-best alternative, I take the following approach: I try to identify firms with "suboptimal" debt structures and estimate the relation to financing and investment. This directly addresses reverse causality because firms should never select a suboptimal debt structure if they anticipate financing or investment needs. If the only reason I observe a relation between debt structure and future firm outcomes is because firms with investment opportunities select ex-ante into a particular debt structure, then the relation should weaken or disappear for firms with suboptimal debt structure. Thus, if the relation between debt structure and financing and investment is similar across firms with more and less optimal debt structures, it must be that debt structure has a causal effect.

This approach requires that points at which debt structure is suboptimal be identified. One way to do this is to identify firms that undertake significant refinancing activity in order to change their capital structure. Assuming that such refinancing is motivated by a desire to move the firm closer to the "optimal" debt structure, these actions can provide a good setting for estimating a causal effect of debt structure. This is because taking action to move capital structure close to the optimal level implies that it was suboptimal in the years immediately preceding the refinancing.

Once firm-years in which debt structure is likely to be suboptimal are identified, I can estimate the relation with financing and investment and compare the strength of the association with that of the association between "more optimal" debt structure and financing and investment. As an example of how this would work, consider a firm for which I can identify refinancings that were motivated by a desire to change capital structure at time $t = 0$ and $t = 8$. Because the firm refinanced at $t = 8$, its debt structure was likely suboptimal at, e.g., $t = 6$. Now assume the firm undertakes some financing and investment activity at $t = 7$ (*before* the major refinancing). The relation between the suboptimal debt structure at $t = 6$ and the outcomes at $t = 7$ should be relatively more causal in nature than the relation between debt structure and firm outcomes in general (i.e., for the rest of the sample).

The key hurdle to implementing such an approach empirically is identifying major refinancings that are undertaken for capital structure reasons. First, *deliberate* refinancings, as opposed to, e.g., convertible debt conversions or exercises of employee stock options, must be identified. As Korteweg, Schwert, and Strebulaev 2014 point out, this is not trivial. Second, once deliberate refinancings are identified, the subset of those that are used for capital structure reasons, as opposed to, e.g., investment or operating reasons, must be identified.

One approach to identifying capital structure-motivated refinancings is outlined in Korteweg, Schwert, and Strebulaev 2014. They use firms' SEC filings to identify and classify major refinancings into those used for (1) operating reasons, (2) investment reasons, and (3) "capital structure" reasons. The capital structure refinancings include equity repurchases, debt repayment or maturing debt, forced conversion of debt into equity, restructuring/reorganization, and "pure capital structure" reasons. It may be possible to use their methodology to capture when a firm moves closer to its optimal debt structure. However, their method requires intensive hand collection of data from firm SEC filings. Thus, as a first pass at identifying *capital structure* motivated refinancings that requires less intensive data collection, I take the approach of Hovakimian, Opler, and Titman 2001, Hovakimian 2004, and Leary and Roberts 2005. These papers consider a capital structure change as having occurred if the absolute value of the difference between the change in net equity and the change in net debt scaled by the previous period total assets exceeds 5%. Borrowing the notation of Korteweg, Schwert, and Strebulaev 2014, this means:

$$\frac{|\Delta E_{i,q} - \Delta D_{i,q}|}{A_{i,q-1}} > 0.05$$

Here, the variables are measured at the quarterly level, and net equity and net debt are defined differently than in Chapter 3.1. Specifically, net equity is measured as the sale of common and preferred stock minus the purchase of common and preferred stock during quarter q, and net debt is the change in total debt (total debt being equal to the sum of short-term debt and long-term debt) from the *previous* quarter. Quarterly total assets $A_{i,q}$ is measured in the same way as in Chapter 3.1.

I construct a dummy equal to 1 if the condition above is met and 0 otherwise and call this variable $Refi$. Thus, $Refi_{i,q}$ is equal to 1 if firm i in quarter q undertook a refinancing as defined above, and 0 otherwise. I include only firms for which I have eight consecutive years of data in order to ensure that I have enough time between refinancing events to conduct the analysis.[29] After this filter, roughly 19% of firm-quarters in the full sample are identified as refinancings, which is consistent with both Leary and Roberts 2005 and Korteweg, Schwert, and Strebulaev 2014.

In order to identify suboptimal debt structure, I take the following approach. I first require that each firm have (1) 8 consecutive years of data, (2) at least 2 refinancings within the time period in which they appear in the data, and (3) at least one stretch of 6 or more years in which no refinancings occur. In other words, a sufficient condition for a firm to be included is that it appear for 8 consecutive years and have a refinancing in both the first and last year in which it appears in the data. Such a situation is illustrated graphically in Figure 1: refinancings occur at $t = 0$ and $t = 8$, and no refinancings occur in between. For firms with more than two refinancings during the time in which they appear in the data, I require at least 6 years with no refinancings between each refinancing firm-year.

After filtering the sample based on these criteria, I then code a firm-year as "suboptimal" debt structure if it appears 6 or more years after one refinancing but two or more years prior to another refinancing. Finally, I regress investment and financing decisions that occur in between refinancings but *after* the "suboptimal" debt structure firm-year on debt structure in the suboptimal firm-year.

[29] Because this cutoff is arbitrary, I conduct robustness checks using different cutoffs.

This method is illustrated graphically in Figure 1. The firm has two refinancings, at $t = 0$ and $t = 8$, and there are no other refinancings in between. I code firm-year $t = 6$ as having suboptimal debt structure because it appears 7 years after the first refinancing but two years prior to the second refinancing. I then measure investment and financing at $t = 7$, which is in between the two refinancings but in the year after the suboptimal debt structure firm-year. I regress the financing and investment at $t = 7$ on debt structure at $t = 6$.

As described above, I estimate equation 3.1 for the subsample of firm-years in which I can identify suboptimal debt structure. I then estimate 3.1 on the subsample of firm-years for which debt structure is not suboptimal. I report the results of both subsample estimations in Table 14. Similar to the subsample analysis in Chapter 5.1, I only report results for the measures of total financing and investment. Columns 1-3 show how suboptimal debt structure is related to financing and investment, and columns 4-6 show how debt structure that should be closer to optimal is related. The measures of total leverage and short-maturity debt are significant (and their signs unchanged relative to the main sample results) for both measures of total financing, indicating that even when these characteristics of debt may be less than optimal, they are still related to future financing. Although short-maturity debt loses significance for investment, it is still negative.[30]

Although the coefficients in columns 1-3 are somewhat smaller in magnitude, they are, for the most part, unchanged in sign and significance relative to columns 4-6. Thus, Table 14 provides at least suggestive evidence that suboptimal debt characteristics are

[30] The requirements that (1) I have 8 consecutive years of data for each firm and (2) that I require 6 or more years of no refinancings prior to when debt structure is measured decrease the estimation sample, and thus the power, significantly. After applying these filters, the number of useable observations drops to 83,078. Of this, there are 5,415 firm-years in which debt structure is "suboptimal."

related to future financing and investment, which would indicate a causal effect because reverse causality concerns are mitigated. A more precise measure of refinancings along the lines of what Korteweg, Schwert, and Strebulaev 2014 describe may make the results stronger. Therefore, I believe that further work in this direction is a promising avenue for establishing causality.

6.2 Other Aspects of Debt

In addition to better addressing endogeneity, the results can be improved by adding two additional aspects of debt structure that should affect financing and investment, but for which the causal effect is empirically unclear.

6.2.1 Convertible Debt

The first aspect of debt that should affect financing and investment is the presence of convertibility features. Convertible debt can be converted into equity by bondholders, and it should theoretically affect financing and investment through its effect on agency costs of debt.

