Refinancing risk and cash holdings*

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Abstract:

The maturity of the debt of U.S. firms has markedly decreased over the 1980-2008 period, resulting in greater refinancing risk for many firms. We hypothesize that firms with debt that has a shorter maturity hold larger cash reserves to reduce important costs they could incur if they have difficulty refinancing their debt. Using a simultaneous equations framework that accounts for the joint determination of cash holdings and debt maturity, we find that firms with shorter maturity debt hold more cash and that this can explain a large fraction of the increase in the cash holdings of U.S. firms over this period. We also show that the market value of a dollar of cash holdings is higher for firms whose debt has a shorter maturity and that larger cash reserves help to mitigate underinvestment problems resulting from refinancing risk. Finally, we document that the inverse associations between the maturity of a firm's debt with the level and market value of its cash holdings are more pronounced during periods when credit market conditions are tighter and refinancing risk is consequently higher. Overall, our findings imply that refinancing risk is a key determinant of corporate cash holdings.

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Refinancing risk, the risk for a firm that it could have difficulty rolling over its debt, is an important source of risk for many firms. We find evidence that firms with shorter maturity debt, which are subject to greater refinancing risk, attempt to mitigate this risk by holding more cash. Further, we document that average debt maturity has markedly shortened over the 1980-2008 period and that this is related to the contemporaneous increase in the cash holdings of U.S. firms over this period documented in Bates, Kahle, and Stulz (2009). Specifically, the shortening of debt maturities explains between 28% and 34% of the overall increase in corporate cash reserves. Consistent with cash serving a valuable role in mitigating refinancing risk, we also find that the market puts a greater value on an incremental dollar of cash when the firm has significant refinancing risk Further, we show that firms use cash reserves to reduce underinvestment due to refinancing difficulties.

Firms whose debt has a short maturity, whom we refer to as SMD firms, face the risk that when they try to roll over their debt, changes in market conditions or capital market imperfections result in refinancing at a significantly higher interest rate (Froot, Scharfstein, and Stein (1993)). If a firm is unable to refinance, it might need to sell off important assets at fire-sale prices in order to pay off debt that is coming due (Brunnermeier and Yogo (2009)). Further, Diamond (1991, 1993) and Sharpe (1991) argue that lenders may underestimate the continuation value of the firm, and not allow refinancing to take place, leading to an inefficient liquidation of the entire firm. Lastly, because of refinancing risk, in certain contexts shorter maturity debt can increase the potential for underinvestment problems. For instance, Almeida, Campello, Laranjeira, and Weisbenner (2010) report that during the 2007-2008 credit crisis those firms with more debt soon coming due decrease their investment levels the most.

We hypothesize that SMD firms hold larger cash holdings to reduce the refinancing risk associated with shorter-term debt. If an SMD firm is forced to refinance its debt at a significantly higher interest rate, large cash reserves could enable the firm to mitigate adverse effects resulting from this. For instance, these reserves could enable the firm to keep fully investing in its growth opportunities.

Further, if a firm is unable to obtain refinancing, large cash holdings could allow the firm to avoid selling off key firm assets to pay off debt that is coming due. Likewise, these holdings would reduce the likelihood of an inefficient liquidation of the entire firm.

We find that in the United States from 1980-2008 firms shortened the maturities of their debt. An important reason for the shortening of debt maturities over this period was the growing role of banks as lenders due to the growth of the syndicated loan market (Sufi (2007)), which enables originating banks to share risk across a syndicate of investors that includes banks and other institutional investors. Bank debt, including syndicated bank debt, tends to have a lower maturity.[1] Overall, from 1980-2008 the fraction of a firm's long-term debt due in the next three years increased from 33.8% to 39.4%, a 16.6% increase. Further, using a model that controls for the determinants of the maturity of a firm's debt, we examine the extent to which debt maturity changed from 1980-2008 holding the determinants of maturity constant. This also controls for changes in the characteristics of public firms over time. The results of this analysis indicate that in 2008 the typical firm with long-term debt has 68.6% more long-term debt due in the next three years than would a firm in 1980 that had similar characteristics.

Although supply-side pressure on debt maturity over the 1980-2008 period could be the major factor leading to the shortening of maturities over this period, we note that even in the absence of supply-side pressure, benefits to shortening the maturity of a firm's debt could produce demand-side pressure as well. For instance, a shorter maturity can reduce agency costs of debt such as underinvestment (Myers (1977)) and asset substitution (Barnea, Haugen, and Senbet (1980), Leland and Toft (1996), and Brockman, Martin, and Unlu (2010)). Also, since shorter-term debt subjects managers to frequent monitoring by capital market participants, the use of this type of debt is predicted to align managers' interests with those of shareholders (Rajan and Winton (1995), Stulz (2000), and Datta, Iskandar-Datta, and Raman (2005)). Finally, with an upward sloping yield-curve, shorter-term loans can

[1] Sufi (2007) documents that the U.S. syndicated loan market grew from $137 million in 1987 to over $1 trillion by 2007. He also reports that the average maturity of typical syndicate loans is a little over three years.

potentially reduce a firm's financing costs, at least in the short-run (Taggart (1977), Marsh (1982), Graham and Harvey (2001), and Faulkender (2005)).[2]

~~Because our research question links the decline in maturity to the increase in corporate cash holdings, w~~We next examine the general effect of debt maturity on a firm's cash holdings. Cash holdings and debt maturity are likely endogenously determined. If lenders provide a firm with a loan that has a short maturity, the firm might decide to hold more cash to mitigate refinancing risk, but higher current cash holdings could also increase the likelihood lenders would offer a firm a shorter-term loan and the firm's propensity to accept such a loan offer. Consequently, we use a simultaneous equations framework in which cash holdings and debt maturity are endogenous to one another. The results of our analysis show that debt maturity has a causal effect on cash holdings. Decreases (increases) in the maturity of a firm's debt lead to the firm holding more (less) cash. This effect holds after controlling for profitability, growth opportunities, leverage, the ease with which a firm can access external capital markets, whether a firm has a line of credit with a bank, and a host of other control variables. Also, this effect is present in the subsample of firms that survive the entire 1980-2008 period. We further document that the effect of debt maturity on cash holdings is economically important and find evidence that the shortening of firms' debt maturities over our sample period is likely a key factor that explains why over this period the average U.S. firm more than doubles its cash holdings (Bates, Kahle, and Stulz (2009)).

Refinancing risk should be greater when credit market conditions are tighter. If refinancing risk drives the inverse association between a firm's debt maturity and its cash holdings, this association should be strongest when credit market conditions are tighter. Consistent with expectations, we find that the inverse association between the maturity of a firm's debt with the level of its cash holdings is markedly more pronounced during years when credit conditions are tighter.

[2] In contemporaneous work, Custodio, Ferreira and Laureano (2010) also note the decline in corporate debt maturity and comprehensively examine demand-side explanations for it. They are unable to find support for demand-side forces, leaving either a new theory of the benefits of short-term debt or supply-side forces as the remaining explanation.

We subsequently investigate whether the contribution of cash holdings to firm value is greater for SMD firms. We expect that this should be the case because for such firms a larger cash balance decreases the potential distress costs a firm could incur if it has trouble rolling over its debt. Employing the Faulkender and Wang (2006) methodology to determine the market value of an incremental dollar of cash reserves, we find that the value of an incremental dollar of corporate cash reserves is higher for SMD firms. Further, we document that this effect is substantially more pronounced during years when credit market conditions are tighter and refinancing risk is therefore higher. These two findings support the hypothesis that additional cash holdings are especially valuable for firms who face greater refinancing risk.

Finally, we examine if large cash holdings are particularly useful to reduce underinvestment problems for SMD firms. This would be the case if when credit market conditions tighten, these firms sometimes have to draw on their cash reserves to pay off debt that is coming due or that is refinanced at a higher interest rate. In such instances, having larger cash holdings would allow SMD firms to still have enough cash left over for investment. Consistent with this proposition, we find that the positive effect of cash holdings on investment is more pronounced for SMD firms and that this result becomes even stronger when credit market conditions tighten.

Overall, our study contributes in several ways. First, we show that refinancing risk is an important determinant of corporate cash holdings. Our results suggest that if a firm's debt has a short maturity, the firm holds more cash to reduce potential costs it could incur at the time when its debt would need to be rolled over. Our findings also indicate that stock market participants recognize the additional value of cash holdings for SMD firms. Likewise, our results imply that larger corporate cash reserves help to mitigate underinvestment problems resulting from refinancing risk. Further, we document that since 1980 the debt maturity of U.S. firms has markedly decreased and that this phenomenon explains a large fraction of the increase in the cash holdings of U.S. firms over the same period.

Second, our findings shed additional light on the trade-offs that firms face when deciding on how much cash they should hold. Prior research suggests corporate cash reserves can be costly in firms with poor corporate governance that have CEOs who make value-decreasing acquisitions (Jensen (1986), Harford (1999), Harford, Mansi, Maxwell (2007), and Dittmar and Mahrt-Smith (2007)). However, Kim, Mauer, and Sherman (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), Faulkender and Wang (2006), and Denis and Sibilkov (2009) show that corporate cash holdings benefit financially constrained firms by enabling these firms to fully invest in their growth prospects. Our results indicate that these holdings are also quite valuable for SMD firms and that such firms consequently trade-off potential costs of large cash reserves with the benefits resulting from a mitigation of refinancing risk.

Finally, the results that the inverse associations between the maturity of a firm's debt with the level and market value of its cash holdings are more pronounced during years when credit market conditions are tighter and that the more positive effect of cash holdings on investment for SMD firms is heightened during such years are important. These results highlight the usefulness of considering time-variation in capital liquidity when conducting research about what drives corporate financial policy choices. Recent work that examines how capital liquidity affects firm behavior focuses on the 2007-2008 credit crisis (e.g., Campello, Graham and Harvey (2010), Ivashina and Scharfstein (2010), Duchin, Ozbas, and Sensoy (2010)). Our findings suggest that during non-crisis periods there is also considerable variation in capital liquidity and refinancing risk that can be exploited by researchers who study corporate financial policy decisions.

The remainder of the paper is organized as follows. Section 1 reviews prior work and develops hypotheses. Section 2 discusses our sample and provides evidence on how the structure and maturity of the debt of U.S. corporations has changed since 1980. Section 3 provides the results of our tests. Finally, Section 4 concludes.

I. Related literature and hypothesis development

A. Costs and benefits of large corporate cash reserves

Large corporate cash holding can be beneficial for firms because they reduce underinvestment problems in firms with high external financing costs that have large growth opportunity sets (e.g., Kim, Mauer, and Sherman (1998) and Opler, Pinkowitz, Stulz, and Williamson (1999)). Consistent with this proposition, Faulkender and Wang (2006) find that the contribution of cash holdings to firm value is larger for more financially constrained firms, while Denis and Sibilkov (2010) document that the positive effect of cash holdings on investment is markedly larger for such firms. Also, Harford, Mikkelson, and Partch (2003) report that a large cash balance enables firms to continue investing in their growth opportunities both during and immediately after an industry downturn. Further, Haushalter, Klasa, and Maxwell (2007) and Fresard (2010) show that the ability to fully invest in growth opportunities provided by cash holdings enables firms to compete more successfully in the product markets.

