The Journal of FINANCE
The Journal of THE AMERICAN FINANCE ASSOCIATION

THE JOURNAL OF FINANCE • VOL. LXIX, NO. 3 • JUNE 2014

Refinancing Risk and Cash Holdings

JARRAD HARFORD, SANDY KLASA, and WILLIAM F. MAXWELL*

ABSTRACT

We find that firms mitigate refinancing risk by increasing their cash holdings and saving cash from cash flows. The maturity of firms' long-term debt has shortened markedly, and this shortening explains a large fraction of the increase in cash holdings over time. Consistent with the inference that cash reserves are particularly valuable for firms with refinancing risk, we document that the value of these reserves is higher for such firms and that they mitigate underinvestment problems. Our findings imply that refinancing risk is a key determinant of cash holdings and highlight the interdependence of a firm's financial policy decisions.

BOTH CASH HOLDINGS AND THE maturity structure of long-term debt are major considerations for firms, and there are trade-offs in determining each. An important aspect for debt maturity is that shortening maturity increases potential costs stemming from refinancing risk. When refinancing, firms face the risk that changes in market conditions or capital market imperfections could result in refinancing at a significantly higher interest rate (Froot, Scharfstein, and Stein (1993)). Firms also face the risk that lenders could underestimate the continuation value of the firm and not allow refinancing to take place, leading to an inefficient liquidation of the firm (e.g., Diamond (1991, 1993) and Sharpe (1991)) or the sale of important firm assets at fire-sale prices (Brunnermeier and Yogo (2009) and Choi, Hackbarth, and Zechner (2013)). An additional cost arising from this refinancing risk is that it can increase the potential for underinvestment problems (Almeida et al. (2012)). Firms with long-term debt that has a shorter maturity (hereafter referred to as shorter maturity debt) face refinancing risk more frequently.

*Harford is with the Foster School of Business, University of Washington, Klasa is with the Eller College of Management, University of Arizona, and Maxwell is with the Cox School of Business, Southern Methodist University. We thank an anonymous referee; an Associate Editor; Malcolm Baker; Travis Box; Murillo Campello; Lin Chen; Amar Gande; Cam Harvey (the Editor); Chris James; Kathy Kahle; Swaminathan Kalpathy; Hayong Yun; and seminar participants at Brigham Young University, McGill University, Texas Tech University, Virginia Tech University, the University of Arizona, a University of Oregon conference, a City University of Hong Kong symposium, and the University of Innsbruck Financial Markets and Risk conference for helpful comments. We also thank Douglas Fairhurst and Matthew Serfling for excellent research assistance. Klasa thanks the University of Arizona Eller College of Management for the financial support provided by the Anheuser-Busch Endowed Chair in Entrepreneurship Studies.

DOI: 10.1111/jofi.12133

We hypothesize that cash reserves enable a firm to mitigate the adverse effects of refinancing risk. For instance, cash reserves could enable the firm to fully invest in its growth opportunities. Likewise, if the firm is unable to obtain refinancing, large cash holdings could allow it to avoid selling key firm assets to pay off debt that is coming due and could also reduce the likelihood of an inefficient liquidation of the entire firm. Consequently, we test the hypothesis that firms mitigate refinancing risk by managing their cash holdings. After doing so, we look at broader implications of the interaction between cash policy and debt maturity decisions.

Our hypothesis relies in part on the assumption that most firms are rationed by their lenders with respect to how much they can borrow (Faulkender and Petersen (2006)), and as a result lenders often have discretion over loan terms, such as the maturity of a loan (Roberts and Sufi (2009)). Consequently, after finding that at its preferred rates it is only being offered shorter maturity credit, a firm could increase its cash holdings to reduce refinancing risk. However, our hypothesis also applies 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, they weigh the benefits of shorter maturity debt against the refinancing risk, while simultaneously considering how larger cash holdings could reduce their refinancing risk.[1]

Jensen (1986), Harford (1999), Dittmar and Mahrt-Smith (2007), and Harford, Mansi, and Maxwell (2007) provide evidence on the agency costs of large cash reserves. Given that shorter maturity debt subjects managers to frequent monitoring by capital market participants, the interests of managers in firms with shorter maturity debt should be more aligned with those of shareholders (e.g., Rajan and Winton (1995), Stulz (2000), Harvey, Lins, and Roper (2004)). The fact that agency costs should be lower for these firms mitigates the costs normally associated with larger cash reserves.[2] Furthermore, because shorter maturity debt tends to be bank debt and banks are able to obtain more information about borrowers compared to other lenders, their monitoring should help to further reduce managerial agency costs (e.g., James (1987), Lummer and McConnell (1989), Rauh and Sufi (2010)).[3]

[1] Consistent with the conjecture that firms take steps to minimize their refinancing risk, Johnson (2003) documents that firms with significant amounts of shorter maturity debt hold less total debt.

[2] Other benefits of large corporate cash holdings include that they allow firms to avoid transactions costs associated with the frequent accessing of external capital markets. In addition, these holdings benefit firms with larger growth opportunities as they can reduce underinvestment problems for these firms when information asymmetry problems result in high external financing costs (e.g., Kim, Mauer, and Sherman (1998), Opler et al. (1999)). Consistent with this proposition, firms with larger information asymmetry problems hold more cash, and for these firms the incremental value of an additional dollar of cash is larger and the positive effect of cash holdings on investment is more pronounced (Opler et al. (1999), Faulkender and Wang (2006), Denis and Sibilkov (2010)).

[3] Shorter maturity debt is also expected to reduce agency costs of debt such as underinvestment (Myers (1977)) and asset substitution (e.g., Barnea, Haugen, and Senbet (1980), Leland and Toft (1996), Brockman, Martin, and Unlu (2010)).

To examine the impact of debt maturity and refinancing risk on firms' cash holdings practices, it is important to account for the likelihood that cash holdings and debt maturity are 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 simultaneously increase the propensity for lenders to offer a firm a short-term loan and for the firm to accept such a loan offer. Thus, we use a simultaneous equations framework in which cash holdings and debt maturity are assumed to be jointly determined and in which we control for a host of determinants of these two variables. The results of our analysis show that decreases in the maturity of a firm's debt lead the firm to hold more cash and that this effect is economically important.[4] In additional tests, we find that this effect is due in part to firms with shorter maturity debt saving more cash out of their cash flows.