Green 1984 shows that firms may issue convertible debt to mitigate asset substitution. This is possible because convertibility reduces how convex the payoff to shareholders is in the value of the firm's assets, thus reducing their incentive to shift into higher-risk projects.[31] Hennessy and Tserlukevich 2008 also show that convertible

[31] When convertibility is not present, shareholders can transfer value from bondholders by risk shifting. However, convertibility forces existing shareholders to share the benefits of a riskier project with new shareholders when conversion occurs.

debt can mitigate risk-shifting. In contrast, Lyandres and Zhdanov 2014 show that convertible debt can mitigate or even eliminate underinvestment incentives.[32]

As with maturity, security, and priority, the theory thus offers potentially conflicting predictions. If convertibility reduces risk-shifting, then we might expect the presence of conversion options to be associated with less financing and investment ex-post, as growth options are not exercised as often. On the other hand, if these clauses reduce underinvestment, then we would expect greater financing and investment ex-post. Thus, the effect can go two ways depending on which theory we consider.

And as with maturity, security, and priority, the existing *empirical* literature focuses primarily on the ex-ante question: how does the choice of whether to issue convertible debt vary with expectations about investment opportunities or with expectations about the severity of asset substitution? Lewis, Rogalski, and Seward 1998 show that firms that face more severe risk-shifting issue convertible debt with higher post-conversion ownership.[33] Similarly, Dorion et al. 2014 find that firms with greater ex-ante risk-shifting incentives tend to issue more convertible debt.[34]

As for convertibility and underinvestment, Lewis, Rogalski, and Seward 1999 and Krishnaswami and Yaman 2008 both find that higher market-to-book ratio predicts a

[32]Their model considers two opposing ways in which convertibility can affect investment incentives. On the one hand, the debt-like features of convertible debt lead to underinvestment. On the other hand, the convertibility can lead equityholders to invest *earlier* than they would with only straight debt, which essentially lowers the value of the convertibility option to bondholders and leads to them converting later. Delayed conversion in turn reduces the proportion of the total equity value the bondholers capture, which reduces the transfer of wealth to bondholders from the investment and mitigates underinvestment.

[33]Higher post-conversion ownership by debtholders means that equityholders are punished more if debtholders choose to convert.

[34]Interestingly, they do not find a significant relation between market-to-book (a proxy for the cost of underinvestment) and the probability of issuing convertible debt. Related to my study, they also estimate the relation between convertibility and realized investment in risky projects.

higher probability of issuing convertible debt as opposed to straight debt. This implies that firms that expect *underinvestment* issue more convertible debt.

The existing empirical results may be interpreted as consistent with the predictions of both Green 1984 and Hennessy and Tserlukevich 2008 as well as Lyandres and Zhdanov 2014. That is, firms may expect that convertible debt reduces both over- and under-investment. However, because the existing empirical results do not relate convertibility to *realized* financing and investment, they cannot say whether convertibility is able to reduce over- or under-investment ex-post.

Given the lack of empirical evidence on how the presence of convertibility provisions affects financing and investment ex-post, my first extension will be to incorporate this into the analysis. The sign of the coefficient on convertible debt will shed light on which of the effects (over- or underinvestment) is remedied by convertible debt ex-post. That is, if convertible debt is more important, on average, for underinvestment, then we would expect a positive association with future financing and investment.

As a first pass, I gather data on convertibility from S&P Capital IQ and Mergent FISD. For each firm-year, I construct the proportion of total debt outstanding that has a convertibility provision. I use the Mergent FISD bond type "CCOV" to construct this variable from the offering amount and amount outstanding in any given year. I add the variable $Conv$ to equation 3.1 and report the results in Table 15. The proportion of convertible debt is positively and significantly related to net financing, investment, and the probability of a LPID. This is consistent with the prediction of Lyandres and Zhdanov 2014 that convertibility features should reduce future underinvestment incentives.

6.2.2 Performance Sensitive Debt

The second characteristic of debt that I will incorporate into my analysis is performance pricing provisions. These are debt contract clauses that make debt sensitive to firm performance. These clauses typically take the form of a rating or financial ratio trigger that results in, e.g., an increase in coupon rate, a forced early repayment of debt by equityholders, or a forced early repayment of debt with proceeds from liquidation of the firm's assets. The existing literature suggests that such performance sensitive debt (PSD) can affect financing and investment by mitigating agency costs.

The model of Bhanot and Mello 2006 suggest that credit rating based triggers can reduce equityholders' incentives to overinvest by shifting into riskier projects. However, they show that this only occurs if the trigger is tied to a cash infusion by equityholders, as opposed to, e.g., an increase in the coupon rate. In contrast, Koziol and Lawrenz 2010 find that triggers tied to increases in coupon rate (in so-called step-up bonds) *can* effectively mitigate overinvestment incentives.

Sarkar and Zhang 2015 also focus on PSD and agency costs, but instead look at how performance provisions can affect underinvestment. They consider a setting in which the coupon payment rises as performance deteriorates and default risk increases, but in which the coupon payment falls as performance improves. The symmetric nature of the performance trigger can result in coupon-based PSD reducing the effects of debt overhang.[35] Myklebust 2012 considers the joint choice of performance pricing

[35] This is because when equityholders invest in a positive NPV project, earnings of the firm increase, which reduces default risk and results in a coupon decrease. The lower coupon payment makes existing risky debtholders worse off at the expense of equityholders, mitigating the underinvestment incentive ex-ante.

provisions and debt priority and finds that the impact of PSD on agency costs of debt should depend on the priority structure of debt.[36]

Thus, the existing theoretical literature on how PSD affects agency costs offers mixed implications for financing and investment. On the one hand, if PSD mitigates risk-shifting incentives, then the use of PSD might be associated with less investment ex-post. On the other hand, if PSD mitigates the effects of debt overhang, then we might expect it to be associated with more debt and equity financing (because growth options are exercised and funded with both debt and equity more often), as well as investment, ex-post.

The empirical results on the relation between performance pricing provisions and financing and investment are limited. The only paper, to my knowledge, that looks at the relation between PSD and future financing is Begley 2012, which uses a sample of loans from Dealscan and finds that firms that use PSD provisions receive more private debt financing at a lower cost than those that do not. I am currently still in the process of gathering data for PSD provisions.

[36]Consistent with Hackbarth and Mauer 2012, this model shows that if the firm has outstanding risky debt, then issuing new debt of equal or higher priority reduces underinvestment but increases risk-shifting, whereas issuing new debt of lower priority achieves the opposite. In the former case, if the new debt also contains PSD provisions, then the risk-shifting problem is exacerbated. On the other hand, if the firm issues new debt of lower priority with a PSD provision, then the underinvestment problem is not as severe.

Chapter 7

CONCLUSION

I study the link between current debt structure and future financing and investment. My results suggest that, contrary to existing empirical work and many theoretical predictions, a greater proportion of short-maturity debt is associated with lower ex-post financing and investment. This is consistent with short-term debt creating rollover risk that can effectively reduce ex-ante debt capacity. The result is not driven by the presence of call options in long-term debt, nor is it driven by an association between bank debt and financing and investment. Additionally, the results show that a higher total level of debt may reduce future external financing and investment. The negative relation is not simply the result of rebalancing, nor is it due to a mechanical feedback effect from growth options to leverage. Furthermore, I do not find that total debt negatively impacts future investment primarily via an agency cost channel, whereby higher debt imposes greater debt overhang. I conclude that the effect is primarily a result of higher leverage reducing future debt capacity. Finally, I find evidence that unsecured debt increases future debt issuance, but has an ambiguous effect on future investment.