On the other hand, there are also costs to large corporate cash reserves. Most importantly, in firms with agency problems these reserves can allow managers to invest in value-decreasing projects (e.g., Jensen (1986), Harford (1999), Harford, Mansi, and Maxwell (2008)). Supporting the view that in poorly governed firms cash holdings are costly, Dittmar and Mahrt-Smith (2007) find that market participants value a dollar of cash holdings less highly when a firm has more severe agency problems. Another cost of large cash holdings is that they can lead to a reduction in the bargaining position of a firm relative to unionized labor (Klasa, Maxwell, Ortiz-Molina (2009)).

B. The effect of credit supply on corporate leverage and debt maturity

Consistent with the Modigliani and Miller (1958) assumption that the supply of capital is perfectly elastic, many prior studies implicitly assume that firms' capital structures are entirely driven by their demand for debt. However, a growing body of work shows that that the supply of debt financing is also an important determinant of firms' capital structures.[3] For instance, after controlling for firm characteristics and the endogeneity of having public debt, Faulkender and Petersen (2006) document that firms with access to public debt hold 35% more debt than do other firms. They interpret this finding as implying that firms who do not have access to public debt markets, who make up approximately 80% of firms on Compustat, are significantly rationed by investors with respect to how much they can borrow. Also, they suggest that their results can potentially explain why the typical U.S. firm is underleveraged, even though increasing the level of its debt could result in a doubling of the tax benefits of debt for this firm (i.e., Graham (2000)).[4]

Extant work also shows that within the group of firms relying on banks for debt financing, supply-side factors are important in explaining heterogeneity in firms' capital structures. For example, Bernanke and Blinder (1992), Kashyap, Stein, and Wilcox (1993), Gertler and Gilchrist (1994), and Kashyap and Stein (2000) document that when the Fed employs a tighter monetary policy, the resulting draining of cash reserves from the U.S. banking system leads to drops in corporate borrowing and debt levels, as well as changes in the structure of corporate debt. Likewise, Becker (2007), Gan (2007), and Leary (2009) show that exogenous economic shocks that raise (lower) the supply of capital that banks have available to fund corporate loans result in increases (decreases) in corporate leverage ratios and the level of debt-financed corporate investment.

If typical U.S. firms are underleveraged and rationed by their lenders with respect to how much they can borrow, then these lenders likely have discretion about loan terms, such as the maturity of a loan. Consistent with this proposition, Roberts and Sufi (2009) provide evidence that when the supply of available credit in the economy expands (contracts), banks' bargaining power and their ability to dictate

[3] See Baker (2009) for a comprehensive review of the literature that examines how debt and equity market supply conditions affect corporate financing and investing decisions. Also, see Morellec (2010) for theoretical explanations of how capital market supply frictions affect these decisions.

[4] Tang (2009) reports that even within the group of firms that have access to public debt markets, supply-side factors affect the level of a firm's debt. Specifically, he exploits Moody's 1982 credit rating refinement to examine the effect of an exogenous change on firms' credit market access and finds that firms with refinement upgrades subsequently increase their debt ratios.

loan terms decreases (increases). As a result, in many cases banks may make the decision on what is the appropriate maturity for a given corporate loan. For example, banks will consider the maturity of their own liabilities and of outstanding loans that they have already made when making decisions about the maturity of new corporate loans. Likewise, banks will be influenced by a firm's risk characteristics when deciding on what should be the maturity of a loan offer made to the firm.

C. Hypothesis development

As discussed in the introduction, firms with short maturity debt can be subject to significant refinancing risk. This leads to our main hypothesis.

> *Hypothesis 1. Firms whose debt has a shorter maturity attempt to mitigate the refinancing risk they face by holding large cash reserves.*

This hypothesis generates the empirical prediction that SMD firms hold larger cash reserves. As argued above, for typical publicly traded firms in the U.S. that have long-term debt, the maturity of their loans may be decided by the banks providing them with debt financing. As such, firms that receive loans with earlier maturity dates may try to mitigate the higher refinancing risk they face by holding more cash.[5] We should note that we are not predicting that they hold enough cash to self-refinance. Rather, that holding cash reduces potential underinvestment problems as it allows for partial refinancing if credit conditions are poor, and increases firms' creditworthiness for refinancing.

Even though some firms will find that at their preferred rates they are only being supplied with shorter-term credit, *Hypothesis 1* applies as well to firms that have more control over their debt maturity, whether through the ability to issue public debt or due to credit strength that allows them choices in bank loans. Specifically, when these firms make joint decisions about debt maturity and cash holdings,

[5] Theoretical work by Acharya, Gale, and Yorulmazer (2011) shows that if banks themselves receive loans with short maturities to finance shorter-term corporate loans that this leads to even greater refinancing risk for SMD firms. This further suggests that SMD firms would take steps to reduce refinancing risk.

they will weigh the benefits of having debt with a shorter maturity against the refinancing risk, while simultaneously considering how larger cash holdings could reduce their refinancing risk.

During periods when the supply of credit is tighter and it is consequently more difficult for firms to receive commercial loans, refinancing risk is higher. As a result, during such periods SMD firms would have even greater propensities to hold large cash reserves. Hence, *Hypothesis 1* also leads to the empirical prediction that during periods when credit market conditions are tighter there is a more pronounced positive association between the extent to which a firm's debt has a short maturity and the level of its cash holdings.

Additionally, as discussed earlier, extant work shows that the market value of a firm's cash holdings depends on the costs and benefits of these holdings. Because holding larger cash reserves helps to mitigate refinancing risk, this should be reflected in the market's valuation of a firm's cash reserves. This leads to our second hypothesis.

> *Hypothesis 2. The contribution of cash holdings to firm value is higher for firms whose debt has a short maturity.*

This hypothesis results in the empirical prediction of a positive association between whether a firm's debt has a short maturity and the market's valuation of its cash holdings. When the supply of available credit is tighter and refinancing risk is consequently higher, the contribution of cash holdings to firm value should be greater. Thus, a second empirical prediction that results from *Hypothesis 2* is that during periods when credit market conditions are tighter, the positive association between whether a firm's debt has a short maturity and the market's valuation of its cash holdings is more pronounced.

Finally, Almeida, Campello, Laranjeira, and Weisbenner (2010) provide evidence that shows during credit crisis periods firms with more debt that is soon coming due suffer from underinvestment problems. Presumably, this occurs because at such times these firms use some of their cash reserves to pay off debt that is coming due or that is refinanced at a higher interest rate and they then have less cash available for investment. It follows that for SMD firms, larger cash holdings could be particularly useful to avoid underinvestment. This leads to our third hypothesis.

> *Hypothesis 3. Larger cash holdings mitigate underinvestment problems more for firms with debt that has a short maturity.*

This hypothesis results in the empirical prediction that the positive effect of cash holdings on investment is more pronounced for firms with debt that has a shorter maturity. When credit market conditions tighten, larger cash holdings should be even more useful to mitigate underinvestment problems in firms with debt that has a shorter maturity. Consequently, a second empirical prediction resulting from *Hypothesis 3* is that the more positive effect of cash holdings on investment for SMD firms becomes even stronger when credit market conditions tighten.

II. Sample Description and the Changing Nature of Debt in the U.S.

Our initial sample consists of 127,471 firm-years for industrial firms (utilities and financial firms are excluded) from 1980 to 2008 incorporated in the U.S. with non-zero sales and total assets. We further exclude firms that do not have long-term debt, where long-term debt is defined as long-term debt maturing in more than one year plus the current portion of long-term. This leaves us with a sample of 106,128 observations.

In Table I we report time trends in debt characteristics. To do so, we split the sample into six time periods and compute yearly means and then take the average of the years for each time period. This allows us to succinctly examine time-trends. Table I shows that the percentage of firms with long-term debt in their capital structure decreases over time. From the 1980-1984 to the 2005-2008 periods the percentage of industrial firms with long-term debt decreases from 90.0% to 76.3%, which is consistent with changes in the characteristics of the overall population of publicly traded firms over time. This table also documents that over these periods there is a slight increase in the average ratio of long-term debt to total assets from 0.229 to 0.243.

The evidence in Table I also indicates that debt maturity has decreased over time. First, following prior work (e.g., Barclay and Smith (1995), Johnson (2003), Billett, King, and Mauer (2007)), we create a summary measure of debt maturity using the fraction of long-term debt that is due in the next three years. This fraction increases from 0.383 to 0.482 from the 1980-1984 to 2000-2004 periods.[6] Subsequently, during the 2005-2008 period, a period of time during which at first a significant refinancing of debt takes place which tends to increase debt maturity, the fraction of long-term debt due in the next three years decreases to 0.427.[7]

Consistent with a shortening of debt maturities, Table I also reports that the fraction of long-term debt consisting of debentures, which are debt contracts with a maturity of more than ten years decreases from the 1980-1984 to the 2005-2008 periods from 0.093 to 0.031. Also, the fraction of long-term debt consisting of debt with a variable interest rate (debt tied to prime in Compustat), which tends to be bank debt with a shorter maturity increases over these same periods from 0.168 to 0.258.

To provide further evidence on whether debt maturity has changed over time, we use data from the FISD and Dealscan databases on the maturity of public and private bond issues and the maturity of bank loans. The analysis is limited to those firms that have data on either or both of the Dealscan or FISD databases and to the subperiods from 1985-1989 to 2005-2008 because data from the Dealscan and FISD are only reliably available from 1986 onward. Using the FISD data on public and private bond issues we approximate each year the maturity of newly issued bonds. Table I shows that this maturity decreases from 16.6 to 11.3 years from the 1985-1989 to the 2005-2008 periods. Similarly, using the Dealscan data on bank loans we calculate each year an estimate of the maturity of newly issued bank loans. The average maturity of a firm's bank loans falls from 5.0 to 3.8 years from the 1985-1989 to the

[6] As noted earlier, Custodio, Ferreira, and Laureano (2010) also report evidence that the debt maturity of U.S. firms has decreased over the last several decades.

[7] Over our sample period the fraction of publicly traded firms that have debt that is rated as high-yield increases. Given that bond ratings data are reliably available from Compustat from 1985 onward, we investigate this issue and document that from the 1985-1989 to the 2005-2008 periods the fraction of Compustat firms with a high yield debt rating increases from 8.3% to 19.6%. However, the decrease in the maturity of debt over our sample period is not driven by the increasing number of firms with high-yield debt. We find that the mean value for the fraction of these firms' long-term debt due in the next three years is only about 0.19 and that this fraction remains roughly constant over our sample period.

2005-2008 periods. To reflect the increased utilization of bank debt, Panel A also reports estimates for the value-weighted maturity of individual sample firms' outstanding bonds and bank debt in which the weighting is a function of the value of the amount of newly issued bonds and bank debt. The results for this analysis shows that the average maturity of bond and bank debt decreases from 10.9 to 5.6 years from the 1985-1989 to the 2005-2008 subperiods.

Finally, Table I also reports evidence on average net debt issuance/book assets for our sample firms. Net debt issuance is calculated as annual long-term debt issuance minus annual long-term debt reduction for a firm. Average net debt issuance is related to average debt maturity. When credit conditions are stronger, firms issue more loans and/or refinance existing commitments, which then typically lengthens the maturity of a firm's long-term debt. Conversely, when credit conditions are weaker and debt issuance levels are low this can shorten average debt maturity levels. For instance, the 1990-1994 period, over which the average value for the fraction of firms' long-term debt due in the next three years peaks at 0.488, is also the period over which net debt issuance/book assets is at its lowest level over our sample period.