One of the broader implications of understanding the relation between debt maturity and cash holdings relates to the documented upward trend in cash holdings over time. While the amount of firms' long-term debt relative to assets has remained constant over the study's 1980 to 2008 sample period, the average maturity of this debt has shortened markedly, and thus refinancing risk has increased over this period. 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)). Syndication 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 shorter maturity.[5] Overall, the fraction of a firm's long-term debt due in the next three years (our primary measure of refinancing risk or debt maturity) increased by 16.6% over the study's sample period. The increase is even more striking once we control for the firm-level determinants of the maturity of a firm's long-term debt. For example, in 2008 the typical firm with long-term debt has 66.3% more long-term debt due in the next three years than a firm in 1980 with the same characteristics.[6] After controlling for the joint determination of cash holdings and debt maturity, the shortening of debt maturities explains approximately 32% of the increase in corporate cash reserves over the period studied in Bates, Kahle, and Stulz (2009).

A firm should be less concerned with refinancing risk if it has less debt or when credit market conditions are strong. We find that the positive association between shorter maturity debt and cash holdings is weaker in these

[4] The results of a Hausman test indicate that cash holdings and debt maturity are indeed jointly determined. After controlling for the joint determination of cash holdings and debt maturity, we find some evidence that larger cash holdings can lead to firms holding long-term debt with a shorter maturity. However, this effect is economically very small.

[5] 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 syndicated loans is a little over three years.

[6] In contemporaneous work, Custodio, Ferreira, and Laureano (2013) also note a decrease in corporate debt maturity over the past three decades. Their findings are consistent with supply-side factors playing an important role in this decrease.

circumstances. This finding is further evidence that the association is driven by firms mitigating refinancing risk.

We next investigate whether the presence of credit lines affects our findings. Specifically, we test whether bank lines of credit substitute for cash in mitigating refinancing risk. To do so, we collect data from firms' annual reports on whether they have a credit line and have drawn on it. Firms that do not have a bond rating are potentially rationed by investors with respect to how much outside capital they can obtain (e.g., Faulkender and Petersen (2006)). For these firms, we do not find that having an untapped line of credit from a bank results in a weaker association between shorter maturity debt and cash holdings. This result is consistent with recent work suggesting that financially constrained firms are less likely to view credit lines and cash holdings as substitutes (e.g., Sufi (2009), Campello, Graham, and Harvey (2010), Lins, Servaes, and Tufano (2010)). Our findings are different for firms with a bond rating (less constrained); we document that shorter maturity debt continues to be positively associated with cash holdings when a firm has at least partially drawn its credit line. However, this association becomes insignificant for rated firms with an untapped line of credit. One interpretation of this result is that firms that normally enjoy easier access to capital view an untapped credit line as a viable substitute for cash holdings to mitigate unexpectedly unfavorable refinancing conditions. For these firms, refinancing difficulties would likely be caused by debt market conditions rather than firm-specific distress (which would affect their access to a line as well).

One way that large cash reserves can provide value for firms with shorter maturity debt is by reducing underinvestment when firms can only partially roll over their debt or they refinance it at a higher rate. Consistent with this proposition, we document that the positive effect of cash holdings on investment is more pronounced for firms with shorter maturity debt and that this result becomes even stronger when credit market conditions are tight and refinancing risk is therefore higher.

Finally, if larger cash reserves mitigate refinancing risk and the costs associated with this risk, such as underinvestment, the market's valuation of an incremental dollar of cash holdings should be higher for firms with shorter maturity debt. Employing the Faulkender and Wang (2006) methodology, we find that the value of an incremental dollar of corporate cash reserves is indeed higher for firms with shorter maturity debt. Furthermore, we document that this effect is substantially more pronounced during years when credit market conditions are tight. These two findings are additional support for the hypothesis that large cash holdings are especially valuable for firms that face greater refinancing risk.

Overall, our study contributes to the literature in several ways. First, we provide insights on how the maturity of a firm's long-term debt impacts its other financial policy decisions, as well as the intertwined nature of these decisions. By documenting that refinancing risk associated with shorter maturity debt induces firms to hold more cash and save more cash from their cash flows, we show that debt maturity is an important determinant of a firm's corporate

liquidity policies, helping to explain the general upward trend in corporate cash holdings. Furthermore, we report that (1) the positive associations between shorter maturity debt and the level and market value of corporate cash holdings are more pronounced during years when credit market conditions are not as strong and (2) the more positive effect of cash holdings on investment for firms with greater refinancing risk is stronger during such years. These findings highlight the usefulness of considering time-variation in the supply of credit when conducting research about what drives corporate financial policy choices. Recent work that examines how credit supply affects firm behavior focuses on the 2007 to 2008 credit crisis (e.g., Campello, Graham, and Harvey (2010), Duchin, Ozbas, and Sensoy (2010), and Campello et al. (2011)). Our findings suggest that there is also considerable variation in credit supply and refinancing risk during noncrisis periods that can be exploited by researchers who study corporate financial policy decisions.

The remainder of the paper is organized as follows. Section I discusses our sample and provides evidence on how the structure and maturity of the debt of U.S. corporations has changed since 1980. Section II provides our empirical results. Finally, Section III concludes.

I. Sample Description and the Changing Nature of Debt in the United States

Our initial sample of 124,372 firm-years consists of U.S. incorporated industrial firms (utilities and financial firms are excluded) from 1980 to 2008 with nonzero sales and total assets. Our final sample of 103,806 observations excludes firms that do not have long-term debt, where long-term debt is defined as debt maturing in more than one year plus the current portion of this debt.

To proxy for debt maturity, prior work focuses on the fraction of a firm's total debt that is due in the next three years, which includes debt that has a maturity of less than one year at issuance (e.g., Barclay and Smith (1995), Johnson (2003), Billett, King, and Mauer (2007)). However, we exclude debt with less than a year to maturity when issued from our debt maturity/refinancing risk measure. We do so because nonfinancial firms typically pay this debt when it is due rather than refinance it, as it is used to finance a firm's short-term assets and other short-term liquidity needs that are often seasonal in nature.[7] This follows from the matching principle that short-term assets are financed with short-term debt, and that long-term assets are financed with long-term debt, preferred stock, or common equity. Stohs and Mauer (1996), Guedes and Opler (1996), and Graham and Harvey (2001) provide evidence consistent with

[7] In contrast, refinancing risk related to debt with a maturity of less than one year at issuance can be an important source of risk for financial firms. For instance, see Acharya, Gale, and Yorulmazer (2011) for evidence on how financial firms' refinancing risk resulting from their reliance on short-term debt that needed to be rolled over was an important factor that led to the recent financial crisis.

nonfinancial firms following the matching principle.[8] As such, we use the fraction of a firm's *long-term debt* due in the next three years (including the current portion of this debt) as our main proxy for the maturity of a firm's debt and its refinancing risk. We note that the study's results are not dependent on the choice of the time period used in the numerator or on excluding short-term debt from our measure for refinancing risk (we do not ignore short-term debt, but rather include it when calculating net working capital, which is a control variable in our cash models).