Figure 1. Identifying Suboptimal Debt Structure Between Refinancings

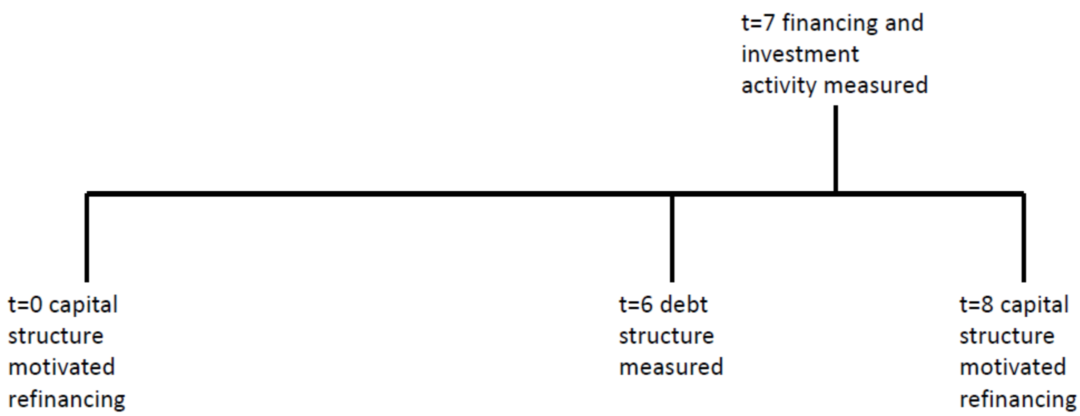

Table 1. Variable definitions

Variable	Description
Book_lev	Total debt divided by the book value of assets
Mkt_lev	Total debt divided by the sum of total debt and market capitalization
Short-maturity	Debt maturing in 3 years or less divided by total debt
Unsecured	Unsecured debt divided by total debt
Subordinated	Subordinated debt divided by unsecured debt
LPID	Dummy equal to 1 if firm-year has increase in debt defined in Appendix A.1
LPIE	Dummy equal to 1 if firm-year has increase in equity defined in Appendix A.2
dissue	Increases in long-term debt divided by lagged assets
eissue	Sale of common and preferred stock divided by lagged assets
ndissue	Increases in long-term debt net of reductions, divided by lagged assets
neissue	Sale of common and preferred stock net of repurchases, divided by lagged assets
newexternal	Increases in long-term debt plus sale of common and preferred stock, divided by lagged assets
netexternal	Sum of ndissue and neissue
investment	Capital expenditures divided by lagged assets
cash	Cash holdings divided by assets
rd	R&D expense divided by assets
missrd	Dummy equal to 1 if R&D expense is missing
size	Log(assets)
mtb	(Assets - shareholders equity - deferred taxes + market cap + pref stock liquidating value) / assets
profitability	Operating income before depreciation divided by assets
tangibility	Net property, plants, and equipment divided by assets
dividend payer	Dummy equal to 1 if the firm paid a dividend in the given year
apay	Accounts payable divided by total assets
rtg_dummy	Dummy equal to 1 if the firm-year has a S&P credit rating
salegr	Year-over-year percentage change in sales growth
SA	Hadlock and Pierce 2010 financial constraint index
age	The number of years for which the firm has appeared in Compustat
realcost	Ratio of a firm's interest expense in year t to interest-bearing debt outstanding in year t
spread	Spread over comparable-maturity Tsys of a firm's weighed average offering yield for public debt
peg	The price-earnings growth ratio defined in Easton 2004
inv_seg1	Segment-level capex divided by segment-level assets
inv_seg2	(Segment-level capex minus segment-level depreciation) / segment-level assets

Table 2. Summary Statistics
Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. All variables are winsorized at the 1% level.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Book_lev	150427	0.266	0.246	0	1
Mkt_lev	133099	0.257	0.255	0	0.94
Unsecured	112588	0.624	0.374	0	1
Short-maturity	132494	0.343	0.333	0	1
Subordinated	130963	0.049	0.152	0	0.828
LPID	128609	0.099	0.299	0	1
LPIE	150369	0.08	0.271	0	1
dissue	144168	0.098	0.183	0	1
eissue	146705	0.067	0.175	0	0.974
ndissue	127622	0.025	0.146	-0.295	0.832
neissue	124646	0.061	0.252	-0.161	1.75
newexternal	128310	0.226	0.459	0	2.837
netexternal	117750	0.092	0.323	-0.239	2.097
investment	148218	0.068	0.076	0	0.508
size	151037	5.223	1.9	2.303	10.461
mtb	128028	1.833	1.727	0.46	47.219
profitability	150089	0.076	0.205	-4.72	0.432
tangibility	150742	0.299	0.237	0	0.945
dividend payer	151037	0.387	0.487	0	1
rd	150068	0.04	0.1	0	0.69
missrd	150068	0.45	0.5	0	1
cash	140174	0.111	0.157	0	0.893
apay	150952	0.091	0.079	0.003	0.426
rtg_dummy	151037	0.196	0.397	0	1
salegr	134190	1.203	0.618	0.283	5.369
SA	150427	-2.934	0.684	-4.713	-1.475
age	150427	9.572	8.272	0	37
realcost	127351	0.122	0.149	0.007	1
spread	5537	1.706	3.28	-10.72	9.07
peg	31943	0.148	0.167	0	1.179
inv_seg1	79398	0.071	0.087	0	0.504
inv_seg2	78351	0.022	0.079	-0.162	0.416

Table 3. Variable correlations

Correlation coefficients for right-hand side variables used in the estimation of equations 3.1 and 3.2. Pearson correlation coefficients are reported below the diagonal, and Spearman correlation coefficients are reported above the diagonal. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. All variables are winsorized at the 1% level.

	Book_lev	*Short-mat*	*Unsec*	*Subord*	*Size*	*MTB*	*Profit*	*Tang*	*Div payer*	*R&D*	*Miss R&D*	*Cash*	*Trade cred*	*Rtg dum*
Book_lev	1	-0.22	-0.09	0.3	0.13	-0.18	-0.03	0.27	0.01	-0.29	0.21	-0.37	0.01	0.27
Short-mat	-0.23	1	-0.21	-0.08	-0.24	0.03	-0.06	-0.06	-0.12	0.11	-0.05	0.15	0.01	-0.24
Unsec	-0.06	-0.17	1	-0.01	0.21	0.08	0.04	-0.14	0.17	0.1	-0.06	0.03	0.01	0.19
Subord	0.22	-0.1	0.06	1	0.11	-0.1	0.02	0.03	-0.01	-0.14	0.09	-0.14	0.02	0.2
Size	0.09	-0.27	0.24	0.06	1	-0.01	0.28	0.16	0.35	-0.12	0.04	-0.09	-0.15	0.6
MTB	-0.11	0.11	0.02	-0.05	-0.1	1	0.17	-0.16	-0.04	0.28	-0.18	0.29	-0.07	0
Profit	-0.02	-0.13	0.01	0.05	0.29	-0.22	1	0.24	0.3	-0.19	0.08	-0.14	0.02	0.15
Tang	0.25	-0.1	-0.13	0.02	0.14	-0.14	0.18	1	0.2	-0.32	0.21	-0.29	-0.04	0.14
Div payer	-0.03	-0.16	0.17	-0.03	0.36	-0.09	0.24	0.16	1	-0.13	0.08	-0.17	0.02	0.23
R&D	-0.16	0.17	0.02	-0.08	-0.2	0.31	-0.57	-0.25	-0.2	1	-0.75	0.33	-0.08	-0.1
Miss R&D	0.2	-0.06	-0.06	0.06	0.04	-0.15	0.14	0.25	0.08	-0.39	1	-0.22	-0.02	0.05
Cash	-0.27	0.21	0	-0.08	-0.16	0.34	-0.33	-0.29	-0.19	0.43	-0.2	1	-0.14	-0.08
Trade cred	-0.02	0	0.02	0.01	-0.15	-0.04	-0.06	-0.15	-0.03	-0.07	0.01	-0.13	1	-0.08
Rtg dum	0.23	-0.27	0.21	0.19	0.64	-0.07	0.15	0.13	0.23	-0.14	0.05	-0.13	-0.09	1

Table 4. Financing and Investment: Main Results

Results of estimating linear regressions of new debt issuance (*dissue*, column 1), new equity issuance (*neissue*, column 2), total new external financing (*newexternal*, column 3), *LPID* (column 4), *LPIE* (column 5), net debt issuance (*ndissue*, column 6), net equity issuance (*neissue*, column 7), total net external financing (*netexternal*, column 8), and investment (*investment*, column 9) on debt characteristics and controls. The specifications in columns 4 and 5 are estimated using a linear probability model. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors are clustered at the firm level.