The Table I findings do not address the issue that Compustat firm characteristics have changed from 1980-2008, which could result in changes in predicted debt maturity levels over time. To address this issue we run a regression over the 1980-2008 period of the amount of long-term debt due in the next three years as a fraction of total long-term debt on supply-side and demand-side determinants of debt maturity and a variable representing the year during which a given firm-year takes place. The coefficient on the year variable can then be used to estimate the extent to which debt maturity has changed over the 1980-2008 period after controlling for the determinants of debt maturity. Table II provides the results of this analysis. We note that for the Table II regression models, we limit the sample to those firms for whom we can construct the variables appearing in the Table II models as well as the variables appearing in the simultaneous equations models in Tables IV-VII. However, the Table II results are very similar if we only limit the sample to those firms for whom we have necessary data to run the regressions in this table.

In our regression models we control for total debt/book assets given that a firm's debt maturity can be affected by the total amount of its long-term debt. For instance, Diamond (1991) predicts that, because liquidity risk increases with leverage, it will be preferable for firms with higher leverage to have debt with a longer maturity. Following Barclay and Smith (1996) we also control for firm size, market-to-book assets, the difference between the yield on a government 10-year and six-month bond, and future abnormal earnings, measured as the difference between earnings per share in year $t + 1$ (excluding extraordinary items and discontinued operations and adjusted for any changes in shares outstanding) minus earnings per share in year *t*, divided by the year *t* share price**.** Firm size controls for the issue that smaller firms are likely to only have access to bank debt, which tends to have a shorter maturity (Faulkender and Petersen (2006)). Myers (1977) argues that underinvestment problems caused by debt overhang can be reduced if debt matures before the expiration of growth options. Thus, according to this argument, firms with more growth options should use shorter-term debt. We use market-to-book assets to proxy for growth opportunities. Brick and Ravid (1985) contend that the tax shield value of longer-term debt is higher when the yield curve is more upward sloping, which leads to a prediction that when the difference between the yield on a government 10-year and six-month bond is greater that this lengthens debt maturities. However, managers may prefer loans with a shorter rather than a longer maturity when short-term interest rates are relatively low compared to long-term rates (Taggart (1977), Marsh (1982), Graham and Harvey (2001), and Faulkender (2005)). This implies that firms' debt maturity could be negatively associated with the term structure premium. Changes in firm value have a greater effect on the value of longer-term debt as opposed to shorter-term debt. As a result, firms with private information that their future earnings will be abnormally high should prefer loans that have a shorter maturity. Thus, positive future abnormal earnings are expected to be positively associated with the amount of shorter-term debt in a firm's capital structure.

In our Table II models that predict debt maturity, we follow Stohs and Mauer (1996), Johnson (2003), and Billett, King, and Mauer (2007) and include a control for the average asset maturity of a firm, defined as the book value-weighted maturity of long-term assets and current assets, where the maturity of long-term assets is computed as gross property, plant, and equipment divided by depreciation expense and the maturity of current assets is computed as current assets divided by the cost of goods sold. Myers (1977) argues that underinvestment problems can be reduced if the maturity of a firm's debt is matched with the maturity of its assets. This suggests a positive association between asset and debt maturity. In the Table II models we also include a variable measuring industry cash flow volatility to control for the effect of industry cash flow risk on the maturity of a firm's debt. In industries where cash flow volatility is higher, firms may face greater refinancing risk and consequently in these industries, firms could have a preference for longer-term debt. However, given that the value of shorter-term debt is less sensitive to changes in firm risk than is the value of longer-term debt, lenders may have a preference for shorter loan maturities when industry cash flow risk is higher.

Likewise, in the Table II models we include net debt issuance scaled by book assets as an independent variable. This variable controls for the fact that issuing (retiring) debt typically lengthens (shortens) the maturity of a firm's debt. Finally, in the Table II models we include a dummy variable identifying firms that had an initial public offering (IPO) during the prior five years. This variable controls for changes in debt maturity over our sample period that are the result of new firms entering our sample rather than existing firms altering the maturity of their debt. Also, most young firms do not have access to the public debt markets and consequently rely on banks for financing (Faulkender and Petersen (2006)). Thus, this dummy variable also controls for whether a firm is likely to rely on banks for debt financing.

The results for the first model in Table II show that the regression coefficients on most of the control variables in our model predicting debt maturity are statistically different from zero and have expected signs. Further, the coefficient on the year variable is significantly different from zero and equals

0.008. This indicates that from 1980-2008 after controlling for determinants of debt maturity, on average, the fraction of total long-term debt that is due in the next three years increases by 0.008 a year. This suggests that over our sample period after controlling for the determinants of debt maturity this fraction increases by 0.232 (=29*.008). For the 80,035 firm-years used in the first two regression models in Table II, from 1980-2008 the actual fraction of long-term debt that is due in the next three years increases from 0.338 to 0.394, a 16.6% increase (see Table III). Using the beginning period value for this fraction we estimate that after controlling for the determinants of debt maturity, the fraction of long-term debt due in the next three years increases by approximately 68.6% (=(0.338 + 0.232)/0.338)over our sample period. Thus, after accounting for changes in firm characteristics, the decrease in firms' debt maturity is even more apparent. The fact that over time Compustat firms have begun to hold abnormally high levels of shorter-term debt is consistent with the conjecture that unmodeled changes in the supply of credit explains the shift.

The second model in Table II reports the results when industry fixed effects are included in the model predicting debt maturity. Including industry fixed effects in the model verifies whether the shortening of debt maturity that we observe after controlling for determinants of maturity is perhaps driven by a shift in the industries in which Compustat firms tend to operate over the 1980-2008 period. We find that including industry fixed effects in the model has a minimal effect on the results. Specifically, the coefficient on the year variable continues to be 0.008.

In the third and fourth models in Table III, we re-estimate our regression model using only the 273 firms that survive over our 1980-2008 sample period for whom we can calculate the variables for our analyses. This helps to further control for the fact that over time the characteristics of the population of firms in the Compustat database change. Although not tabulated, we find that average debt maturity also decreases for the set of firms that survive our sample period. Specifically, from 1980 to 2008 the mean value for the fraction of a firm's long-term debt due in the next three years increases from 0.252 to 0.315, a 25% increase. The coefficient on the year variable in the third model in Table III is significantly different from zero and equals 0.005. Thus, after controlling for the determinants of debt maturity, for the group of firms that survive the 1980-2008 period, the fraction of long-term debt due in the next three years increases over our sample period by 0.145 (=29*.005). Consequently, the estimate from a multivariate framework for this set of firms implies a 57.5% (=(0.252 + 0.145)/0.252) increase in this fraction. The fourth model in Table 2 shows that controlling for industry fixed effects does not affect our results. Overall, the findings for the firms that survive our sample period indicate that debt maturity significantly decreases for this set of firms as well.

III. Results of Empirical Tests on Cash Holdings

In the prior section, we show that firms' debt maturity has decreased over time. We now examine how this impacts firms' cash holdings.

A. Methodological approach and univariate findings

In Section I we predict that SMD firms hold more cash to avoid significant costs that they might incur if they have trouble refinancing their debt. Because firms' cash holdings and the maturity of their debt are likely jointly determined, to examine the effect of a firm's debt maturity on its cash holdings we use a simultaneous equations framework in which cash holdings and debt maturity are considered to be endogenous. Specifically, we estimate a three-stage-least-squares (3SLS) system of equations. The 3SLS methodology accounts for any correlation between the residuals of the debt maturity and cash holdings models that is caused by unobserved influences on cash holdings and debt maturity. Relative to the two-stage least squares approach, 3SLS provides greater estimation efficiency.

For the cash holdings model, we measure cash holdings as the natural logarithm of cash and short-term investments deflated by book assets. We follow Opler, Pinkowitz, Stulz, and Williamson (1999) and include as exogenous variables the natural logarithm of real inflation-adjusted book assets, market-to-book assets, research and development expenses scaled by sales, capital expenditures scaled by book assets, net-working capital net of cash scaled by book assets, a dummy variable for whether a firm paid dividends in a given year, operating income scaled by book assets, total leverage scaled by book assets, and industry cash flow volatility.

We control for book assets because there are economies to scale to holding more cash and because larger firms typically have easier access to external capital, which reduces the usefulness of holding a large cash balance. Market-to-book assets and research and development expenses proxy for growth opportunities and information asymmetry between a firm and market participants concerning the firm's prospects. Underinvestment is more costly for firms with large growth opportunities, and consequently these firms are predicted to hold more cash. Likewise, because external financing costs are higher for firms with greater information asymmetry about their prospects, such firms are expected to have larger cash reserves. Research and development expenses are included in the cash model as an additional control for growth opportunities. Capital expenditures proxy for the investment level of a firm. Firms that invest more are expected to accumulate less cash, therefore capital expenditures are expected to be negatively associated with cash holdings. Net-working capital can substitute for cash. Thus, firms with a higher value for this variable are expected to hold less cash. We control for whether a firm pays dividends because if it does it is expected to have easier access to external capital and consequently a smaller cash balance. We include operating income/book assets in the cash model because firms that are more profitable are less likely to be financially constrained and to need a large cash balance for precautionary purposes. Potentially, more profitable firms may suffer from greater agency costs related to managerial discretion. Thus, operating income/book assets may also control for such costs. We control for leverage because firms could use cash holdings to reduce their leverage so they can decrease financial constraints, which would result in an inverse association between cash holdings and leverage.

As in Bates, Kahle, and Stulz (2009), we also include acquisition expenses scaled by book assets as an exogenous variable in the cash model. Like capital expenditures, acquisition expenses proxy for the investment level of a firm, and are expected to be negatively associated with cash holdings. Also, as in their paper, we include industry cash flow volatility to control for idiosyncratic cash flow risk in an industry. This risk is predicted to be positively associated with cash holdings. We also include in our cash holdings model a control for credit market conditions during a particular year. When the supply of available credit tightens and refinancing risk consequently increases firms may increase their cash holdings to decrease their refinancing risk. To proxy for credit market conditions we follow Harford (2005) and Officer (2007) and use the four-quarter moving average of the spread of commercial and industrial loan rates (on loans greater than $1 million) over the federal funds rate as a proxy for the supply of available credit.[8,9] In the cash model we also control for net debt issuance/book assets given that if a firm issues more long-term debt than it retires in a given year this could increase its cash reserves. Finally, in the cash model we control for whether a firm had an initial public offering during the prior five years. We include this variable in the cash model to control for changes in the population of Compustat firms over time, and to control for the fact that firms that had their IPO over the prior five years tend to hold more cash (Bates, Kahle and Stulz (2009)).