We report time trends in debt characteristics in Table I. 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. Before discussing changes in debt maturity over time, we note that the percentage of firms with long-term debt in their capital structure decreases from 90.0% to 76.3% between the 1980 to 1984 and 2005 to 2008 periods. Comparing the same periods, there is a slight increase in the average ratio of long-term debt to total assets from 0.229 to 0.243 for firms with long-term debt.

Turning to debt maturity, Table I documents that the fraction of a firm's long-term debt due in the next three years increases from 0.383 to 0.482 from the 1980 to 1984 to the 2000 to 2004 periods. The 2005 to 2008 period began with a significant amount of refinancing, which tends to increase debt maturity. As a result, over this period the fraction of long-term debt due in the next three years decreases to 0.427. Overall, between the 1980 to 1984 and 2005 to 2008 periods, this fraction increases by 11.5%, implying a shortening of debt maturity and an increase in firms' refinancing risk (to be succinct whenever discussing a changing statistic over time, we are always comparing the beginning time period to the last time period unless otherwise noted). The statistics for the summary measures calculated using the fraction of long-term debt due in one or five years also suggest that debt maturity has decreased over our sample period. Specifically, these two fractions increase by 28.2% and 17.0% over time. Further consistent with a shortening of debt maturities, Table I reports that the

[8] To provide further insights on whether nonfinancial firms are likely to pay off short-term debt when it comes due rather than refinance it, we examine whether the amount of these firms' outstanding short-term debt varies considerably across the quarters of a firm's fiscal year. If so, this would be consistent with these firms typically paying off short-term debt when it is due. For this analysis, we use Compustat quarterly and annual data to back out the amount of a firm's outstanding debt that was short-term at issuance during every quarter of its fiscal year. Specifically, for firm-years in our sample in which there is outstanding short-term debt, each quarter we subtract from a firm's value for the Compustat quarterly variable DLCQ (which represents the sum of outstanding short-term debt and the current portion of long-term debt) the average value for the firm for the Compustat annual variable DD1 (which represents the current portion of long-term debt) at the end of its prior and current fiscal year. In doing so, we implicitly assume that the amount of the current portion of a firm's long-term debt typically remains roughly constant across the quarters of its fiscal year. For each of these firm-years, we then calculate the ratio of the estimate of outstanding short-term debt during the quarter when it is highest to that in the quarter when it is lowest. The median value of this ratio is 1.7, which suggests that, during the fiscal quarter when outstanding short-term debt is highest, it is approximately 70% higher than it is during the quarter when it is lowest. This finding is consistent with firms paying off short-term debt when it is due rather than refinancing it.

Table I

The Changing Nature of Debt and Cash Holdings in the United States

This table examines the changing nature of debt and cash holdings characteristics of U.S. incorporated firms with nonzero sales and total assets and with long-term debt >0 over the 1980 to 2008 period. Utilities and financials are excluded. Our final sample includes 103,806 firm-years. Long-term debt 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 six time periods and compute yearly means and then calculate the average over 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. 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 to 1984	1985 to 1989	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2008
Debt Characteristics						
Proportion of Compustat firms with long-term debt	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 one year	0.149	0.179	0.209	0.208	0.225	0.191
Fraction of long-term debt due within three years	0.383	0.425	0.488	0.470	0.482	0.427
Fraction of long-term debt due within five years	0.535	0.567	0.631	0.620	0.626	0.626
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
Cash						
Cash holdings and short-term investments/book assets	0.110	0.124	0.126	0.149	0.176	0.177

fraction of long-term debt consisting of debentures, which are debt contracts with a maturity of more than 10 years, decreases 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 is usually bank debt with a shorter maturity, increases from 0.168 to 0.258.

To provide further evidence on whether debt maturity has changed over time, we use data from the Mergent Fixed Income Securities Database (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, which limits our sampling to 1986 onward. We approximate the maturity of newly issued bonds each year by using the FISD data on public and private bond issues. Table I

shows that original issue maturity decreases from 16.6 to 11.3 years. Similarly, we calculate an estimate of the maturity of newly issued bank loans each year using the Dealscan data. The average maturity of a firm's bank loans falls from 5.0 to 3.8 years. To reflect the increased utilization of bank debt, Table I 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 show that the average maturity of bonds and bank debt decreases from 10.9 to 5.6 years. Finally, as it relates to our other variable of interest, we report that average cash holdings/book assets increases from 0.110 to 0.177, a 60.9% increase over our sample period.

Table I makes no adjustment for potential changes in Compustat firm characteristics over time. To address this issue, we estimate a panel regression in Table II in which the fraction of long-term debt due in the next three years is regressed on supply-side and demand-side determinants of debt maturity as well as a variable representing the fiscal year of the observation. We use the coefficient on the year variable to estimate the extent to which debt maturity has changed from 1980 to 2008 after controlling for the determinants of maturity.[9]

The control variables are drawn from prior literature. Diamond (1991) predicts that, because liquidity risk increases with leverage, it will be preferable for firms with more leverage to have debt with a longer maturity. In addition, in firms with larger cash flows, higher debt could reduce agency costs by forcing managers to pay out funds that might otherwise have been invested in negative net present value projects (e.g., Jensen (1986), McConnell and Servaes (1995)). Thus, firms with higher debt should have less of a need to shorten maturity to reduce agency costs. Both of these factors imply a positive association between leverage and debt maturity. Hence, to account for a firm's debt maturity being affected by the total amount of long-term debt, we control for total debt/book assets.

Following Barclay and Smith (1995), 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. Smaller firms suffer from greater information asymmetry problems with capital providers, such that these firms often only have access to bank debt, which tends to have a shorter maturity (James (1987), Lummer and McConnell (1989), and Faulkender and Petersen (2006)). Firms with higher market-to-book assets are expected to have larger growth opportunities, and as such they could face larger information asymmetry problems with capital providers and rely more on shorter maturity bank debt. Furthermore, Myers (1977) argues that underinvestment problems caused by debt overhang can be reduced if debt matures before the

[9] In the Table II regression models, we limit the sample to those firms appearing in the simultaneous equations models in Tables IV and VI. However, the results are very similar if we include the full sample of firms for which we have necessary data to run the regressions in Table II. The results of these robustness tests are reported in the Internet Appendix, which may be found in the online version of this article.