	New debt	New eq	Tot new	LPID	LPIE	Net debt	Net eq	Tot net	Inv
Book_lev	0.019**	0.034***	0.062***	-0.31***	-0.074***	-0.18***	0.050***	-0.13***	-0.038***
	(0.0077)	(0.0043)	(0.0093)	(0.0062)	(0.0058)	(0.0047)	(0.0043)	(0.0061)	(0.0022)
Short-mat	0.020***	0.000062	0.020***	-0.027***	0.0039	-0.024***	0.00063	-0.024***	-0.0055***
	(0.0030)	(0.0015)	(0.0037)	(0.0039)	(0.0036)	(0.0016)	(0.0015)	(0.0022)	(0.00082)
Unsecured	-0.016***	-0.0028*	-0.022***	0.0064*	-0.0052	0.014***	-0.0044***	0.0099***	-0.00057
	(0.0035)	(0.0015)	(0.0042)	(0.0036)	(0.0033)	(0.0017)	(0.0015)	(0.0024)	(0.00093)
Subord	0.017*	0.0012	0.017	-0.0019	0.0085	0.0040	0.0057*	0.011*	0.0035
	(0.0096)	(0.0035)	(0.011)	(0.0082)	(0.0079)	(0.0049)	(0.0034)	(0.0060)	(0.0026)
Size	-0.0059***	-0.021***	-0.028***	-0.0089***	-0.011***	-0.0094***	-0.021***	-0.032***	-0.0034***
	(0.0019)	(0.0010)	(0.0023)	(0.0010)	(0.00094)	(0.0010)	(0.0010)	(0.0014)	(0.00064)
MTB	0.0064***	0.019***	0.026***	0.021***	0.024***	0.0091***	0.016***	0.027***	0.0074***
	(0.0011)	(0.0012)	(0.0018)	(0.0014)	(0.0013)	(0.00073)	(0.0013)	(0.0018)	(0.00037)
Profitability	-0.0082	-0.090***	-0.11***	0.069***	0.16***	-0.0047	-0.090***	-0.10***	0.043***
	(0.0094)	(0.011)	(0.015)	(0.0098)	(0.0099)	(0.0058)	(0.011)	(0.015)	(0.0029)
Tangibility	0.064***	0.010*	0.079***	0.0052	-0.0087	0.035***	0.0074	0.050***	0.026***
	(0.010)	(0.0057)	(0.013)	(0.0074)	(0.0066)	(0.0066)	(0.0057)	(0.0090)	(0.0050)
Div payer	0.0041	0.0023*	0.0060*	0.0063**	0.0013	0.011***	0.00060	0.013***	0.00071
	(0.0030)	(0.0012)	(0.0036)	(0.0029)	(0.0027)	(0.0016)	(0.0012)	(0.0020)	(0.00092)
R&D	0.0043	0.38***	0.40***	-0.031	0.23***	0.010	0.34***	0.35***	0.00031
	(0.019)	(0.027)	(0.036)	(0.020)	(0.022)	(0.014)	(0.030)	(0.035)	(0.0060)
Miss R&D	0.0063	0.0038*	0.0097	0.011***	0.0028	0.0039	0.0016	0.0047	0.0018
	(0.0050)	(0.0020)	(0.0059)	(0.0032)	(0.0028)	(0.0025)	(0.0020)	(0.0034)	(0.0014)
Cash	-0.11***	-0.027***	-0.14***	-0.17***	0.079***	-0.039***	-0.035***	-0.079***	0.028***
	(0.0083)	(0.0087)	(0.012)	(0.011)	(0.012)	(0.0053)	(0.0088)	(0.011)	(0.0031)
Trade credit	0.17***	0.056***	0.25***	0.14***	0.030*	0.078***	0.057***	0.14***	0.027***
	(0.027)	(0.012)	(0.033)	(0.019)	(0.017)	(0.013)	(0.012)	(0.018)	(0.0074)
Rtg dum	-0.025***	0.0026*	-0.024***	-0.0051	0.00080	-0.0056***	0.0018	-0.0035	0.00062
	(0.0041)	(0.0014)	(0.0049)	(0.0038)	(0.0036)	(0.0022)	(0.0015)	(0.0027)	(0.0012)
Observations	75,357	77,163	73,915	78,003	78,996	73,638	71,981	67,513	78,036
R-squared	0.026	0.136	0.073	0.086	0.067	0.093	0.125	0.128	0.108
Firm & Yr FE	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Ind-Yr FE	No	No	No	Yes	Yes	No	No	No	No

Table 5. Financing and Investment: Effective Maturity
Results of estimating linear regressions of total new external financing (*newexternal*, column 1), total net external financing (*netexternal*, column 2), investment (*investment*, column 3), *LPID*, and *LPIE* on debt characteristics and controls. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Total new	Total net	Inv	LPID	LPIE
Book_lev	0.059***	-0.13***	-0.037***	-0.30***	-0.074***
	(0.0093)	(0.0061)	(0.0022)	(0.0061)	(0.0058)
Short-Eff-Mat	0.012***	-0.020***	-0.0026***	-0.024***	0.0048
	(0.0034)	(0.0021)	(0.00075)	(0.0039)	(0.0035)
Unsecured	-0.023***	0.011***	-0.00028	0.0071**	-0.0053
	(0.0042)	(0.0024)	(0.00093)	(0.0036)	(0.0033)
Subord	0.016	0.012*	0.0038	-0.0013	0.0084
	(0.011)	(0.0060)	(0.0026)	(0.0082)	(0.0079)
Size	-0.029***	-0.032***	-0.0032***	-0.0088***	-0.011***
	(0.0023)	(0.0014)	(0.00064)	(0.0010)	(0.00094)
MTB	0.026***	0.027***	0.0074***	0.021***	0.024***
	(0.0018)	(0.0018)	(0.00037)	(0.0014)	(0.0013)
Profitability	-0.11***	-0.10***	0.043***	0.070***	0.16***
	(0.015)	(0.015)	(0.0029)	(0.0098)	(0.0099)
Tangibility	0.079***	0.050***	0.026***	0.0052	-0.0087
	(0.013)	(0.0090)	(0.0050)	(0.0074)	(0.0066)
Div payer	0.0059	0.013***	0.00073	0.0061**	0.0013
	(0.0036)	(0.0020)	(0.00092)	(0.0029)	(0.0027)
R&D	0.40***	0.35***	0.00019	-0.032	0.23***
	(0.036)	(0.035)	(0.0060)	(0.020)	(0.022)
Miss R&D	0.0096	0.0045	0.0018	0.011***	0.0028
	(0.0059)	(0.0034)	(0.0014)	(0.0032)	(0.0028)
Cash	-0.14***	-0.079***	0.028***	-0.17***	0.079***
	(0.012)	(0.011)	(0.0031)	(0.011)	(0.012)
Trade credit	0.25***	0.14***	0.027***	0.14***	0.029*
	(0.033)	(0.018)	(0.0074)	(0.019)	(0.017)
Rtg dum	-0.025***	-0.0023	0.00093	-0.0040	0.00073
	(0.0049)	(0.0027)	(0.0012)	(0.0038)	(0.0036)
Observations	73,902	67,502	78,023	77,990	78,983
R-squared	0.072	0.128	0.107	0.086	0.067
Firm & Yr FE	Yes	Yes	Yes	No	No
Ind-Yr FE	No	No	No	Yes	Yes