The dependent variable in the debt maturity model is the fraction of a firm's long-term debt that is due in the next three years. The exogenous variables in the model include those appearing in the Table II models used to calculate the 1980-2006 change in debt maturity after controlling for determinants of debt maturity. In addition, we control for credit market conditions using the spread of commercial and

[8] As discussed in Harford (2005), through the Federal Reserve Senior Loan Officer (SLO) survey, the Federal Reserve surveys senior loan officers across the United States asking them whether over the previous quarter they tightened or eased credit standards for commercial loans. Unfortunately, between 1984-1990 the Federal Reserve did not collect this information. However, Lown, Morgan, and Rohatgi (2000) study the 1973-1983 and 1991-1998 periods and document that over the period for which data is collected for the SLO survey that the extent to which the SLO survey reports that credit conditions are tightening is highly correlated with the spread between the average interest rate on commercial and industrial loans and the federal funds rate. Thus, based on the results from Lown, Morgan, and Rohatgi (2000), the spread of the commercial and industrial loan rate over the federal funds rate may be used as a proxy for the extent to which credit market conditions are tightening.

[9] Harford (2005) uses the spread of the commercial and industrial loan rate over the federal funds rate to proxy for the availability of commercial loans and shows that the existence of strong credit market conditions is a necessary requirement for an industry merger wave to take place. Officer (2007) also uses this spread as a measure for the availability of commercial loans and reports that when the availability of commercial loans is low that firms are more likely to sell off subsidiaries at considerable discounts as a means of raising capital.

industrial loan rates over the federal funds rate because capital market conditions may jointly affect a firm's cash holdings and the maturity of its debt. This would occur if difficult refinancing conditions naturally leads to a shortening of debt maturities as fewer issues are refinanced.[10]

Table III reports univariate statistics for cash holdings and for the fraction of a firm's long-term debt due in the next three years for the sample of 80,035 firm-year observations over the 1980-2008 period that we are left with after data requirements for the variables included in our system of equations. Panel A in this table shows that for this sample the mean values for these two variables are 0.124 and 0.400. Also, Panel A shows that in 8.9% of firm-year observations over our sample period, all of a firm's debt is due in the next three years.

Panels B and C in Table III report univariate statistics for cash holdings and for the fraction of a firm's long-term debt due in the next three years for the 1980 and 2008 years. The mean value of cash holdings/book assets increases over our sample period from 0.085 to 0.139, a 63.5% increase. Although not tabulated, we also find that over the 1980-2006 period for the 76,398 firm-year observations that we are left with after data requirements, cash holdings/book assets increases from 0.085 to 0.162, a 90.6% increase. Presumably, the decrease in corporate cash holdings from 2006 to 2008 partly reflects firms drawing on their cash reserves over the 2007-2008 credit crisis period. The 90.6% increase in cash holdings/book assets that we find over the 1980-2006 period compares to the 112% increase for this variable that Bates, Kahle, and Stulz (2009) report over the same period for the sample of firm-year observations that they are left with after data requirements for the variables included in their cash model. The difference in our findings for the change in the mean cash holdings/book assets ratio from 1980-2006 relative to those in Bates et al. (2009) occurs because we only study firms that have long-term debt and due to the additional data requirements for the debt maturity model.

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[10] In addition to controlling for factors that could affect the maturity of a firm's debt, the variables appearing in the debt maturity model also potentially control for changes in debt maturity over our sample period resulting from supply-side or demand-side factors.

Panels B and C in Table III also show that for the firm-years we are left with after data requirements the mean value for the fraction of a firm's long-term debt due in the next three years increases from 0.338 to 0.394 from 1980 to 2008. Also, consistent with a shortening of debt maturities, Panels B and C document that the fraction of firms that have all of their debt due in the next three years increases from 2.8% to 12.4% between 1980 and 2008. Finally, the differences for the 25th percentile, 75th percentile, and median values for the fraction of a firm's long-term debt due in the next three years between the 1980 and 2008 years show that the increase in the mean values of this variable between these two years is in part due to a fattening of the right tail of this variable.

In some of the tests in this paper, we examine whether the associations between the maturity of a firm's debt with the level and market value of its cash holdings and with investment vary with contemporaneous credit market conditions, measured using the spread of commercial and industrial loan rates over the federal funds rate. Panel D of Table III reports the spread values over each of the years of our sample period, demonstrating that there is considerable variation in the values for this spread. The spread values are lowest during 1985, 1986, 1983, 1996, and 1984 at 0.83, 0.97, 1.23, 1.23, and 1.24. In contrast, the spread values are highest during 1980, 2003, 2005, 2008, and 1981 at 2.01, 2.07, 2.08, 2.12, and 2.73. Overall, the mean and median spread values over our 29-year sample period are both 1.63, while the 25th and 75th percentile values are 1.37 and 1.80.

Before examining the results of our 3SLS simultaneous equations analysis, we discuss the validity of our approach. We ran tests to determine the suitability of the instruments in the cash and debt maturity equations and the appropriateness of using an instrumental variables approach. The results of these tests are as follows. First, the results of F-tests and partial r-square tests of excluded instruments indicate that the instruments in the cash and debt maturity equations are jointly significant in explaining the endogenous variables and that the instruments are valid. Second, the results of a series of tests for whether we have underidentification or weak instrument problems reject the hypothesis that the instruments in our equations suffer from such problems. Third, we ran a Sargan test and found that the cash and debt maturity equations do not suffer from overidentification problems. Finally, we ran a Hausman test to examine if debt maturity is exogenous to cash holdings. The results of this test confirm that debt maturity is indeed endogenous to cash holdings and that it is consequently appropriate to use an instrumental variables approach rather than ordinary least squares when examining the effect of debt maturity on cash holdings.

B. Multivariate evidence on the effect of debt maturity on cash holdings

Table IV reports the results using the 3SLS methodology for the cash holdings equation. The coefficients on most of the control variables are significant and have the expected signs. The significantly positive coefficient on the debt due in next three years/total long-term debt variable for the first model in this table implies that the maturity of a firm's debt has a causal effect on its cash holdings. A shorter (longer) maturity results in larger (smaller) cash holdings. The results for the second model in this table show that the positive effect of having debt with a shorter maturity on a firm's cash holdings is robust to including year fixed effects in both the cash and debt maturity equations in the 3SLS system of equations. This alleviates concerns that this positive effect may simply be due to an increasing trend in cash holdings and a decreasing trend in debt maturity during our sample period. The findings for the third model document that this positive effect is also robust to including both year and industry fixed effects in the cash and debt maturity equations. This suggests that the inverse association between debt maturity and cash holdings is not somehow driven by industry characteristics that we have not controlled for.[11]

[11] Data on bond ratings are only reliably available from Compustat from 1985 onward. As a result, we do include in the cash and debt maturity models an indicator variable for whether a firm has a bond rating, which can proxy for a firm's ability to access external capital and whether it has publicly traded debt. As a robustness test, we re-estimate the Table IV models over the 1985-2008 period, including in the cash and debt maturity equations an indicator variable for whether a firm has a bond rating. We find that including this indicator variable in these models has little effect on our results. This is not surprising as we include in both equations firm size, which is a widely used proxy for a firm's ability to access external capital and which Faulkender and Petersen (2006) show is a statistically and economically important determinant for whether a firm has a bond rating. Also, prior work (e.g., Berger and Udell (1995), Petersen and Rajan (1994, 1995), and Faulkender and Petersen (2006)) shows that as a firm ages its ability to access external capital markedly increases and it is more likely to have publicly traded debt. Thus, the indicator variable for whether a firm had its IPO during the prior

The result of a positive effect of having more shorter-term debt on cash holdings is not only statistically significant, but also economically significant. We examine the effect of a one percent increase in the fraction of a firm's long-term debt due in the next three years on its cash holdings. At the mean value for this fraction over our sample period of 0.400, a one percent increase in this fraction equals 0.004. We multiply this number with the coefficients on the debt due in the next three years/total long-term debt variable for the three models in Table IV. Next, taking the anti-logs of the resulting values we find that a 1% increase in the fraction of total long-term debt due in the next three years leads to 2.4%, 2.7%, or 2.2% increases in cash holdings, depending on if the first, second, or third model is considered.

In the fourth to sixth models of Table IV we report the results of our 3SLS analyses when the sample period is 1980-2006 instead of 1980-2008. We do this for two reasons. First, this enables us to document whether the results reported in the first three models of this table are sensitive to the inclusion of the 2007-2008 credit crisis years. Second, excluding the 2007 and 2008 years from the analysis allows us to use the regression coefficients from models 4-6 to estimate how much of the increase in corporate cash holdings over the 1980-2006 period studied in Bates, Kahle, and Stulz (2009) can be explained by the contemporaneous decrease in debt maturity.

The results for models 4-6 in Table IV show that the coefficients on the fraction of debt due in the next three years variable are very similar to those from models 1-3, suggesting that the inclusion of firm years from 2007 and 2008 in the analyses conducted in the first three models does not have an important effect on the inverse association we find between the maturity of a firm's debt and its cash holdings. To examine whether changes in debt maturity over the 1980-2006 period lead to important changes in cash holdings over this period, we multiply the change in the mean value for the amount of debt due in the next three years as a fraction of total long-term debt from 1980 to 2006 with the

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five years that is included in the cash and debt maturity models also controls for a firm's ability to access external capital. and whether it has publicly traded debt. Further, in the cash model, the variables for market-to-book assets, research and development expenses scaled by sales, industry cash flow risk, operating income/book assets, and whether a firms pays dividends also help to control for if a firm is likely to be financially constrained and the effect of information asymmetry between a firm and market participants on the firm's ability to access external capital.

coefficients on the debt due in the next three years variable for models 4-6 in Table IV. Subsequently, taking the anti-logs of the resulting values we find that the increase in the fraction of total long-term debt due in the next three years from 1980-2006 leads to 27.9%, 31.3%, or 25.9% increases in cash holdings over this period, depending on if the first, second, or third model in Table IV is considered. As reported earlier, for the 76,398 firm-year observations for which we have data for all variables used in the 3SLS system of equations over the 1980-2006 period, the mean value of cash holdings scaled by book assets increases by 90.6%. Thus, the results for the last three models in Table IV suggest that for our sample firms the increase in the use of shorter-term debt from 1980-2006 can explain roughly 30.7%, 34.6%, and 28.6% (27.9/90.6, 31.3/90.6, and 25.9/90.6) of the increase in cash holdings over this period. As reported in Table I, over our sample period the fraction of industrial firms on Compustat with long-term debt varies from 90.0% to 76.3%. This implies that overall for industrial Compustat firms an important fraction of the increase in cash holdings from 1980-2006 can be explained by the shortening of debt maturities over this period.

Bates, Kahle, and Stulz (2009) report that increases in industry cash flow risk and research and development expenses and decreases in capital expenditures and net-working-capital net of cash over the 1980-2006 period are important determinants of the increase in corporate cash holdings over this period. To assess the relative importance of the shortening of debt maturities between 1980-2006 in explaining the increase in corporate cash reserves over this period, we use the coefficient estimates from models 4-6 of Table IV to estimate how much of the change in cash holdings from 1980-2006 can be explained by the increases in industry cash flow risk and research and development expenses and the decreases in capital expenditures and net-working-capital net of cash over this period. However, we acknowledge that our results only apply to firms with long-term debt.