Table II

The Change in Debt Maturity after Controlling for Determinants of Maturity

Data are for Compustat industrial firms over the 1980 to 2008 period. The dependent variable is long-term debt due over the next three years/total long-term debt. Observation year is the fiscal year when an observation takes place. Term structure is 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 (1997) 48 industry groups. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

Model	1	2
Intercept	−15.801	−15.900
	(<0.001)	(<0.001)
Observation year	0.008	0.008
	(<0.001)	(<0.001)
Total debt/book assets	−0.221	−0.240
	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	−0.058	−0.059
	(<0.001)	(<0.001)
Market-to-book assets	0.000	0.002
	(0.748)	(0.074)
Term structure	0.004	0.004
	(<0.001)	(<0.001)
Future year abnormal earnings	0.030	0.031
	(<0.001)	(<0.001)
Weighted average asset maturity	−0.003	−0.003
	(<0.001)	(<0.001)
Industry cash flow risk	0.043	0.051
	(0.212)	(0.142)
Net debt issuance/book assets	−0.328	−0.322
	(<0.001)	(<0.001)
Firm had its IPO during the prior five years dummy	0.003	0.004
	(0.418)	(0.357)
Natural logarithm of cash and short-term investments/book assets		−0.011
		(0.000)
Industry fixed effects	Yes	Yes
R^2-adjusted	0.198	0.200
N	80,035	80,035

expiration of growth options. Thus, firms with higher market-to-book assets, which are expected to have larger growth options, should use shorter maturity debt. We include the slope of the yield curve, but there are differing predictions for how it should relate to debt maturity. Brick and Ravid (1985) argue that the tax shield value of long-term debt is higher when the yield curve is more upward sloping, which suggests debt maturity lengthens when the slope of the yield curve increases. However, Taggart (1977), Marsh (1982), Graham and Harvey (2001), and Faulkender (2005) argue that managers find shorter maturity loans relatively more attractive when short-term interest rates are particularly low compared to long-term rates, which suggests that firms' debt maturity should be negatively associated with the term structure premium. Finally, changes in firm value have a greater effect on the value of longer term debt as opposed to shorter term debt. Firms with private information about abnormal future earnings could reduce debt maturity, producing a positive relation between future abnormal earnings and the amount of a firm's shorter term debt.

Following Stohs and Mauer (1996), Johnson (2003), and Billett, King, and Mauer (2007), we include the average asset maturity of a firm in our debt maturity model. 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, which suggests a positive association between asset and debt maturity. 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 information asymmetry problems, which could result in financing with shorter maturity bank debt. Likewise, given that the value of shorter maturity debt is less sensitive to changes in firm risk, lenders may have a preference for shorter loan maturities when industry cash flow risk is higher.

To control for the fact that issuing (retiring) debt typically lengthens (shortens) the maturity of a firm's debt, we include net debt issuance scaled by book assets. We also include a dummy variable identifying whether a firm had an initial public offering (IPO) during the prior five years. This variable controls for changes in debt maturity that are the result of new firms entering our sample rather than existing firms altering the maturity of their debt. It also controls for the fact that, due to information asymmetry–related issues, most young firms do not have access to the public debt markets and consequently rely on banks for financing (Faulkender and Petersen (2006)). Finally, we also include industry fixed effects in our debt maturity models to control for other unmodeled industry effects.

The results for the first model in Table II show that the regression coefficients on most of the control variables are statistically different from zero and have the expected signs. Furthermore, the coefficient on the year variable is significantly different from zero and equals 0.008. This indicates that, after controlling for the determinants of debt maturity, the fraction of total long-term debt due in the next three years increases by 0.008 per year on average from 1980 to 2008,

for a total increase of 0.224 (=28 * 0.008). For the 80,035 firm-years used in the first two regression models in Table II, the mean value of the fraction of long-term debt that is due in the next three years increases from 0.338 to 0.394, a 16.6% increase from 1980 to 2008 (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 66.3% (=0.224/0.338) 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 Compustat firms have begun to hold abnormally high levels of shorter maturity debt is consistent with the conjecture that unmodeled changes in the supply of credit explain the shift. Also, this finding implies that the refinancing risk of U.S. industrial firms has increased markedly.

The second model in Table II reports the results when cash holdings are included as an independent variable. As discussed earlier, it is possible that higher current cash holdings could increase both the likelihood that lenders offer a firm a shorter term loan and the firm's propensity to accept such a loan offer. Following much of the work in the cash holdings literature, we measure the cash holdings/book assets ratio as the natural logarithm of this ratio.[10] We find that controlling for cash holdings in our debt maturity model has little effect on the results. Specifically, the coefficient on the year variable continues to be 0.008. The findings for this model also show that the coefficient on the cash holdings variable is negative, suggesting that larger cash holdings result in firms *increasing* the maturity of their debt. However, caution should be used in drawing inferences from this result given that the second model in Table II does not account for the joint determination of cash holdings and debt maturity. Indeed, later we report results showing that these two variables are endogenously determined, and subsequently estimate specifications that account for this endogeneity. The sign on cash holdings in the debt maturity regression then reverses, but its economic magnitude is quite small.

Finally, as robustness tests, we also reestimate the first model in Table II but change the dependent variable to be the fraction of a firm's long-term debt due in the next one or five years or the fraction of a firm's *total* debt due (which includes short-term debt) in the next three years. Here, we find results indicating that these three fractions increase by 113.8%, 51.1%, and 39.0% between 1980 and 2008 (see the Internet Appendix). Thus, the conclusion that there has been a significant decrease in firms' debt maturities is robust to the metric used to calculate debt maturity.

[10] A change in cash holdings can have markedly different consequences dependent on the firm's initial cash position, and there are significant outliers in the cash to assets ratio. By taking the natural logarithm of the ratio, we mitigate these issues.

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 and VI. Panel D reports for each year from 1980 to 2008 the four-quarter moving average of the spread of the commercial and industrial loan rates over the federal funds rate.