Table 6. Financing and Investment: Bank Debt
Results of estimating linear regressions of total new external financing (*newexternal*, column 1), total net external financing (*netexternal*, column 2), investment (*investment*, column 3), $LPID$, and $LPIE$ on debt characteristics and controls. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Total new	Total net	Inv	LPID	LPIE
Book_lev	0.042***	-0.16***	-0.033***	-0.27***	-0.097***
	(0.016)	(0.011)	(0.0038)	(0.0089)	(0.0095)
Short-Mat	0.027***	-0.019***	-0.0056***	-0.024***	0.0063
	(0.0049)	(0.0033)	(0.0011)	(0.0057)	(0.0058)
Bankdebt	0.014***	-0.0079**	-0.0030***	0.0036	-0.0019
	(0.0053)	(0.0034)	(0.0011)	(0.0054)	(0.0056)
Unsecured	-0.024***	0.0081**	-0.0019	0.0035	0.0013
	(0.0065)	(0.0038)	(0.0012)	(0.0055)	(0.0055)
Subord	0.051***	0.0093	-0.0057	0.0093	-0.0087
	(0.018)	(0.011)	(0.0038)	(0.013)	(0.014)
Size	-0.050***	-0.051***	-0.0032**	-0.0054***	-0.012***
	(0.0046)	(0.0032)	(0.0014)	(0.0015)	(0.0016)
MTB	0.022***	0.022***	0.0045***	0.022***	0.024***
	(0.0023)	(0.0020)	(0.00052)	(0.0022)	(0.0022)
Profitability	-0.13***	-0.14***	0.027***	0.029**	0.13***
	(0.021)	(0.017)	(0.0037)	(0.013)	(0.016)
Tangibility	0.096***	0.075***	-0.016*	0.018	-0.00079
	(0.025)	(0.018)	(0.0097)	(0.012)	(0.011)
Div payer	0.0060	0.013***	0.00056	0.0095**	0.00090
	(0.0057)	(0.0032)	(0.0013)	(0.0046)	(0.0047)
R&D	0.43***	0.40***	0.0061	-0.019	0.17***
	(0.055)	(0.054)	(0.0080)	(0.028)	(0.034)
Miss R&D	-0.020	0.0035	-0.00087	0.011**	-0.0017
	(0.013)	(0.0064)	(0.0019)	(0.0051)	(0.0052)
Cash	-0.12***	-0.090***	0.018***	-0.13***	0.070***
	(0.020)	(0.019)	(0.0042)	(0.016)	(0.019)
Trade credit	0.13**	0.074*	0.021	0.061**	0.0038
	(0.061)	(0.041)	(0.013)	(0.030)	(0.030)
Rtg dum	-0.012	0.0022	0.0050**	-0.015***	0.0019
	(0.0094)	(0.0052)	(0.0022)	(0.0055)	(0.0061)
Observations	26,618	24,251	28,114	28,201	28,276
R-squared	0.080	0.148	0.063	0.077	0.069
Firm & Yr FE	Yes	Yes	Yes	No	No
Ind-Yr FE	No	No	No	Yes	Yes

Table 7. Financing and Investment: Dynamic Panel Results
Results of GMM estimation of equation 3.3, implemented using the Stata module *xtabond*. Dependent variables are total new external financing (*newexternal*, column 1), total net external financing (*netexternal*, column 2), and investment (*investment*, column 3). All independent variables are lagged one period. Data is for nonfinancial, nonutility North American Compustat firms, 1978-2015. I require that each firm-year have greater than $10 million in assets to be included, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Tot new	Tot net	Inv
Book_lev	-0.14***	-0.33***	-0.039***
	(0.016)	(0.013)	(0.0037)
Short-mat	0.040***	-0.020***	-0.00071
	(0.0043)	(0.0030)	(0.00099)
Unsecured	0.032***	0.038***	-0.00029
	(0.0052)	(0.0038)	(0.0013)
Subord	0.00011	0.0058	0.0024
	(0.017)	(0.011)	(0.0032)
Size	-0.14***	-0.17***	-0.0076***
	(0.0053)	(0.0046)	(0.0015)
MTB	0.014***	0.018***	0.0029***
	(0.0028)	(0.0029)	(0.00057)
Profitability	0.086***	0.069***	0.041***
	(0.022)	(0.022)	(0.0054)
Tangibility	0.24***	0.20***	-0.27***
	(0.023)	(0.019)	(0.0098)
Div payer	-0.014***	0.0014	-0.0018*
	(0.0046)	(0.0031)	(0.0011)
R&D	0.69***	0.54***	0.017*
	(0.055)	(0.055)	(0.0097)
Miss R&D	0.014*	0.0034	-0.0012
	(0.0085)	(0.0059)	(0.0020)
Cash	-0.24***	-0.17***	0.020***
	(0.017)	(0.016)	(0.0040)
Trade credit	0.51***	0.45***	-0.0048
	(0.042)	(0.035)	(0.0095)
Rtg dum	-0.077***	-0.012**	-0.00076
	(0.0077)	(0.0051)	(0.0017)
L.total_external	0.14***		
	(0.010)		
L.net_external		0.045***	
		(0.0090)	
L.investment			0.35***
			(0.014)
Observations	52,722	45,675	59,505

Table 8. High vs. Low Sales Growth Firms

Results of estimating linear regressions of total new external financing (*newexternal*), total net external financing (*netexternal*), and investment (*investment*) on debt characteristics and controls. The high-growth sample is defined as firm-years in which sales growth is above the median, and the low-growth sample is firm-years in which sales growth is at or below the median. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	High growth			Low growth		
	Tot New	Tot Net	Inv	Tot New	Tot Net	Inv
Book_lev	0.053***	-0.14***	-0.038***	0.090***	-0.12***	-0.033***
	(0.013)	(0.0092)	(0.0032)	(0.013)	(0.0083)	(0.0027)
Short-mat	0.018***	-0.018***	-0.0052***	0.028***	-0.024***	-0.0038***
	(0.0052)	(0.0035)	(0.0013)	(0.0051)	(0.0029)	(0.00096)
Unsecured	-0.017***	0.0072**	0.00030	-0.027***	0.015***	-0.00052
	(0.0054)	(0.0035)	(0.0013)	(0.0059)	(0.0032)	(0.0011)
Subord	0.013	0.018**	0.00084	0.011	0.0083	0.0062*
	(0.014)	(0.0086)	(0.0033)	(0.017)	(0.0085)	(0.0032)
Size	-0.038***	-0.038***	-0.0028***	-0.011***	-0.021***	-0.00100
	(0.0029)	(0.0021)	(0.00091)	(0.0036)	(0.0020)	(0.00081)
MTB	0.024***	0.025***	0.0070***	0.023***	0.023***	0.0063***
	(0.0017)	(0.0016)	(0.00048)	(0.0026)	(0.0022)	(0.00050)
Profitability	-0.098***	-0.11***	0.040***	-0.13***	-0.11***	0.053***
	(0.017)	(0.015)	(0.0040)	(0.019)	(0.015)	(0.0040)
Tangibility	0.10***	0.053***	0.032***	0.067***	0.055***	0.032***
	(0.018)	(0.013)	(0.0073)	(0.017)	(0.012)	(0.0057)
Div payer	0.0073	0.011***	0.00029	0.00015	0.014***	0.0012
	(0.0051)	(0.0031)	(0.0013)	(0.0047)	(0.0025)	(0.0011)
R&D	0.27***	0.22***	-0.0061	0.44***	0.41***	0.018**
	(0.045)	(0.044)	(0.0081)	(0.055)	(0.054)	(0.0087)
Miss R&D	0.0097	-0.0050	0.0015	0.0051	0.0026	0.0020
	(0.0080)	(0.0052)	(0.0022)	(0.0075)	(0.0041)	(0.0016)
Cash	-0.15***	-0.095***	0.034***	-0.14***	-0.093***	0.016***
	(0.016)	(0.015)	(0.0043)	(0.019)	(0.015)	(0.0041)
Trade credit	0.24***	0.12***	0.027***	0.25***	0.16***	0.030***
	(0.043)	(0.027)	(0.011)	(0.043)	(0.024)	(0.0088)
Rtg dum	-0.029***	-0.0064*	0.00036	-0.021***	0.0023	0.0010
	(0.0062)	(0.0038)	(0.0017)	(0.0069)	(0.0036)	(0.0014)
Observations	35,820	32,249	37,497	37,533	34,797	39,970
R-squared	0.076	0.131	0.102	0.062	0.094	0.096
Firm-Yr FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9. Negative vs. Nonnegative Profitability Firms
Results of estimating linear regressions of total new external financing (*newexternal*), total net external financing (*netexternal*), and investment (*investment*) on debt characteristics and controls. The negative profitability sample is defined as firm-years in which profitability is less than 0, and the nonnegative profitability sample is firm-years in which profitability is at or above 0. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Negative profitability			Nonnegative profitability		
	Tot New	Tot Net	Inv	Tot New	Tot Net	Inv
Book_lev	0.034*	-0.095***	-0.024***	0.068***	-0.15***	-0.041***
	(0.020)	(0.018)	(0.0050)	(0.011)	(0.0061)	(0.0026)
Short-mat	0.0034	-0.024***	-0.0051**	0.025***	-0.022***	-0.0053***
	(0.0091)	(0.0083)	(0.0022)	(0.0040)	(0.0021)	(0.00089)
Unsecured	-0.024**	-0.0060	-0.0022	-0.020***	0.013***	0.00026
	(0.010)	(0.0095)	(0.0024)	(0.0046)	(0.0023)	(0.00099)
Subord	0.017	0.0025	0.010	0.015	0.0063	0.0025
	(0.044)	(0.030)	(0.0078)	(0.012)	(0.0058)	(0.0026)
Size	-0.068***	-0.064***	0.0011	-0.024***	-0.028***	-0.0039***
	(0.0066)	(0.0060)	(0.0017)	(0.0026)	(0.0014)	(0.00069)
MTB	0.022***	0.025***	0.0037***	0.020***	0.021***	0.0089***
	(0.0035)	(0.0038)	(0.00054)	(0.0018)	(0.0014)	(0.00056)
Profitability	-0.15***	-0.12***	0.018***	0.020	-0.030**	0.073***
	(0.031)	(0.033)	(0.0037)	(0.020)	(0.013)	(0.0063)
Tangibility	0.080***	0.089***	-0.021*	0.066***	0.033***	0.033***
	(0.031)	(0.029)	(0.011)	(0.015)	(0.0091)	(0.0053)
Div payer	0.00099	0.012	0.0013	0.0051	0.011***	0.00011
	(0.012)	(0.011)	(0.0031)	(0.0038)	(0.0019)	(0.00097)
R&D	0.43***	0.40***	-0.0059	-0.016	0.062*	-0.017
	(0.053)	(0.057)	(0.0074)	(0.044)	(0.034)	(0.012)
Miss R&D	-0.0012	-0.020	-0.0059	0.0051	0.0025	0.0014
	(0.021)	(0.016)	(0.0053)	(0.0061)	(0.0032)	(0.0015)
Cash	-0.054**	-0.037	0.027***	-0.21***	-0.11***	0.022***
	(0.023)	(0.023)	(0.0047)	(0.014)	(0.0099)	(0.0042)
Trade credit	0.22***	0.18***	0.035**	0.27***	0.12***	0.025***
	(0.066)	(0.058)	(0.016)	(0.040)	(0.018)	(0.0083)
Rtg dum	0.012	0.018	0.011**	-0.029***	-0.0053**	0.00086
	(0.019)	(0.019)	(0.0051)	(0.0050)	(0.0027)	(0.0012)
Observations	12,930	10,886	13,395	60,985	56,627	64,641
R-squared	0.192	0.210	0.068	0.040	0.097	0.124
Firm-Yr FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 10. Constrained vs. Unconstrained Firms