We first examine the increase in industry cash flow risk from 1980-2006. Here, we only consider the regression coefficient estimates from models 5 and 6 given that the coefficient on the industry cash flow variable in the fourth model is negative. From these two models, we estimate that the increase in industry cash flow risk from 1980-2006 explains approximately 23.0% (Model 5) or 6.6% (Model 6) of the increase in corporate cash holdings over this period. For the increase in research and development expenses/sales, we use the coefficient estimates from models 4, 5 and 6 in Table IV and estimate that the increase in these expenses from 1980-2006 explains 3.3%, 4.8%, or 3.3% of the increase in cash holdings. Likewise, we find that the decreases in capital expenditures/book assets and net working capital net of cash/book assets from 1980-2006 explain respectively 2.9%, 3.6%, and 3.0%, or 17.2%, 18.8%, and 20.1% of the 1980-2006 increase in cash holdings. Overall, we confirm the Bates, Kahle, and Stulz (2009) findings that the increases in industry cash flow risk and research and development expenses and the decreases in capital expenditures and net working capital net of cash over the 1980-2006 period are important determinants of the increase in corporate cash holdings over this period. However, our results also show that the shortening of the maturity of firms' debt from 1980-2006 needs to be considered as well as a major factor that led to the increase in corporate cash reserves over this period.

C. Bank lines of credit

One concern could be that we are not be capturing the impact of bank lines, as Sufi (2009) shows that for firms that maintain high cash flows a bank line of credit can be a substitute for holding large cash reserves.[12,13] Table V provides evidence on whether controlling for whether a firm has a line of credit affects the association between debt maturity and cash holdings. We obtain data on whether a firm has a credit line from Amir Sufi's website. This data was used in Sufi (2007). The data covers firm years over the 1996-2003 period. Requiring data items to construct the variables used in our 3SLS system of equation results in a sample of 16,632 observations for which we can control in the debt maturity and

[12] However, during financial crisis periods firms with a line of credit may draw down their credit lines out of fear that banks might deny them credit in the future (e.g., Campello, Graham and Harvey (2010) and Ivashina and Scharfstein (2010)). Thus, during crisis periods there could be a complement relation between whether a firm has a line of credit and the size of its cash holdings.

[13] By hedging interest rate risk with derivatives, firms can potentially reduce some of their refinancing risk and the need for a large cash balance to mitigate this risk. However, Opler, Pinkowitz, Stulz, and Williamson (1999) show that after controlling for other determinants of corporate cash holdings that firms that make intensive use of derivatives hold more rather than less cash. Their findings suggest a complement rather than a substitute relation between derivatives use and the use of cash holdings to reduce refinancing risk.

cash models for whether a firm has a credit line. For this set of observations firms have lines of credit with banks 88.4% of the time.

The results for the first model in Table V show that for the sample of observations for which we know whether a firm has a credit line that we continue to find that firms with shorter debt maturities hold larger cash reserves. The second model in this table documents that this result is robust to controlling for year fixed effects. Likewise, the third model in this table shows that this finding is also robust to controlling for both year and industry fixed effects. The fourth, fifth, and sixth models provide the results when a dummy variable for whether a firm has a credit line is included in both the debt maturity and cash models. The findings for these three models show that having a credit line has a negative effect on a firm's cash holdings, implying, on average, a substitute relationship between cash holdings and whether a firm has a credit line. Also, the findings for these three models document that not only is the positive effect of having debt with a short maturity on cash holdings robust to controlling for whether a firm has a credit line, but that this effect becomes slightly more pronounced after including this control variable in the debt maturity and cash models.

D. Firms that survive the 1980-2008 period

Table VI reports the results when we repeat the analyses whose results are reported in models 1-4 of Table IV, but consider only the 273 firms that survive over our 1980-2008 sample period for whom we can calculate the variables in the cash and debt maturity models. We analyze this set of firms separately to ensure that the negative effect of debt maturity on cash holdings is not somehow due to changes in the population of firms on Compustat over time. The significantly positive coefficient on the debt due in next three years/total long-term debt variable for the first model in this table indicates that even for those firms that survive the entire 1980-2008 period that the maturity of a firm's debt has a causal positive effect on its cash holdings. The results for the second and third models in this table show that the positive effect of having debt with a shorter maturity on a firm's cash holdings is robust to including year fixed effects or both year and industry fixed effects in the cash and debt maturity equations.

E. The effect of credit supply

Table VII provides evidence on the effect of the supply of credit on the inverse association between the maturity of a firm's debt and the level of its cash holdings. If this association occurs in the context of firms' attempts to reduce refinancing risk by holding more cash then it should be more pronounced during periods when credit market conditions are tighter and refinancing risk is likely higher. To examine this issue we estimate the 3SLS system of equations separately over the years during which the spread of commercial and industrial loan rates over the federal funds rate is greater or equal to the median value of 1.63 for the 29 years from 1980-2008 and over the years during which this spread value is below 1.63. The first two models in Panel A of Table VII provide the results when the system of equations is run over the high-spread years while the third and fourth models in this table report the results for the low-spread years. Comparing the coefficient on the debt due in the next three years/total long-term debt variable for the first and third models, in which industry fixed effects are not included in the models, we find that the coefficient on this variable is nearly three times as large for the first model as compared to that for the third model (5.109 versus 1.770). Likewise, when we control for industry fixed effects, we document that the coefficient on the debt due variable is markedly larger for the second model as compared to the fourth model (3.656 versus 1.036). In sum, the Table VII, Panel A results show that the positive effect of having debt with a short maturity on corporate cash holdings is much stronger during the 15 of the 29 years over our sample period when credit conditions are tighter and refinancing risk is consequently greater. This evidence is strong support for the proposition that the inverse association we document between the maturity of a firm's debt with the level of its cash holdings is driven by firms that face greater refinancing risk holding larger cash reserves to mitigate this risk.

In Panel B of Table VII we report the results of further analyses of the effect of credit market conditions on the inverse association between the maturity of a firm's debt and the level of its cash holdings. It should be the case that during years when credit conditions are very tight that some SMD firms will actually draw on their cash reserves to pay off debt that is coming due if they are unable to refinance. As a result, during years when credit conditions are markedly tight a number of SMD firms may *reduce* the level of their cash holdings relative to non-SMD firms. This would cause the inverse association between the maturity of a firm's debt and the level of its cash holdings to become less pronounced during years when credit conditions are very tight. The first two models in Panel B document the results when only the five years over our sample period with the highest rate spread values are considered. The third and fourth models in Panel B of Table VII report the results for the other ten years when the rate spread value is greater or equal to the median value of 1.63 for the 29 years from 1980-2008.

The results for the first two models in Panel B of Table VII show that during the years with the very worst credit conditions, the coefficients on the debt due variable are 1.313 without industry fixed effects and 0.480 with industry fixed effects. These coefficients are markedly lower than the coefficients of 5.109 and 3.656 on this variable in the first two models of Panel A of Table VII, which examine the 15 years when the rate spread was equal to or above the median sample period value. Likewise, these coefficients are notably lower than the coefficients of 5.846 and 4.819 on the debt due variable in the third and fourth models of Panel B of Table VII. Put together, the Panel B, Table VII results imply that as credit conditions tighten, SMD firms precautionarily hold more cash, inducing a strong inverse association between debt maturity and cash holdings. If conditions further worsen, some SMD firms with maturing debt use that cash to mitigate the impact of refinancing difficulties, weakening the overall observed inverse relation between debt maturity and cash holdings. As such, the findings from Panel B,

Table VII are further support for our hypothesis that SMD firms attempt to mitigate the refinancing risk they face by holding large cash reserves.[14]

F. The impact of debt maturity on the contribution of cash holdings to firm value

The Table IV-VII results support the hypothesis that SMD firms hold more cash to offset the larger refinancing risk that they face. To further verify the validity of this proposition, we examine if the contribution of cash holdings to firm value is larger for these firms. We estimate how a change in cash holdings leads to a change in the market value of a firm using the approach developed by Faulkender and Wang (2006). For this purpose, we use a sample of 58,433 firm-year observations over the 1980-2008 period for which we are able to construct the variables required for the analysis.

Table VIII provides the results of our analysis. The first model in this table is a base case model that is identical to the model used in Faulkender and Wang (2006), with dependent and independent variables calculated exactly as in that paper. The dependent variable for this model is a firm's current fiscal year excess stock return, defined as the firm's annual stock return minus the firm's matched Fama and French 5 × 5 portfolio return. The independent variables in the model are the change in current year cash holdings defined as cash and short-term investments, the change in current year earnings defined as earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits, the change in current year net assets defined as total book assets minus cash holdings, the change in current year research and development expenses, the change in current year interest expense, the change in current year common dividends paid, prior year cash holdings, current year market leverage, current year net financing defined as total equity issuance minus repurchases plus debt issuance minus debt redemption, the interaction of prior year cash holdings with the current year change in cash holdings,

[14] As a robustness test, we repeated all of the analyses in Tables IV-VII using a firm's market leverage instead of its book leverage as the control for its financial leverage. The results are very similar to the results tabulated in Tables IV-VII. We also reran all of the analyses in Tables IV-VII using the generalized method of moments methodology instead of the 3SLS methodology and obtained very similar results.

and the interaction of current year market leverage with the current year change in cash holdings. Except for market leverage, all the independent variables are scaled by the lagged market value of equity.

The results for the first model in Table VIII show that the coefficient on the change in current year cash holdings variable is significant and positive, which indicates that the marginal value of an extra dollar of cash is positive. We calculate the marginal value of an extra dollar of cash for the average firm in our sample using several of the regression coefficients from the first model in Table VIII, as well as mean values for a few of the independent variables from this model. Specifically, we make use of the regression coefficients on the change in current year cash holdings variable and the interactions of this variable with prior year cash holdings and with current year market leverage and also use the mean values of lagged cash holdings as a percentage of market value of equity and market leverage of 0.107 and 0.223. We find that the marginal value of an incremental dollar of cash for our sample firms equals $0.94 (=1.201 + (-0.902 * 0.107) + (-0.730 * 0.223)).

To investigate whether for SMD firms the contribution of cash holdings to firm value is greater, in the second model in Table VIII we also include as independent variables a dummy variable for whether a firm-year is in the highest quintile for that particular year for the fraction of long-term debt due in the next three years and the interaction of this variable with the change in current year cash holdings variable. Interestingly, we find that the coefficient on the interaction variable is significantly positive. This indicates that the marginal value of an extra dollar of cash is significantly higher for SMD firms. Presumably, this occurs because for such firms additional cash holdings are important because they help to reduce refinancing risk. We evaluate the economic importance of this result by calculating the marginal value of an extra dollar of cash for both firm-years that are in the highest quintile over a particular year for the fraction of firm long-term debt due in the next three years and for firm-years that are in the lower four quintiles for this variable over a particular year. For the former group of firms the marginal value of an extra dollar of cash equals $1.14 (=1.128 +(-0.918 * 0.107) + (-0.616 * 0.223) + 0.247) while for the latter group this marginal value equals $0.89 (=1.128 +(-0.918 * 0.107) + (-0.616 *

0.223)). These findings indicate that the result that the marginal value of an extra dollar of cash is higher for SMD firms is economically important.