Sample Period	Mean	25th Pct.	Median	75th Pct.	Fraction of Firms with All Long-Term Debt Due within Three Years
Panel A: 1980 to 2008					
Cash holdings and short-term investments/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 and short-term investments/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 and short-term investments/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		

II. Empirical Results

A. Methodological Approach

Firms' cash holdings and the maturity of their debt are likely determined jointly. Consequently, to examine the effect of debt maturity on cash holdings, we use a simultaneous equations framework in which cash holdings and debt maturity are treated as endogenous. We estimate a two-stage least squares (2SLS) system of equations in which the standard errors of the coefficients are adjusted for the clustering of observations at the firm level. To do so, we first separately estimate two OLS regressions for cash holdings and debt maturity, and then simultaneously estimate the two structural equations by including the predicted values from the first-stage regressions as explanatory variables. The 2SLS 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.

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 et al. (1999) and include the following variables in our model: net working capital net of cash scaled by book assets, 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, and a dummy variable for whether a firm paid dividends in a given year.

Net working capital can substitute for cash. Thus, firms with a higher value for net working capital are expected to hold less cash. We note that we do not include the current portion of long-term debt in our calculation of the net working capital variable given that this portion of a firm's debt appears in our debt maturity variable. However, debt with a maturity of less than one year at issuance is included in our net working capital measure, which helps to control for the refinancing risk, if any, stemming from this type of debt. Book assets controls for the issue that smaller firms typically suffer from larger information asymmetry problems with external capital providers, and as a result are expected to hold larger cash balances. 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 larger 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. Capital expenditures proxy for a firm's level of investment. Firms that invest more are expected to accumulate less cash. Therefore, capital expenditures are predicted to be negatively associated with cash holdings. Firms that pay dividends are expected to have easier access to external capital and consequently a smaller cash balance.

We also include operating income/book assets, total debt/book assets, and industry cash flow volatility as independent variables in our cash holdings model. Controlling for operating income addresses the issue that more

profitable firms are less likely to be financially constrained and to need large cash balances for precautionary purposes. In addition, it controls for the possibility that more profitable firms suffer from greater agency costs related to managerial discretion. Including leverage in the cash model controls for the fact that interest payments reduce the ability of firms to accumulate excess cash balances (Jensen (1986)), which results in a negative impact of financial leverage on cash holdings. Furthermore, including leverage in the cash model addresses the fact that firms with greater leverage are subject to a higher level of refinancing risk than are firms with less leverage. Finally, industry cash flow volatility controls for cash flow uncertainty in an industry. When cash flow uncertainty in an industry is higher, firms in the industry should suffer from larger information asymmetry problems with capital market participants, and therefore industry cash flow volatility is predicted to be positively associated with cash holdings.

As in Bates, Kahle, and Stulz (2009), we also include acquisition expenses scaled by book assets in the cash model. Like capital expenditures, acquisition expenses proxy for a firm's level of investment, and are expected to be negatively associated with cash holdings. To the extent that managers of firms with large cash holdings could make acquisitions that benefit themselves personally but reduce firm value (e.g., Jensen (1986), Harford (1999)), controlling for acquisitions also helps to control for such agency costs. We also include 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 mitigate 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 (hereafter referred to as the C&I rate spread) as a proxy for the supply of available credit.[11] We further control for net debt issuance/book assets because, if a firm issues more long-term debt than it retires in a given year, this could increase its cash reserves.[12] We also include a dummy variable identifying firms that had an IPO during the prior five years to control for changes in the

[11] 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, from 1984 to 1990 the Federal Reserve did not collect this information. However, Lown, Morgan, and Rohatgi (2000) study the 1973 to 1983 and 1991 to 1998 periods and document that over the period for which data are collected for the SLO survey, the extent to which the SLO survey reports that credit conditions are tightening is highly correlated with the C&I rate spread. Thus, based on the results from Lown, Morgan, and Rohatgi (2000), the C&I rate spread may be used as a proxy for the extent to which credit market conditions are tightening.

[12] If we control for net debt issuance over the prior three years/book assets rather than net debt issuance during the current year/book assets, our results are very similar (see the Internet Appendix). This implies that the positive association we document between shorter maturity debt and cash holdings is not due to firms with shorter maturity debt having larger cash holdings because they received a loan in the prior one to three years and are still holding on to some of the proceeds from the loan.

population of Compustat firms over time and for the potential of larger information asymmetry problems for these firms (Bates, Kahle, and Stulz (2009)). Finally, industry and year fixed effects are included to capture unobserved industry and time factors correlated with corporate cash holdings.

The dependent variable in the debt maturity model is the fraction of a firm's long-term debt due in the next three years. The independent variables in the model include those appearing in the first model in Table II, except for the time trend variable. Also, we include the C&I rate spread because credit market conditions may jointly affect a firm's cash holdings and the maturity of its debt. This would occur if difficult refinancing conditions naturally lead to a shortening of debt maturities as fewer issues are refinanced. Finally, both industry and year fixed effects are included in the debt maturity model.

Before turning to the results of the 2SLS analyses, we report univariate statistics for cash holdings and 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 to 2008 period that meet the data requirements for the variables included in our system of equations. Panels A, B, and C of Table III provide additional evidence of a shortening of debt maturity and show that the average ratio of cash holdings to book assets for our sample firms rises from 0.085 to 0.139 from 1980 to 2008, a 63.5% increase. Panel D in Table III provides the values for the C&I rate spread over our sample period. As documented in this panel, there is considerable variation in the spread values over our sample years.

B. Multivariate Evidence on the Effect of Debt Maturity on Cash Holdings

After confirming that the instruments used in the cash and debt maturity models are valid and that debt maturity and cash holdings are indeed endogenously determined, we estimate our system of equations.[13] Table IV reports the second-stage results for the structural equation that explains cash holdings. The first model in this table shows that the coefficients on most of the control variables are significant and have the expected signs. The significantly positive coefficient on the long-term debt due in the next three years/total long-term debt variable implies that the maturity of a firm's debt has a causal effect on

[13] To determine the validity of using 2SLS, we examined 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 analyses are as follows. First, the results of *F*-tests and partial R^2 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 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.