Results of estimating linear regressions of total new external financing (*newexternal*), total net external financing (*netexternal*), and investment (*investment*) on debt characteristics and controls. The constrained sample is defined as firm-years in which the variable SA is above the median, and the unconstrained sample is firm-years in which SA is at or below the median. SA is derived from Hadlock and Pierce 2010. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $5***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Constrained			Unconstrained		
	Tot New	Tot Net	Inv	Tot New	Tot Net	Inv
Book_lev	0.044***	-0.14***	-0.040***	0.064***	-0.14***	-0.033***
	(0.015)	(0.012)	(0.0036)	(0.013)	(0.0076)	(0.0029)
Short-mat	0.0065	-0.025***	-0.0041***	0.030***	-0.024***	-0.0062***
	(0.0056)	(0.0042)	(0.0013)	(0.0046)	(0.0025)	(0.0010)
Unsecured	-0.015**	0.012***	-0.0026*	-0.017***	0.012***	0.0010
	(0.0061)	(0.0043)	(0.0014)	(0.0061)	(0.0029)	(0.0012)
Subord	0.0080	0.014	0.0027	0.0070	0.0088	-0.0017
	(0.021)	(0.014)	(0.0057)	(0.012)	(0.0066)	(0.0025)
Size	-0.045***	-0.056***	-0.0030***	-0.027***	-0.026***	-0.0054***
	(0.0047)	(0.0033)	(0.0011)	(0.0037)	(0.0020)	(0.00092)
MTB	0.027***	0.029***	0.0067***	0.018***	0.017***	0.0074***
	(0.0022)	(0.0022)	(0.00046)	(0.0023)	(0.0019)	(0.00061)
Profitability	-0.090***	-0.074***	0.026***	-0.041*	-0.076***	0.078***
	(0.016)	(0.015)	(0.0031)	(0.023)	(0.016)	(0.0061)
Tangibility	0.11***	0.074***	-0.030***	0.059***	0.045***	0.036***
	(0.021)	(0.016)	(0.0080)	(0.018)	(0.011)	(0.0069)
Div payer	0.0012	0.0090**	0.0043***	0.0026	0.012***	-0.00041
	(0.0056)	(0.0036)	(0.0015)	(0.0048)	(0.0024)	(0.0011)
R&D	0.43***	0.39***	-0.0011	0.30***	0.32***	-0.016
	(0.043)	(0.045)	(0.0069)	(0.067)	(0.058)	(0.011)
Miss R&D	0.0027	-0.0011	0.0023	0.0043	0.0037	-0.00051
	(0.0082)	(0.0064)	(0.0024)	(0.0081)	(0.0040)	(0.0018)
Cash	-0.097***	-0.072***	0.026***	-0.21***	-0.11***	0.024***
	(0.017)	(0.016)	(0.0040)	(0.019)	(0.013)	(0.0047)
Trade credit	0.25***	0.16***	0.016	0.25***	0.11***	0.046***
	(0.038)	(0.030)	(0.0096)	(0.062)	(0.024)	(0.011)
Rtg dum	-0.062***	-0.016	-0.0049	-0.019***	-0.0052*	0.0029**
	(0.017)	(0.012)	(0.0048)	(0.0056)	(0.0030)	(0.0013)
Observations	34,249	30,960	35,633	39,666	36,553	42,403
R-squared	0.092	0.136	0.076	0.041	0.083	0.138
Firm-Yr FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 11. Segment-level Investment Regressions

Results of estimating linear regressions of two measures of segment-level investment on debt characteristics and controls for core (columns 1 and 3) and noncore (columns 2 and 4) segments. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Inv_seg1		Inv_seg2	
	Core	Noncore	Core	Noncore
Book_lev	-0.044***	-0.032***	-0.055***	-0.033***
	(0.0042)	(0.0075)	(0.0047)	(0.0075)
Short-mat	-0.0038**	-0.0090***	-0.0075***	-0.011***
	(0.0016)	(0.0032)	(0.0017)	(0.0032)
Unsecured	0.0015	0.0063*	-0.00019	0.0046
	(0.0019)	(0.0036)	(0.0019)	(0.0036)
Subord	0.0034	0.0025	0.0021	0.0017
	(0.0045)	(0.0072)	(0.0049)	(0.0068)
Size	-0.0038***	-0.0016	-0.0050***	-0.0030
	(0.0011)	(0.0020)	(0.0011)	(0.0020)
MTB	0.0076***	0.0058***	0.011***	0.0083***
	(0.00076)	(0.0017)	(0.00083)	(0.0017)
Profitability	0.048***	0.045***	0.053***	0.047***
	(0.0064)	(0.012)	(0.0074)	(0.011)
Tangibility	0.0072	0.027**	-0.052***	-0.027**
	(0.0086)	(0.014)	(0.0080)	(0.013)
Div payer	0.0017	-0.00059	0.0015	0.0013
	(0.0018)	(0.0028)	(0.0018)	(0.0029)
R&D	0.0088	0.053	-0.034**	-0.0084
	(0.013)	(0.040)	(0.015)	(0.043)
Miss R&D	0.00025	-0.0011	-0.00056	0.0017
	(0.0027)	(0.0042)	(0.0028)	(0.0042)
Cash	0.019***	0.027**	0.024***	0.034***
	(0.0068)	(0.013)	(0.0072)	(0.013)
Trade credit	0.040***	0.014	0.038***	0.0093
	(0.014)	(0.020)	(0.013)	(0.018)
Rtg dum	-0.0022	-0.0026	-0.0018	-0.0042
	(0.0022)	(0.0035)	(0.0024)	(0.0034)
Observations	28,970	14,207	28,660	13,922
R-squared	0.075	0.049	0.104	0.043
Firm & Yr FE	Yes	Yes	Yes	Yes

Table 12. Test for Selection on Unobservables

Results of the Oster 2015 test for selection on unobservables, implemented using the Stata module "psacalc." The table reports the values of δ for each of the four debt structure measures in the regression specifications that use *newexternal*, *netexternal*, *investment*, $LPID$, and $LPIE$ on the left-hand side. The values of R^2_{max} are computed by multiplying the fully-controlled R^2 from Table 4 by 1.3. See Oster 2015 for details on the derivation of δ. A value of $\delta < 0$ indicates that the coefficient increases in magnitude with the addition of controls. Although this does not imply that the coefficient is unstable, it does mean this method is uninformative about the size of the omitted variable bias.