If the result that market participants place a higher value on a dollar of cash holdings for SMD occurs because these firms face higher refinancing risk and larger cash holdings mitigate this risk then we should observe that when credit market conditions tighten and refinancing risk increases that this result becomes more pronounced. The third model in Table VIII provides evidence on this issue. This model is the same as the second model in Table VIII, except that it is run using data for only those years during which the spread of commercial and industrial loan rates over the federal funds rate is in the highest quintile for the 29 years we study over the 1980-2008 sample period. The results for this model show once again that the market's valuation of a dollar of cash holdings is significantly higher for SMD firms. For firm-years that are in the highest quintile over a particular year for the fraction of firm long-term debt due in the next three years the marginal value of an extra dollar of cash equals $1.38 (=1.264 + (-1.211 * 0.105) + (-0.526 * 0.209) + 0.345) while for other firms the marginal value of an extra dollar of cash is $1.03 (=1.264 + (-1.211 * 0.105) + (-0.526 * 0.209)). Importantly, the difference between the market value of an incremental dollar of cash holdings for SMD firms and the value for other firms increases from 0.25 to 0.34 when considering only those firm-years during which credit market conditions are particularly tight. This evidence further supports our conclusion that the higher market value of an extra dollar of cash for SMD firms is the result of additional cash holdings being more valuable for firms that face greater refinancing risk.

G. The effect of debt maturity on the importance of cash holdings for investment

As outlined in Section I.C., we also hypothesize that larger cash holdings mitigate underinvestment more for SMD firms. Table IX provides the results of empirical tests of this hypothesis. In these analyses we utilize the basic investment model employed in Faulkender and Petersen (2011). They use their model to examine whether the American Jobs Creation Act, which significantly lowered the tax cost at which US firms could access unrepatriated foreign earnings, had a positive effect on investment. In their model, investment is defined as capital expenditures and research and development and advertising expenses. As control variables, they include in their model the natural logarithm of the market value of assets, market-to-book assets, and pre-investment earnings/book assets, where pre-investment earnings are defined as earnings before interest, taxes, and depreciation plus research and development and advertising expenses. We add four independent variables to their model. We include a dummy variable for whether during a particular year the fraction of the firm's long-term debt that is due in the next three years is in the top sample quintile, lagged cash holdings/book assets, and the interaction of these two variables. Because issuing debt can affect both investment and the maturity of a firm's debt, we also control for net debt issuance during the year. We note that as argued in the corporate investments literature, cash holdings and investment are endogenous. We attempt to deal with this issue by including lagged rather than current year cash holdings in the investment model and using firm fixed effects.

The results for the first model in Table IX show that the coefficients on the lagged cash holdings variable and the interaction of this variable with the dummy variable for whether the fraction of a firm's long-term debt due in the next three years is in the top sample quintile during a particular year are both positive and significant. The finding for the interaction variable implies that, consistent with the study's third hypothesis, there is a more pronounced positive effect of cash holdings on investment for SMD firms. This result is consistent with the notion that SMD firms face a greater risk that at times they will need to draw on their cash reserves to pay off debt coming due that they have difficulty refinancing or to pay interest on debt that is refinanced at a higher interest rate. As a result, having a large cash balance can be particularly useful for these firms to avoid underinvestment. The magnitude of the coefficient on the interaction variable indicates that this result is economically important. Specifically, the results for the first model in Table IX suggest that for firms for whom the fraction of long-term debt due in the next three years is not in the top sample quintile an incremental dollar of cash reserves in the prior year leads to an extra 12.7 cents in investment in the current year. However, for firms for whom the fraction of long-term debt due in the next three years is in the top sample quintile, an incremental dollar of cash reserves in the prior year leads to 14.7 cents in investment in the current year.

The findings for the first model in Table IX also show that the coefficient on the variable for whether the fraction of a firm's long-term debt due in the next three years is in the top sample quintile is significant and negative, which is consistent with the Almeida, Campello, Laranjeira, and Weisbenner (2010) finding that during the 2007 financial crisis firms that had more debt soon coming due decreased their investment levels the most. It is interesting to note that they find their result in the context of a credit crisis. However, our result implies that overall having debt with a shorter maturity negatively impacts investment. This finding runs counter to the Myers (1977) prediction that shortening the maturity of a firm's debt reduces underinvestment problems because debt would then be more likely to mature before investment options expire, which would reduce debt overhang. A potential explanation for this finding is that the negative effect on corporate investment of refinancing risk resulting from having debt with a shorter maturity outweighs the benefits for corporate investment of shortening debt maturity in an attempt to reduce debt overhang.

The second model in Table IX reports the results when we run our regression model using data for only those years during which the spread of commercial and industrial loan rates over the federal funds rate is in the highest quintile for the 29 years over the 1980-2008 sample period. As predicted, we find that the more positive effect of cash holdings on investment for SMD firms becomes even stronger when credit market conditions tighten. Specifically, the coefficient estimates from this model suggest that under tight credit market conditions for firms for whom the fraction of long-term debt due in the next three years is not in the top sample quintile, an incremental dollar of cash reserves in the prior year leads to an extra 12.1 cents in investment in the current year. However, for firms for whom the fraction of long-term debt due in the next three years is in the top sample quintile, an incremental dollar of cash reserves in the prior year leads to 19.5 cents in investment in the current year. Finally, comparing the coefficient on the variable for whether the fraction of a firm's long-term debt due in the next three years is in the top sample quintile between the first and second models shows that when credit market conditions tighten, the negative effect of having debt with a short maturity on investment becomes more pronounced. This finding is consistent with the notion that under tight credit market conditions the negative effect on corporate investment of having debt with a shorter maturity becomes even more important relative to the benefits for corporate investment of using shorter-term debt in an attempt to reduce debt overhang.

IV. Conclusion

We provide evidence on whether firms' cash holdings policies are impacted by refinancing risk, the risk that a firm will experience difficulty rolling over its debt. We find that firms whose debt has a shorter maturity, whom we refer to as SMD firms, hold more cash. This finding is consistent with firms that face greater refinancing risk attempting to mitigate this risk by holding more cash. We also document that from 1980-2008 the maturity of the debt of U.S. firms has significantly decreased and that this phenomenon explains an important fraction of the large increase in the cash holdings of U.S. firms over this period.

Using the Faulkender and Wang (2006) methodology to determine the market value of an incremental dollar of cash holdings, we examine whether the contribution of cash holdings to firm value is greater for SMD firms. Consistent with the proposition that cash holdings are particularly valuable for firms that face greater refinancing risk, we find that an incremental dollar of cash is worth more for SMD firms.

We also investigate whether large cash holdings reduce underinvestment more for SMD firms. This could be the case if when credit market conditions tighten these firms sometimes have to draw on their cash reserves to pay off debt that is coming due or that is refinanced at a higher interest rate and they then have less cash holdings available for investment. Consistent with the notion that for SMD firms cash holdings are especially important to reduce underinvestment, we find that the positive effect of cash holdings on investment is more pronounced for these firms.

Finally, we investigate the effect of credit market conditions on our results. We find that the inverse associations between the maturity of a firm's debt with the level and market value of its cash holdings are more pronounced during years when credit market conditions are tighter and refinancing risk is consequently higher. Likewise, we document that the more positive effect of cash holdings on investment for SMD firms becomes even stronger when credit market conditions tighten. These findings are consistent with our conclusion that firms increase cash holdings in an attempt to mitigate the refinancing risk of shorter-maturity debt. Overall, our findings imply that larger cash holdings are valuable for firms with shorter-term debt and that these firms trade-off costs of holding a large cash balance with the benefits resulting from a decrease in refinancing risk.

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Table I: The Changing Nature of Debt in the U.S.

This table examines the changing nature of debt characteristics of U.S. incorporated firms from 1980 to 2008 with non-zero sales and total assets. Utilities and Financials are excluded. We only include firms with long-term debt > 0. Our final sample includes 106,128 firm-years. Long-term debt (LTD) is defined as debt maturing in more than one year and the current portion of long-term debt (COMPUSTAT variables DLTT + DD1). To express the time trends in debt characteristics over time, we split the sample into 6 time periods and compute yearly means and then calculate the average of the years for each time period. The maturity structure of firms' public and private bonds is calculated with data from the FISD database. The maturity structure of firms' bank debt is calculated with data from the Dealscan database. We merge both databases with COMPUSTAT and eliminate any utilities and financial firms from the analysis. To calculate the maturity of bonds and bank loans we collect data at the issue level on the amount of bonds and loans issued each year and then create a value-weighted average maturity of debt for newly issued bonds and bank debt.

	1980-84	1985-89	1990-94	1995-99	2000-04	2005-08
Firms with LTD> 0						
Proportion of Compustat firms	0.900	0.876	0.844	0.822	0.788	0.763
Leverage ratio	0.229	0.245	0.235	0.243	0.241	0.243
Fraction of long-term debt due within three years	0.383	0.425	0.488	0.470	0.482	0.427
Debt tied to prime/long-term debt	0.168	0.204	0.208	0.232	0.226	0.258
Debentures/long-term debt	0.093	0.096	0.062	0.042	0.036	0.031
Average bond maturity		16.6	13.2	13.5	10.4	11.3
Average bank loan maturity		5.0	4.1	4.3	3.1	3.8
Average bond & loan weighted maturity		10.9	6.8	6.9	6.3	5.6
Net debt issuance/total book assets	0.017	0.016	-0.002	0.026	0.003	0.019

Table II: The Change in Debt Maturity After Controlling for Determinants of Maturity

Data are for Compustat industrial firms over the 1980-2008 period. The dependent variable is long-term debt due over the next three years/total long-term debt. Observation year is the year when an observation takes place. Term structure is defined as the difference between the yield on a government 10-year and six-month bond. Future year abnormal earnings is the difference between earnings per share in year $t + 1$ (excluding extraordinary items and discontinued operations and adjusted for any changes in shares outstanding) minus earnings per share in year t, divided by the year t share price. Weighted average asset maturity is defined as the book value-weighted maturity of long-term assets and current assets, where the maturity of long-term assets is computed as gross property, plant, and equipment divided by depreciation expense and the maturity of current assets is computed as current assets divided by the cost of goods sold. Industry cash flow risk is calculated as follows. For each firm-year, we compute the standard deviation of cash flow to assets for the previous 10 years, requiring at least three observations. We then average the firm cash flow standard deviations each year across each two-digit SIC industry. Net debt issuance is annual long-term debt issuance minus long-term debt reduction. Industry effects are controlled for by including dummies for Fama-French 48 industry groups.

	Full sample		Firms that survive from 1980-2008	
Model	1	2	3	4
Intercept	-16.074	-15.801	-9.322	-9.203
	(0.000)	(0.000)	(0.000)	(0.000)
Observation year	0.008	0.008	0.005	0.005
	(0.000)	(0.000)	(0.000)	(0.000)
Total debt/book assets	-0.222	-0.221	-0.121	-0.139
	(0.000)	(0.000)	(0.005)	(0.001)
Natural logarithm of real book assets	-0.059	-0.058	-0.030	-0.0230
	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book assets	0.001	0.000	0.009	0.004
	(0.637)	(0.748)	(0.256)	(0.624)
Term structure	0.004	0.004	0.005	0.005
	(0.000)	(0.000)	(0.023)	(0.027)
Future year abnormal earnings	0.030	0.030	0.039	0.035
	(0.000)	(0.000)	(0.004)	(0.008)
Weighted average asset maturity	-0.002	-0.003	-0.001	-0.000
	(0.000)	(0.000)	(0.475)	(0.968)
Industry cash flow risk	0.063	0.043	0.146	0.197
	(0.057)	(0.212)	(0.178)	(0.074)
Net debt issuance/book assets	-0.329	-0.328	-0.214	-0.198
	(0.000)	(0.000)	(0.000)	(0.000)
Firm had its IPO during the prior five years dummy	0.006	0.003	-0.016	-0.020
	(0.135)	(0.418)	(0.528)	(0.437)
Industry fixed effects	No	Yes	No	Yes
R^2-adjusted	0.194	0.198	0.083	0.109
N	80,035	80,035	7,533	7,533

Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for the clustering of observations at the firm level.