Table IV

The Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1980 to 2008 period. The table reports the second-stage results for the structural equation that explains cash holdings estimated using the 2SLS methodology. The second-stage results for the structural equation that explains debt maturity are reported in the Internet Appendix. The second-stage structural equation that explains debt maturity has long-term debt due over the next three years/total long-term debt as the dependent variable, and the independent variables for this model are the predicted value of the natural logarithm of the sum of cash and short-term investments/book assets, total debt/book assets, the natural logarithm of real book assets, market-to-book assets, the difference between the yield on a government 10-year and six-month bond, future-year abnormal earnings, weighted average maturity of a firm's assets, industry cash flow risk, net debt issuance/book assets, whether a firm had its IPO during the prior five years, the average commercial and industrial loan rate spread (spread above the federal funds rate) over a firm's fiscal year, Fama-French (1997) 48 industry dummy variables, and year dummy variables. 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 (1997) 48 industry groups. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

	Sample Period 1980 to 2008				Sample Period 1980 to 2006
Model	1	2	3	4	5
Intercept	−6.789	−3.910	−8.492	−6.800	−6.589
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Long-term debt due in next three years/total long-term debt	5.954				5.887
	(<0.001)				(<0.001)
Long-term debt due in next year/total long-term debt		5.122			
		(<0.001)			
Long-term debt due in next five years/total long-term debt			6.811		
			(<0.001)		
Debt due in next three years/total debt				6.614	
				(<0.001)	
Net working capital/book assets	−1.867	−1.506	−2.190	−4.017	−1.844
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.285	0.112	0.291	0.252	0.278
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Market-to-book assets	0.122	0.092	0.155	0.085	0.121
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Research and development expenses/sales	0.593	0.579	0.588	0.659	0.589
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.750	−1.272	−2.331	−2.175	−1.756
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Dividend paying dummy	−0.099	−0.131	−0.142	−0.127	−0.081
	(0.018)	(<0.001)	(0.004)	(0.004)	(0.061)
Operating income/book assets	0.663	0.951	0.350	1.321	0.645
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Total debt/book assets	−0.701	−1.084	−1.000	−0.564	−0.785
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(<0.001)

(*Continued*)

Table IV—*Continued*

Model	Sample Period 1980 to 2008				Sample Period 1980 to 2006
	1	2	3	4	5
Industry cash flow risk	0.267	0.112	0.705	−0.075	0.506
	(0.309)	(0.590)	(0.031)	(0.808)	(0.102)
Acquisition expense/book assets	−2.092	−1.838	−3.182	−2.215	−2.147
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	0.021	0.007	−0.022	0.014	0.019
	(0.636)	(0.820)	(0.673)	(0.775)	(0.663)
Net debt issuance/book assets	3.084	2.356	3.382	3.600	3.122
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Firm had its IPO during the prior five years dummy	0.034	−0.032	0.048	0.027	0.035
	(0.270)	(0.163)	(0.199)	(0.410)	(0.264)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	80,035	80,035	80,035	80,035	76,398

its cash holdings. A shorter (longer) maturity results in larger (smaller) cash holdings.[14]

The positive effect of shorter maturity debt on cash holdings is not only statistically significant, but also economically significant. Over our sample period, the mean value of the fraction of a firm's long-term debt due in the next three years is 0.400. We multiply a 1% increase (0.004) in this number by its coefficient from the first model in Table IV and take the antilog of the resulting value. Our resulting estimate indicates that a 1% increase in the fraction of total long-term debt due in the next three years leads to a 2.4% increase in cash holdings.

It is also important to consider whether cash holdings affect debt maturity. In the Internet Appendix, we report results for the second-stage structural equation that explains debt maturity. We find that cash holdings positively impact the fraction of a firm's long-term debt due in the next three years. However, the economic importance of this result is very small. Specifically, a 1% increase in cash holdings/book assets increases the fraction of a firm's long-term debt due in the next three years by only 0.04%. Thus, after controlling for

[14] Bond ratings can proxy for a firm's ability to access external capital and whether it has publicly traded debt. However, data on bond ratings are only reliably available from Compustat from 1985 onward. As a result, we do not include a dummy variable for whether a firm has a bond rating in the cash and debt maturity models. As a robustness test, we reestimate the first model in Table IV over the 1985 to 2008 period including this dummy variable and find that our results are unaffected (see the Internet Appendix). This is potentially not surprising as we include firm size in both equations, 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, our remaining control variables capture firm characteristics related to access to capital.

the simultaneity of cash holdings and debt maturity, we conclude that changes in firms' cash holdings have only a minimal effect on the maturity of their debt.

In the fifth model of Table IV, we assess the sensitivity of our results to the financial crisis years by reporting the results when the sample period is 1980 to 2006 instead of 1980 to 2008. Also, excluding 2007 and 2008 from the analysis allows us to use the regression coefficients from the fifth model in this panel to estimate how much of the increase in corporate cash holdings over the 1980 to 2006 period studied in Bates, Kahle, and Stulz (2009) can be explained by the contemporaneous decrease in debt maturity.

The results for this model show that the coefficient on the fraction of long-term debt due in the next three years is very similar to that reported for the first model, which implies that including 2007 and 2008 in our analysis does not have an important effect on the positive association between shorter maturity debt and cash holdings. Using the coefficient on the debt due variable in this model and the change in the mean proportion of long-term debt due in three years from 1980 to 2006, we estimate that this change predicts a 28.8% increase in cash holdings over this period. For the 76,398 firm-year observations for which we have data for all variables used in the 2SLS system of equations over the 1980 to 2006 period, the mean value of cash holdings scaled by book assets rises from 0.085 to 0.162, a 90.6% increase.[15] Therefore, the results for the fifth model in Table IV suggest that the shortening of debt maturity explains roughly 31.8% (= 28.8/90.6) of the increase in cash holdings for our sample firms from 1980 to 2006.[16] We conclude that a large fraction of the increase in the cash holdings of publicly traded U.S. industrial firms over this period can be explained by the contemporaneous shortening of debt maturity.[17]

[15] As reported earlier, the mean value of cash holdings/book assets for the sample firms used in our 2SLS analyses increases by 63.5% from 1980 to 2008. Presumably, the decrease in corporate cash holdings from 2006 to 2008 partly reflects firms drawing on their cash reserves over the 2007 to 2008 credit crisis period. The 90.6% increase in cash holdings/book assets that we find over the 1980 to 2006 period compares to the 112% increase 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 to 2006 relative to those in Bates, Kahle, and Stulz (2009) occurs because we only study firms that have long-term debt as well as the additional data requirements for the debt maturity model.

[16] Bates, Kahle, and Stulz (2009) report that, over the 1980 to 2006 period, firm-level changes in research and development expenses, capital expenditures, cash flow risk, and net working capital explain about 40% of the increase in the cash holdings of U.S. firms. Given that these four firm characteristic variables are included as control variables in our models, our findings imply that the decrease in debt maturity over time is incrementally important in explaining the change in cash holdings over time.