	Total new	Total net	Investment	LPID	LPIE
Book_ lev	1.43	0.07	4.21	0.43	-0.35
Short-maturity	11.54	-3.75	-4.57	-1.43	0.49
Unsecured	2.82	-1.82	0.23	17.12	1.2
Subordinated	3.15	-0.75	-0.91	0.14	-0.46
R-squared max	0.09	0.17	0.14	0.11	0.09

Table 13. Cost of External Financing
Results of estimating linear regressions of realized cost of debt (*realcost*), offer yield spread over maturity-matched Treasuries (*spread*), and the price-earnings growth ratio (*peg*) on debt characteristics and controls. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Realcost	Spread	PEG ratio
Book_lev	0.015***	1.92***	0.13***
	(0.0059)	(0.56)	(0.013)
Short-mat	0.031***	0.70**	0.013***
	(0.0028)	(0.31)	(0.0033)
Unsecured	0.016***	0.22	0.0036
	(0.0027)	(0.37)	(0.0041)
Subord	0.013***	0.099	0.00089
	(0.0050)	(0.49)	(0.013)
Size	-0.0081***	-0.015	-0.0091***
	(0.0016)	(0.16)	(0.0030)
MTB	-0.0020*	-0.41***	-0.020***
	(0.0012)	(0.096)	(0.0021)
Profitability	-0.040***	-0.88	-0.31***
	(0.0093)	(1.20)	(0.028)
Tangibility	-0.0037	-0.11	0.10***
	(0.0088)	(0.88)	(0.017)
Div payer	-0.0072***	0.14	-0.0040
	(0.0022)	(0.28)	(0.0042)
R&D	0.063**	6.89***	0.051
	(0.027)	(2.47)	(0.040)
Miss R&D	-0.0075**	-0.34	0.0082
	(0.0035)	(0.42)	(0.0057)
Cash	0.0036	-0.97	-0.025
	(0.011)	(1.17)	(0.017)
Trade credit	0.055***	2.05	0.013
	(0.019)	(2.10)	(0.037)
Rtg dum	-0.0071***	-0.29	0.0033
	(0.0027)	(0.25)	(0.0042)
Observations	73,308	2,890	20,742
R-squared	0.016	0.240	0.187
Firm-Yr FE	Yes	Yes	Yes

Table 14. Suboptimal Debt Structure
Results of estimating linear regressions of total new external financing (*newexternal*), total net external financing (*netexternal*), and investment (*investment*) on debt characteristics and controls. The suboptimal debt structure sample is defined as firm-years in which debt structure is suboptimal as described in Chapter 6.1, and the optimal debt structure sample is firm-years in which debt structure is not suboptimal. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Suboptimal			Optimal		
	Tot New	Tot Net	Inv	Tot New	Tot Net	Inv
Book_lev	0.18***	-0.067***	-0.033***	0.060***	-0.14***	-0.039***
	(0.042)	(0.015)	(0.011)	(0.011)	(0.0070)	(0.0026)
Short-mat	0.015*	-0.0085***	-0.0011	0.023***	-0.024***	-0.0052***
	(0.0090)	(0.0027)	(0.0019)	(0.0042)	(0.0026)	(0.00097)
Unsecured	0.019*	0.0020	0.0013	-0.027***	0.0091***	-0.00076
	(0.010)	(0.0030)	(0.0030)	(0.0049)	(0.0027)	(0.0011)
Subord	0.019	-0.0010	-0.0014	0.023*	0.0082	0.0014
	(0.038)	(0.0089)	(0.0074)	(0.013)	(0.0066)	(0.0028)
Size	-0.0030	-0.0062**	-0.0067**	-0.024***	-0.032***	-0.0025***
	(0.0087)	(0.0028)	(0.0028)	(0.0028)	(0.0017)	(0.00072)
MTB	-0.0020	0.0027*	0.0052***	0.029***	0.030***	0.0076***
	(0.0039)	(0.0015)	(0.0016)	(0.0017)	(0.0014)	(0.00046)
Profitability	0.044	-0.023	0.071***	-0.13***	-0.13***	0.044***
	(0.051)	(0.014)	(0.018)	(0.015)	(0.013)	(0.0035)
Tangibility	0.070***	0.028**	0.016	0.091***	0.057***	0.025***
	(0.025)	(0.013)	(0.013)	(0.016)	(0.011)	(0.0056)
Div payer	-0.014	0.00040	0.0023	0.0074*	0.013***	0.00077
	(0.010)	(0.0028)	(0.0025)	(0.0043)	(0.0023)	(0.0011)
R&D	0.23	-0.029	0.060	0.35***	0.32***	0.00050
	(0.14)	(0.041)	(0.043)	(0.041)	(0.037)	(0.0074)
Miss R&D	-0.015	-0.0081*	-0.0032	0.014**	0.0040	0.0019
	(0.016)	(0.0044)	(0.0040)	(0.0068)	(0.0041)	(0.0016)
Cash	-0.071***	-0.043***	0.015	-0.14***	-0.082***	0.029***
	(0.024)	(0.011)	(0.011)	(0.015)	(0.012)	(0.0039)
Trade credit	0.20**	0.081***	0.079***	0.25***	0.15***	0.030***
	(0.082)	(0.029)	(0.028)	(0.039)	(0.022)	(0.0091)
Rtg dum	-0.0058	-0.00066	-0.00052	-0.033***	-0.0037	0.00077
	(0.016)	(0.0065)	(0.0047)	(0.0054)	(0.0031)	(0.0014)
Observations	4,891	4,702	5,068	51,513	48,641	54,060
R-squared	0.053	0.040	0.179	0.069	0.136	0.108
Firm-Yr FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 15. Financing and Investment: Convertible debt
Results of estimating linear regressions of total new external financing (*newexternal*, column 1), total net external financing (*netexternal*, column 2), investment (*investment*, column 5), $LPID$, and $LPIE$ on debt characteristics and controls. All right-hand side variables are one-period lagged levels. Data is for nonfinancial, nonutility North American Compustat firms from 1978-2015. I require that each firm-year have greater than $10 million in assets in order to be included in the sample, and I exclude observations that are missing any of the explanatory variables required for my primary tests. All variables are defined in Table 1. $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$. Standard errors clustered at the firm level.