Table III: Univariate characteristics of sample used for multivariate tests

Panels A, B, and C report descriptive statistics using the sample of 80,035 firm years for which it is possible to calculate the dependent and independent variables used in the regression models in Tables IV-VII.

Sample period	Mean	25th Pct.	Median	75th Pct.	Fraction of firms with all debt due within three years
Panel A: 1980-2008					
Cash holdings/book assets	0.124	0.019	0.058	0.160	-
Fraction of long-term debt due within three years	0.400	0.110	0.314	0.653	0.089
Panel B: 1980					
Cash holdings/book assets	0.085	0.022	0.049	0.106	-
Fraction of long-term debt due within three years	0.338	0.155	0.274	0.456	0.028
Panel C: 2008					
Cash holdings/book assets	0.139	0.024	0.074	0.183	-
Fraction of long-term debt due within three years	0.394	0.040	0.293	0.678	0.124

Panel D: Four-quarter moving average of the spread of commercial and industrial loan rates over the federal funds rate

Year	Spread	Year	Spread	Year	Spread
1980	2.01	1990	1.53	2000	1.80
1981	2.73	1991	1.75	2001	1.71
1982	1.87	1992	1.63	2002	1.79
1983	1.23	1993	1.57	2003	2.07
1984	1.24	1994	1.37	2004	1.95
1985	0.83	1995	1.37	2005	2.08
1986	0.97	1996	1.23	2006	1.73
1987	1.42	1997	1.31	2007	1.59
1988	1.54	1998	1.38	2008	2.12
1989	1.73	1999	1.64		

Table IV: The Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1980-2008 period. The table reports regression results estimated using the 3SLS methodology. The unreported debt maturity model has debt due over the next three years/total long-term debt as the dependent variable and the independent variables for this model are industry cash flow risk, market-to-book assets, firm size, total leverage/book assets, weighted average maturity of a firm's assets, the difference between the yield on a government 10-year and six-month bond, abnormal earnings, the natural logarithm of the sum of cash and short-term investments divided by book assets, the average commercial and industrial loan rate spread (spread above the federal funds rate) over a firm's fiscal year, net debt issuance/book assets, and whether a firm had its IPO during the prior five years. Industry cash flow risk is calculated as follows. For each firm-year, we compute the standard deviation of cash flow to assets for the previous 10 years, requiring at least three observations. We then average the firm cash flow standard deviations each year across each two-digit SIC industry. Net debt issuance is annual long-term debt issuance minus long-term debt reduction. Industry fixed effects are dummies for Fama-French 48 industry groups.

	Sample period = 1980 - 2008			Sample period = 1980 - 2006		
Model	1	2	3	4	5	6
Intercept	-6.169	-7.948	-6.732	-6.121	-6.389	-6.583
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt due in next three years/total long-term debt	5.903	6.705	5.522	5.853	6.488	5.486
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Natural logarithm of real book value of assets	0.217	0.344	0.278	0.213	0.330	0.274
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book assets	0.148	0.167	0.143	0.146	0.163	0.142
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D/sales	0.221	0.328	0.219	0.217	0.312	0.215
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital expenditures/book assets	-0.750	-0.947	-0.780	-0.709	-0.887	-0.757
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net working capital/book assets	-0.846	-0.918	-0.988	-0.843	-0.916	-0.973
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dividend paying dummy	-0.105	-0.138	-0.098	-0.098	-0.130	-0.095
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Operating income/book assets	0.171	0.228	0.195	0.181	0.225	0.196
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total debt/book assets	-0.830	-0.611	-0.828	-0.915	-0.723	-0.905
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry cash flow risk	-0.657	1.801	0.422	-0.767	2.366	0.732
	(0.000)	(0.000)	(0.012)	(0.000)	(0.000)	(0.000)
Acquisition expense/book assets	-0.754	-1.035	-0.872	-0.746	-1.005	-0.844
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Commercial and industrial loan rate spread	0.0250	0.031	0.025	0.041	0.031	0.024
	(0.249)	(0.543)	(0.615)	(0.058)	(0.554)	(0.626)
Net debt issuance/book assets	2.937	3.127	2.648	2.985	3.102	2.685
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm had its IPO during the prior five years dummy	-0.041	0.038	0.043	-0.041	0.041	0.040
	(0.023)	(0.029)	(0.000)	(0.000)	(0.020)	(0.019)
Year fixed effects	No	Yes	Yes	No	Yes	Yes
Industry fixed effects	No	No	Yes	No	No	Yes
N	80,035	80,035	80,035	76,398	76,398	76,398

Significance levels for whether coefficient estimates are different from zero are in parentheses.

Table V: The Effect of Debt Maturity on Cash Holdings Controlling For Credit Lines

Data are for Compustat industrial firms over the 1996-2003 period. The table reports regression results estimated using the 3SLS methodology. The unreported debt maturity model has debt due over the next three years/total long-term debt as the dependent variable and the independent variables for this model are industry cash flow risk, market-to-book assets, firm size, total leverage/book assets, weighted average maturity of a firm's assets, the difference between the yield on a government 10-year and six-month bond, abnormal earnings, the natural logarithm of the sum of cash and short-term investments divided by book assets, the average commercial and industrial loan rate spread (spread above the federal funds rate) over a firm's fiscal year, net debt issuance/book assets, and whether a firm had its IPO during the prior five years. Industry cash flow risk is calculated as follows. For each firm-year, we compute the standard deviation of cash flow to assets for the previous 10 years, requiring at least three observations. We then average the firm cash flow standard deviations each year across each two-digit SIC industry. Net debt issuance is long-term debt issuance minus long-term debt reduction. Industry fixed effects are dummies for Fama-French 48 industry groups.

Model	1	2	3	4	5	6
Intercept	-5.996	-6.792	-5.970	-5.787	-6.703	-6.095
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt due in next three years/total long-term debt	5.550	5.924	5.031	5.894	6.427	5.687
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Natural logarithm of real book value of assets	0.263	0.289	0.235	0.302	0.332	0.287
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book assets	0.137	0.142	0.123	0.125	0.129	0.113
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D/sales	0.404	0.396	0.287	0.313	0.301	0.205
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital expenditures/book assets	-1.782	-1.679	-1.422	-1.459	-1.346	-1.101
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net working capital/book assets	-1.661	-1.595	-1.766	-1.412	-1.329	-1.432
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dividend paying dummy	-0.274	-0.261	-0.181	-0.234	-0.219	-0.145
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Operating income/book assets	0.067	0.066	0.089	0.122	0.117	0.122
	(0.226)	(0.233)	(0.086)	(0.015)	(0.016)	(0.006)
Total debt/book assets	-1.130	-0.899	-1.128	-0.811	-0.550	-0.735
	(0.000)	(0.004)	(0.000)	(0.011)	(0.111)	(0.080)
Industry cash flow risk	3.521	3.534	1.566	3.422	3.433	1.658
	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)	(0.005)
Acquisition expense/book assets	-1.900	-1.840	-1.529	-1.596	-1.519	-1.200
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Commercial and industrial loan rate spread	-0.385	-0.111	-0.036	-0.394	-0.070	0.012
	(0.000)	(0.635)	(0.873)	(0.000)	(0.775)	(0.960)
Net debt issuance/book assets	3.760	3.913	3.409	3.754	3.919	3.468
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm had its IPO during the prior five years dummy	-0.102	-0.101	-0.062	-0.101	-0.101	-0.068
	(0.007)	(0.014)	(0.131)	(0.011)	(0.020)	(0.122)
Firm has a credit line dummy				-0.777	-0.805	-0.778
				(0.000)	(0.000)	(0.000)
Year fixed effects	No	Yes	Yes	No	Yes	Yes
Industry fixed effects	No	No	Yes	Yes	No	Yes
N	16,632	16,632	16,632	16,632	16,632	16,632

Significance levels for whether coefficient estimates are different from zero are in parentheses.

Table VI: The Effect of Debt Maturity on Cash Holdings for Firms that Survive from 1980-2008

Data are for Compustat industrial firms over the 1980-2008 period. The table reports regression results estimated using the 3SLS methodology. The unreported debt maturity model has debt due over the next three years/total long-term debt as the dependent variable and the independent variables for this model are industry cash flow risk, market-to-book assets, firm size, total leverage/book assets, weighted average maturity of a firm's assets, the difference between the yield on a government 10-year and six-month bond, abnormal earnings, the natural logarithm of the sum of cash and short-term investments divided by book assets, the average commercial and industrial loan rate spread (spread above the federal funds rate) over a firm's fiscal year, net debt issuance/book assets, and whether a firm had its IPO during the prior five years. Industry cash flow risk is calculated as follows. For each firm-year, we compute the standard deviation of cash flow to assets for the previous 10 years, requiring at least three observations. We then average the firm cash flow standard deviations each year across each two-digit SIC industry. Net debt issuance is annual long-term debt issuance minus long-term debt reduction. Industry fixed effects are dummies for Fama-French 48 industry groups.

Model	1	2	3
Intercept	-9.341	-11.058	-8.240
	(0.000)	(0.000)	(0.000)
Debt due in next three years/total	17.964	15.425	14.412
long-term debt	(0.000)	(0.000)	(0.014)
Natural logarithm of real book	0.326	0.393	0.330
value of assets	(0.000)	(0.000)	(0.064)
Market-to-book assets	-0.101	-0.010	0.078
	(0.209)	(0.852)	(0.317)
R&D/sales	4.857	4.112	3.749
	(0.005)	(0.000)	(0.258)
Capital expenditures/book assets	-0.947	-1.487	-2.686
	(0.234)	(0.000)	(0.000)
Net working capital/book assets	-0.608	-0.715	-1.640
	(0.279)	(0.061)	(0.047)
Dividend paying dummy	0.041	-0.039	-0.145
	(0.790)	(0.599)	(0.403)
Operating income/book assets	0.774	0.491	0.752
	(0.065)	(0.013)	(0.090)
Total debt/book assets	-0.566	-0.557	-0.529
	(0.412)	(0.241)	(0.619)
Industry cash flow risk	-5.972	-1.053	-2.390
	(0.000)	(0.237)	(0.121)
Acquisition expense/book assets	-1.572	-1.562	-1.733
	(0.000)	(0.000)	(0.000)
Commercial and industrial loan	-0.324	0.079	0.062
rate spread	(0.016)	(0.729)	(0.824)
Net debt issuance/book assets	5.405	4.266	4.123
	(0.000)	(0.000)	(0.001)
Firm had its IPO during the prior five	0.513	0.241	0.160
years dummy	(0.124)	(0.343)	(0.636)
Year fixed effects	No	Yes	Yes
Industry fixed effects	No	No	Yes
N	7,533	7,533	7,533

Significance levels for whether coefficient estimates are different from zero are in parentheses.