[17] We examined whether shorter maturity debt's impact on cash holdings changes over our sample period. Specifically, we split our 29 sample years into three subperiods of approximately equal length or two subperiods of approximately equal length and then reran our analyses using only the years from each subperiod. We find that the coefficient on the debt due variable does not significantly differ across subperiods (see the Internet Appendix). This evidence indicates that refinancing risk has not become more severe over time (so that during recent periods the same amount of shorter maturity debt would cause firms to hold more cash to mitigate refinancing risk).

The second, third, and fourth models in Table IV report the results when the debt maturity variable is defined as the fraction of a firm's long-term debt due in the next year, or the next five years, or the fraction of a firm's *total* debt due in the next three years. The results for these models show that the finding of a positive effect of shorter maturity debt on cash holdings is robust to the use of these alternative debt maturity measures. Furthermore, we find that the results obtained with these three models are economically important. Specifically, 1% increases in the fraction of a firm's long-term debt due in the next year or five years or in the fraction of a firm's total debt due in the next three years result in, respectively, 0.86%, 3.87%, or 3.12% increases to a firm's cash holdings.

We also find that the positive effects of shorter maturity debt on cash holdings documented in the first five models of Table IV are robust to controlling for firm fixed effects (see the Internet Appendix). Furthermore, we estimate the economic importance of these results and find that they are economically important with magnitudes similar to those for the Table IV results.[18]

C. The Level of Debt and Refinancing Risk

Firms with both higher debt levels and shorter maturity debt should be subject to the greatest refinancing risk. Thus, if mitigation of refinancing risk drives the positive effect of shorter maturity debt on cash holdings, then this effect should be more pronounced for firms with higher debt. To test this prediction, we have to recognize that the level of a firm's debt is likely jointly determined with its cash holdings and the maturity of its debt. Accordingly, we first estimate a model that predicts firms' debt levels and then use the fitted values from this model to instrument for debt levels. Following Kayhan and Titman (2007), we predict book leverage with the following variables (all lagged): market-to-book assets; property, plant, and equipment/book assets; research and development expenses/sales; a dummy variable for whether a firm reports no research and development expenses; selling expenses/sales, the natural logarithm of sales; and Fama-French 48 industry and year dummy variables.

Instead, the reason U.S. firms are now holding more cash to mitigate refinancing risk is that the shortening of the maturity of long-term debt has led many firms to become subject to greater refinancing risk.

[18] As discussed earlier, debt that is short-term when issued is included in our measure for net working capital. To provide insights on how short-term debt is related to a firm's cash holdings, we ran a slightly different specification of the cash model. In this model, we removed short-term debt from the net working capital variable and included the amount of a firm's short-term debt scaled by its total debt as a separate control. We document a significant negative coefficient on this variable (see the Internet Appendix). This finding is consistent with predictions derived from the pecking order model that short-term debt can serve as a substitute for internal financial slack because it typically has low exposure to information asymmetries relative to other sources of capital. As well, this finding suggests that firms do not hold more cash in anticipation of difficulties issuing short-term debt.

Table V provides the results of our analysis of whether the positive association between shorter maturity debt and cash holdings is more pronounced for firms with higher debt levels. The first model in this table reports the results for firm-years in which predicted book leverage is higher than the median sample value during a particular year. The second model reports the findings for firm-years below the median sample value. The coefficient on the debt due variable in the first model is markedly more positive than it is in the second model (6.397 vs. 1.620), a difference that is significant at the 5% level based on a Chi-squared test. This evidence is consistent with our interpretation that refinancing risk mitigation leads to the positive association between shorter maturity debt and cash holdings.

D. The Effect of Credit Market Conditions

We next examine how the supply of credit affects the positive association between shorter maturity debt and cash holdings. This allows us to further test the study's hypothesis that firms with shorter maturity debt hold larger cash reserves to mitigate refinancing risk. Our hypothesis generates the following three predictions. First, when credit conditions are strong, firms are less worried about refinancing risk, and consequently shorter maturity debt has a smaller effect on cash holdings. Second, a natural implication of our hypothesis is that firms will occasionally draw on their cash reserves to mitigate the impact of refinancing difficulties. As a result, during years when credit conditions are tight, some firms with high refinancing risk may *reduce* the level of their cash holdings relative to firms with lower refinancing risk. This suggests that the positive association between shorter maturity debt and cash holdings would become less pronounced or even insignificant during years when credit conditions are tight. Third, our hypothesis predicts that the positive effect of shorter maturity debt on cash holdings is strongest during periods when credit conditions are weakening, so that firms become concerned with the possibility that they might face refinancing difficulties in the future, but credit market conditions and the economy are still strong enough so that firms are able to increase their cash holdings.

Table VI provides results consistent with each of the three predictions described above. The first model in Table VI reports results when the 2SLS system of equations is estimated over the years with strong credit market conditions (the years when the C&I rate spread is below the median value for the 29 years from 1980 to 2008), while the second model in this table reports results for the other years. Comparing the coefficient on long-term debt due for the first two models, we find that the coefficient on this variable is markedly lower for the first model compared to the second model (0.669 vs. 4.389), a difference that is significant at the 5% level. These results indicate that the positive effect of shorter maturity debt on cash holdings is much weaker when credit conditions are strong and firms should be less concerned with refinancing risk.

The fourth model in Table VI reports results for the years when credit market conditions are tight (the five years when the spread is highest), while the third

Table V

Predicted Debt and the Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1980 to 2008 period. The table reports the second-stage results for the structural equation that explains cash holdings estimated using the 2SLS methodology. The variables and the debt maturity model that has long-term debt due over the next three years/total long-term debt as the dependent variable are defined in Table IV. A firm's predicted book leverage is the fitted value from a regression of book leverage on lagged market-to-book assets; lagged property, plant, and equipment/book assets; lagged research and development expenses/sales; a dummy variable for whether a firm has no research and development expenses; lagged selling expenses/sales; the lagged value of the natural logarithm of sales; Fama-French (1997) 48 industry dummy variables, and year dummy variables. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