	Total new	Total net	LPID	LPIE	Inv
Book_lev	0.062***	-0.13***	-0.31***	-0.074***	-0.038***
	(0.0093)	(0.0061)	(0.0062)	(0.0058)	(0.0023)
Short-mat	0.020***	-0.023***	-0.026***	0.0040	-0.0054***
	(0.0037)	(0.0023)	(0.0039)	(0.0036)	(0.00083)
Unsecured	-0.022***	0.0097***	0.0060*	-0.0052	-0.00062
	(0.0042)	(0.0024)	(0.0036)	(0.0033)	(0.00093)
Subord	0.017	0.011*	-0.0010	0.0088	0.0037
	(0.011)	(0.0060)	(0.0082)	(0.0079)	(0.0026)
Conv	-0.00037	0.016***	0.023**	0.0029	0.0042***
	(0.0068)	(0.0058)	(0.010)	(0.0084)	(0.0015)
Size	-0.028***	-0.032***	-0.0089***	-0.011***	-0.0034***
	(0.0023)	(0.0014)	(0.0010)	(0.00095)	(0.00064)
MTB	0.026***	0.027***	0.021***	0.024***	0.0074***
	(0.0018)	(0.0018)	(0.0014)	(0.0013)	(0.00037)
Profitability	-0.11***	-0.10***	0.070***	0.16***	0.043***
	(0.015)	(0.015)	(0.0097)	(0.0099)	(0.0029)
Tangibility	0.079***	0.050***	0.0056	-0.0086	0.026***
	(0.013)	(0.0090)	(0.0074)	(0.0066)	(0.0050)
Div payer	0.0060*	0.013***	0.0065**	0.0013	0.00074
	(0.0036)	(0.0020)	(0.0029)	(0.0027)	(0.00093)
R&D	0.40***	0.36***	-0.030	0.23***	0.00061
	(0.036)	(0.035)	(0.020)	(0.022)	(0.0060)
Miss R&D	0.0097*	0.0047	0.011***	0.0028	0.0018
	(0.0059)	(0.0034)	(0.0032)	(0.0028)	(0.0014)
Cash	-0.14***	-0.080***	-0.17***	0.079***	0.028***
	(0.012)	(0.011)	(0.011)	(0.012)	(0.0031)
Trade credit	0.25***	0.14***	0.14***	0.029*	0.027***
	(0.033)	(0.018)	(0.019)	(0.017)	(0.0074)
Rtg dum	-0.024***	-0.0036	-0.0052	0.00053	0.00058
	(0.0049)	(0.0027)	(0.0038)	(0.0036)	(0.0012)
Observations	73,873	67,478	77,957	78,950	77,990
R-squared	0.073	0.129	0.086	0.067	0.108
Firm & Yr FE	Yes	Yes	No	No	Yes
Ind-Yr FE	No	No	Yes	Yes	No

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APPENDIX A

LARGE PROACTIVE INCREASES IN DEBT AND EQUITY

A.1 Identifying Large Proactive Increases in Debt

In order to identify large, proactive increases in debt (LPIDs), I utilize the following method, which I derive from Denis and McKeon 2012.

First, I identify firm-years in which (1) total debt increased relative to the previous year and (2) market leverage increased by more than 0.1 relative to the previous year. That is, firm-years in which the year-over-year change in market leverage was greater than 10 percentage points. Market leverage is equal to the book value of debt divided by the sum of the book value of debt and market capitalization. Because market leverage is bound between 0 and 1, this equates to an increase of 10 percentage points or more. This is the way in which I define "large."

Second, from that subset of observations, I further identify which increases in leverage are predominantly a result of a large increase in debt, as opposed to an exogenous *decline* in equity value. Here, I follow Denis and McKeon 2012 and define a variable $\$\Delta ML_{it}$ which captures the value of additional market leverage resulting from the increase:

$$\$\Delta ML_{it} = D_{i,t} - D_{i,t-1}\frac{MA_{it}}{MA_{i,t-1}} \tag{A.1}$$

where D_{it} is the total debt of firm i in year t and MA_{it} is the sum of market value of equity and book value of debt. In order to screen out increases in leverage that result from declines in equity value, I require that the increase in total debt I observe is at least 90% of $\$\Delta ML_{it}$. In other words, if total debt increases by 9, and $\$\Delta ML_{it} = 10$, then I include it.

As an example of how this measure allows for the screening out of increases in leverage that result from declines in equity value, assume the market value of assets in year $t-1$ is 100, and total debt is 20, meaning the firm's market leverage is 0.20. If the firm issues an additional 30 in debt in year t with no change in the value of equity, its assets increase to 130, and its market leverage increases to 0.38. The value of additional debt resulting from the increase, $\$\Delta ML_{it}$, is 24. Therefore, the increase in total debt is 125% of $\$\Delta ML_{it}$, well in excess of the 90% threshold. Now assume that, instead of issuing additional debt in year t, the firm keeps debt at 20, but the market value of equity drops to 32.6 in year t. Assets therefore decrease to 52.63, but leverage increases (due to the decrease in equity) to 0.38. So, we have the same change in market leverage, except there has been no change in debt. In this case, $\$\Delta ML_{it} = 9.47$. But since debt did not change, the 90% threshold is not met, so this observation would be screened out.

This gives me a subset of large leverage increases that are primarily the result of a firm taking on more debt. Finally, from this set of observations I select only those for which I can identify, using the Statement of Cash Flows (SCF), that the funds from the debt issuance were primarily associated with (1) an increase in long-term investment (capital expenditures or acquisitions), (2) engaging in a payout to shareholders or repurchasing stock, (3) an increase in working capital, or (4) covering an operational cash flow shortfall from, e.g., a negative earnings shock. In particular, following Denis and McKeon 2012 I require that the combined uses of funds from the SCF comprise at least 80% of the observed increase in debt. For example, if a firm's debt increases from \$100 million in year t to \$200 million in year $t+1$, the screen requires that data on at least \$80 million of the three potential uses of funds be available.

In addition to filtering the sample based on the SCF, I use the breakdown of the use of funds to classify each LPID into a primary use of funds category. That is, I categorize the LPIDs as primarily being used for long-term investment, payouts, increases in working capital, covering operational cash shortfalls, or for "multiple" uses. The primary use of funds is defined by whichever category comprises greater than 50% of the total percentage of debt increase captured on the SCF. For example, if debt increases \$100 and the SCF captures that entire \$100 increase, and \$75 of the \$100 captured on the SCF is used for acquisitions, then the primary use of funds is classified as long-term investment.

As an example of the SCF screen, in 2002 the market leverage of Lee Enterprises, a publishing company, doubled from 11% (in 2001) to 22% as a result of an increase of \$235 million in total debt, which corresponded to an increase in net debt[37] of \$494 million. Based on the SCF, the proceeds from the issue were used for an increase in long-term investment of \$675 million. Therefore, the use of funds comprises 136% of the increase in net debt, well in excess of the 80% threshold I require. (Note that percentages greater than 100% are not uncommon, as firms often have additional sources of funds, such as equity, that they use to fund operational needs). Additionally, because the percentage of the increase in net debt attributable to long-term investment was greater than the percentage attributable to the other three potential uses, the screening process flags long-term investment as the primary use of funds. A reading of the firm's 10-K for that year confirms that it took on the additional debt in order to help finance the acquisition of Howard Publication Co.[38]

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[37]Net debt is equal to total debt minus cash holdings. See Gamba and Triantis 2008 for a discussion of how debt issuance costs can lead firms to hold cash despite having outstanding debt.

[38]As another example of the increases I identify, in 2013 the market leverage of MDC Holdings Co increased to 42% from 31% in 2012. This was the result of an increase in total debt of \$337.5 million, which corresponded to an increase in *net* debt of \$298 million. Based on the SCF, the proceeds from the issue were used for an increase in long-term investment of \$60 million, as well as an increase in working capital of \$233 million. Therefore, the use of funds comprises 98% of the increase in net debt, well in excess of the 80% threshold I require. Additionally, because the percentage of the increase in net debt attributable to increases in working capital was greater than the percentage attributable to the other three potential uses, the screening process flags working capital as the primary use of funds.

A.2 Identifying Large Proactive Increases in Equity

I identify large increases in equity using two methods. First, I define large, proactive increases in equity (LPIEs) in a manner analogous to the definition of LPIDs described above. The only difference is the following. Because I am interested in increases in equity that result in a significant change in leverage, I require that leverage *decreased* by more than 0.1 relative to the previous year. This is simply the opposite of the criterion for large debt increases. Furthermore, I measure changes in book leverage, as opposed to market leverage. That is, I require the following two criteria: (1) total book equity increased relative to the previous year, and (2) book leverage decreased by more than 0.1 relative to the previous year.

As an alternative method of identifying large equity increases, I use the definition of McKeon 2015, which measures whether the firm issued new stock equal to 3% or more of its total equity in a given year. This identifies "firm-initiated issues," such as IPOs, SEOs, or private placements, as opposed to "employee-initiated issues" that occur because of stock option exercise.