Table VII: Credit Conditions and the Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1980-2008 period. The table reports regression results estimated using the 3SLS methodology. The unreported debt maturity model has debt due over the next three years/total long-term debt as the dependent variable and the independent variables for this model are industry cash flow risk, market-to-book assets, firm size, total leverage/book assets, weighted average maturity of a firm's assets, the difference between the yield on a government 10-year and six-month bond, abnormal earnings, the natural logarithm of the sum of cash and short-term investments divided by book assets, the average commercial and industrial loan rate spread (spread above the federal funds rate) over a firm's fiscal year, net debt issuance/book assets, and whether a firm had its IPO during the prior five years. Industry fixed effects are dummies for Fama-French 48 industry groups.

Panel A: Weaker versus stronger credit market conditions

The first two models in Panel A report the results from the 3SLS system of equations estimated during years when the commercial and industrial loan rate spread was greater or equal to the median value of 1.63 for the 29 years from 1980-2008. The third and fourth models report the results for the years when the commercial and industrial loan rate spread was smaller than the median value of 1.63 for the 29 years from 1980-2008.

	Weaker credit market conditions		Stronger credit market conditions	
Model	1	2	3	4
Intercept	-7.120	-5.730	-2.430	-1.805
	(0.000)	(0.000)	(0.000)	(0.000)
Debt due in next three years/total long-term debt	5.109	3.656	1.770	1.036
	(0.000)	(0.000)	(0.000)	(0.000)
Natural logarithm of real book value of assets	0.182	0.129	0.018	-0.014
	(0.000)	(0.000)	(0.160)	(0.346)
Market-to-book assets	0.159	0.133	0.128	0.110
	(0.000)	(0.000)	(0.000)	(0.000)
R&D/sales	0.258	0.157	0.412	0.360
	(0.000)	(0.000)	(0.000)	(0.000)
Capital expenditures/book assets	-1.039	-0.852	-1.452	-1.425
	(0.000)	(0.000)	(0.000)	(0.000)
Net working capital/book assets	-1.010	-1.166	-1.585	-1.737
	(0.000)	(0.000)	(0.000)	(0.000)
Dividend paying dummy	-0.132	-0.126	-0.191	-0.171
	(0.000)	(0.000)	(0.000)	(0.000)
Operating income/book assets	0.154	0.107	0.421	0.424
	(0.000)	(0.000)	(0.000)	(0.000)
Total debt/book assets	-0.732	-1.047	-2.134	-2.234
	(0.000)	(0.000)	(0.000)	(0.000)
Industry cash flow volatility	0.099	-0.806	1.568	-1.252
	(0.586)	(0.000)	(0.000)	(0.000)
Acquisition expense/book assets	-0.998	-0.881	-1.288	-1.253
	(0.000)	(0.000)	(0.000)	(0.000)
Commercial and industrial loan rate spread	0.736	0.592	-0.605	-0.455
	(0.000)	(0.000)	(0.000)	(0.000)
Net debt issuance/book assets	2.681	2.083	1.782	1.513
	(0.000)	(0.000)	(0.000)	(0.000)
Firm had its IPO during the prior five years dummy	-0.020	-0.002	-0.001	0.003
	(0.414)	(0.941)	(0.952)	(0.836)
Industry fixed effects	No	Yes	No	Yes
N	40,334	40,334	39,701	39,701

Significance levels for whether coefficient estimates are different from zero are in parentheses.

Panel B: Very weak versus weak credit market conditions

The first two models in Panel B report the results from the 3SLS system of equations estimated over the five years from 1980-2008 with the highest commercial and industrial loan rate spread values. The third and fourth models report the results for the years from 1980-2008 when the commercial and industrial loan rate spread is greater or equal to the median value of 1.63 for the 29 years from 1980-2008, but less than 1.95 so that the years examined in the first two models of this panel are excluded from the years examined in the third and fourth models.

	Very weak credit market conditions		Weak credit market conditions	
Model	1	2	3	4
Intercept	-3.200	-2.355	-10.735	-9.065
	(0.000)	(0.000)	(0.000)	(0.000)
Debt due in next three years/total long-term debt	1.313	0.480	5.846	4.819
	(0.000)	(0.115)	(0.000)	(0.000)
Natural logarithm of real book value of assets	0.000	-0.019	0.235	0.193
	(0.978)	(0.149)	(0.000)	(0.000)
Market-to-book assets	0.158	0.135	0.168	0.141
	(0.000)	(0.000)	(0.000)	(0.000)
R&D/sales	0.470	0.300	0.225	0.117
	(0.000)	(0.000)	(0.000)	(0.000)
Capital expenditures/book assets	-2.525	-2.033	-0.784	-0.561
	(0.000)	(0.000)	(0.000)	(0.000)
Net working capital/book assets	-1.830	-2.171	-0.881	-0.902
	(0.000)	(0.000)	(0.000)	(0.000)
Dividend paying dummy	-0.177	-0.143	-0.128	-0.107
	(0.000)	(0.000)	(0.000)	(0.000)
Operating income/book assets	0.406	0.381	0.123	0.076
	(0.000)	(0.000)	(0.000)	(0.001)
Total debt/book assets	-1.560	-1.683	-0.658	-0.864
	(0.000)	(0.000)	(0.000)	(0.000)
Industry cash flow volatility	0.671	0.030	0.407	-0.880
	(0.000)	(0.862)	(0.117)	(0.002)
Acquisition expense/book assets	-1.954	-1.912	-0.854	-0.652
	(0.000)	(0.000)	(0.000)	(0.000)
Commercial and industrial loan rate spread	0.173	0.094	2.449	1.996
	(0.000)	(0.032)	(0.000)	(0.000)
Net debt issuance/book assets	1.408	1.085	3.056	2.548
	(0.000)	(0.000)	(0.000)	(0.000)
Firm had its IPO during the prior five years dummy	0.011	0.038	-0.030	-0.019
	(0.710)	(0.161)	(0.351)	(0.537)
Industry fixed effects	No	Yes	No	Yes
N	13,367	13,367	26,967	26,967

Significance levels for whether coefficient estimates are different from zero are in parentheses.

Table VIII: The Effect of Debt Maturity on the Market Valuation of Cash Holdings

The table reports OLS regressions of changes in firm value on changes in cash holdings, a dummy variable for whether a firm's debt has a short maturity, the interaction of the prior two variables and control variables. The sample consists of 58,433 firm-year observations over the 1980-2008 period with required data for the regressions. The dependent variable is the firm's excess stock return with excess return defined as the firm's annual fiscal year stock return minus the matched Fama and French 5 × 5 portfolio's return. The firm-level independent variables are: cash holdings (cash and short term investments), earnings (earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits), net assets (total assets minus cash holdings), research & development expenses, interest expenses, dividends (common dividends paid), market leverage (total debt divided by the total debt plus the market value of equity), and net financing (total equity issuance minus repurchases plus debt issuance minus debt redemption). These independent variables, except leverage, are divided by the lagged market value of equity. A delta (Δ) reflects the variable is calculated as the change from year t-1 to t. The first model in Table VIII is the basic model from Faulkender and Wang (2006). In the second model we include a dummy variable for whether the fraction of a firm's long-term debt that is due in the next three years is in the top quintile of sample values for that year, and also include the interaction of this dummy variable with the Δ Cash holdings variable. The third model is the same as the second model, except that it is run using data for only those years during which the spread of commercial and industrial loan rates over the federal funds rate is in the highest quintile for the 29 years over the 1980-2008 sample period. Probabilities are in parentheses underneath the coefficients and are adjusted for clustering at the firm-level.

	Full sample		Weak credit market conditions
Model	1	2	3
Constant	0.040 (0.000)	0.058 (0.000)	0.044 (0.000)
Δ Cash holdings	1.201 (0.000)	1.128 (0.000)	1.264 (0.000)
5th Quintile of debt due in next three years		-0.061 (0.000)	-0.046 (0.000)
5th Quintile of debt due in next three years× Δ Cash holdings		0.247 (0.000)	0.345 (0.000)
Δ Earnings	0.664 (0.000)	0.659 (0.000)	0.672 (0.000)
Δ Net Assets	0.036 (0.000)	0.036 (0.000)	0.026 (0.000)
Δ Research & development expense	0.546 (0.000)	0.506 (0.000)	0.430 (0.000)
Δ Interest expense	-1.557 (0.000)	-1.511 (0.000)	-1.352 (0.000)
Δ Dividends	0.152 (0.007)	0.295 (0.004)	3.005 (0.000)
Cash $holdings_{t-1}$	0.444 (0.000)	0.444 (0.000)	0.385 (0.000)
Leverage	-0.430 (0.000)	-0.457 (0.000)	-0.324 (0.000)
Net Financing	0.238 (0.000)	0.233 (0.000)	0.110 (0.000)
Cash $holdings_{t-1}$ × Δ Cash holdings	-0.902 (0.000)	-0.918 (0.000)	-1.211 (0.000)
Leverage × Δ Cash holdings	-0.730 (0.000)	-0.616 (0.000)	-0.526 (0.000)
R^2-adjusted	0.098	0.100	0.105
N	58,433	58,433	10,603

Table IX: The Effect of Debt Maturity on the Importance of Cash Holdings for Investment
The table reports OLS fixed effects regressions of investment on a dummy variable for whether the fraction of a firm's long-term debt due in the next three years is in the top sample quintile during a particular year, lagged cash holdings, the interaction of the two prior variables, net debt issuance/book assets, the natural logarithm of the real market value of assets, market-to-book assets, and pre-investment earnings/book assets. The sample is made up of firms included in our analysis of the market valuation of corporate cash holdings and consists of 56,252 firm-year observations over the 1980-2008 period with required data for the regressions. Investment is defined as capital expenditures, acquisition expenses, research and development expenses, and advertising expenses scaled by book assets. Pre-investment earnings/book assets is defined as earnings before interest, taxes, depreciation, and amortization plus research and development and advertising expenses scaled by book assets. The second model is the same as the first model, except that it is run using data for only those years during which the spread of commercial and industrial loan rates over the federal funds rate is in the highest quintile for the 29 years over the 1980-2008 sample period. Probabilities are in parentheses underneath the coefficients and are adjusted for clustering at the firm-level.

	Full sample	Weak credit market conditions
Model	1	2
Constant	0.105	0.144
	(0.000)	(0.000)
5^{th} Quintile of debt due in next three years	-0.005	-0.016
	(0.004)	(0.005)
Cash $Holdings_{t-1}$	0.127	0.121
	(0.000)	(0.000)
5^{th} Quintile of debt due in next three years×	0.020	0.074
Cash $holdings_{t-1}$	(0.005)	(0.000)
Net debt issuance/book assets	0.214	0.159
	(0.000)	(0.000)
Natural logarithm of real market value of assets	-0.001	-0.003
	(0.210)	(0.162)
Market-to-book-assets	0.002	-0.048
	(0.000)	(0.002)
Pre-investment earnings/book assets	0.063	0.144
	(0.000)	(0.000)
Year fixed effects	Yes	No
R^2-adjusted	0.167	0.177
N	56,252	10,153