Model	Predicted Debt Level > Annual Sample Median Value 1	Predicted Debt Level ≤ Annual Sample Median Value 2
Intercept	−7.718	−2.281
	(<0.001)	(<0.001)
Long-term debt due in next three years/total long-term debt	6.397	1.620
	(<0.001)	(0.019)
Net working capital/book assets	−1.216	−2.681
	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.304	0.040
	(<0.001)	(0.030)
Market-to-book assets	0.103	0.116
	(<0.001)	(<0.001)
Research and development expenses/sales	0.572	0.577
	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.326	−2.775
	(<0.001)	(<0.001)
Dividend paying dummy	−0.032	−0.223
	(0.596)	(<0.001)
Operating income/book assets	0.300	0.557
	(0.012)	(<0.001)
Total debt/book assets	−0.308	−2.099
	(0.139)	(<0.001)
Industry cash flow risk	1.131	−0.205
	(0.003)	(0.380)
Acquisition expense/book assets	−2.041	−2.569
	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	0.005	−0.025
	(0.946)	(0.533)
Net debt issuance/book assets	2.898	2.093
	(<0.001)	(<0.001)
Firm had its IPO during the prior five years dummy	−0.032	−0.033
	(0.471)	(0.231)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
N	37,155	37,168

Table VI

Credit Market Conditions and the Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1980 to 2008 period. The table reports the second-stage results for the structural equation that explains cash holdings estimated using the 2SLS methodology. The variables and the debt maturity model that has long-term debt due over the next three years/total long-term debt as the dependent variable are defined in Table IV. The first model reports the results for the years when the commercial and industrial loan rate spread was less than the median value of 1.63 for the 29 years from 1980 to 2008. The second model reports the results for the years when the commercial and industrial loan rate spread was greater than or equal to the median value of 1.63 for the 29 years from 1980 to 2008. The third model reports the results for the years from 1980 to 2008 when the commercial and industrial loan rate spread is greater than or equal to the median value of 1.63 for the 29 years from 1980 to 2008, but excluding the five years with the highest spread values. The fourth model reports the results for the five years from 1980 to 2008 with the highest commercial and industrial loan rate spread values. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

	Credit Market Is		Less Strong Credit Market Is	
Model	Strong 1	Less Strong 2	Weakening 3	Tight 4
Intercept	−1.605	−6.032	−9.728	−2.246
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Long-term debt due in next three years/total long-term debt	0.669	4.389	6.236	0.515
	(0.041)	(<0.001)	(<0.001)	(0.132)
Net working capital/book assets	−2.010	−1.837	−1.720	−2.345
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.038	0.117	0.201	−0.036
	(0.032)	(<0.001)	(<0.001)	(0.007)
Market-to-book assets	0.106	0.118	0.119	0.129
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Research and development expenses/sales	0.514	0.559	0.606	0.422
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.891	−1.343	−0.898	−2.302
	(<0.001)	(<0.001)	(0.007)	(<0.001)
Dividend paying dummy	−0.165	0.106	0.194	−0.097
	(<0.001)	(0.036)	(0.008)	(0.016)
Operating income/book assets	0.507	0.819	0.893	0.618
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Total debt/book assets	−2.071	−0.771	−0.343	−1.622
	(<0.001)	(<0.001)	(0.216)	(<0.001)
Industry cash flow risk	−0.272	−1.041	−1.829	0.197
	(0.238)	(<0.001)	(<0.001)	(0.342)
Acquisition expense/book assets	−1.842	−2.333	−2.097	−2.541
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	−0.384	0.619	1.967	0.076
	(<0.001)	(<0.001)	(<0.001)	(0.016)
Net debt issuance/book assets	1.392	2.611	3.285	1.152
	(<0.001)	(<0.001)	(<0.001)	(<0.001)

(*Continued*)

Table VI—*Continued*

Model	Credit Market Is		Less Strong Credit Market Is	
	Strong 1	Less Strong 2	Weakening 3	Tight 4
Firm had its IPO during the prior five years dummy	0.007 (0.062)	0.010 (0.763)	−0.006 (0.898)	0.041 (0.252)
Year fixed effects	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes
N	41,586	38,449	27,229	11,220

model reports results for the years when credit conditions are weakening (the remaining 10 years when the spread is equal to or greater than the median value over our sample period). The results for the fourth model in Table VI show that, over the five years with the tightest credit market conditions, the coefficient on the debt due variable becomes insignificant. In contrast, the results for the third model document that the coefficient on this variable is 6.236 and that this is the highest coefficient value on this variable across the four models in Table VI. Furthermore, a Chi-squared test reveals that the coefficients on the debt due variable in the third and fourth models of this table differ at the 5% significance level. Taken together, the Table VI results provide strong support for the conclusion that refinancing risk mitigation drives the positive association between shorter maturity debt and cash holdings.

E. Do Bank Lines of Credit Reduce the Need to Mitigate Refinancing Risk with Large Cash Reserves?

Most publicly traded firms in the United States have a bank line of credit (Sufi (2009)), providing a potential alternative source to mitigate refinancing risk. However, how firms use credit lines as substitutes for cash is a function of firm and market characteristics. Sufi (2009) reports that a line of credit is a viable substitute for cash holdings, but only for financially unconstrained firms. Lins, Servaes, and Tufano (2010) examine whether cash holdings and lines of credit are used to hedge against different types of risk and show that credit lines allow firms to take advantage of profitable investment opportunities available in good times, while cash reserves are used to protect firms from negative cash flow shocks in bad times. Campello, Graham, and Harvey (2010) and Ivashina and Scharfstein (2010) provide evidence from the recent financial crisis on how an important tightening of the credit supply affects the substitutability between cash holdings and lines of credit. Collectively, the findings from these two papers indicate that, when credit supply tightens markedly, financially constrained firms face the risk that their lines of credit will get pulled. Finally, Campello et al. (2011) show that, during the crisis, the terms of financially

constrained firms' credit lines worsened. For instance, line maturity declined and the interest rate charged on funds drawn increased.

The prior research discussed above suggests that, for financially unconstrained firms, a credit line can substitute for cash holdings. If so, then the larger is an unconstrained firm's unused credit line, the more easily the firm could mitigate refinancing risk with the funds available from its credit line. To provide some evidence on this issue, we collect firms' annual 10-K filings over the 1996 to 2008 period and follow the methodology outlined in Sufi (2009) to search for phrases in these filings that would indicate a firm has a line of credit. We find that a firm has a bank line of credit in approximately 88% of firm-years in our sample. Subsequently, we develop an algorithm that enables us to search for phrases in firms' 10-K filings that imply that all of the funds available from a firm's credit line(s) are unused at the end of the firm's fiscal year. We next create a dummy variable that takes a value of one if a firm has used some of its credit line funds at the end of its fiscal year (this variable equals one for 77% of the firm-years when a firm has a credit line). We use this variable to proxy for whether a firm potentially has limited credit line resources. In the Internet Appendix, we provide a detailed description of the algorithms used to create the credit line variables as well as the results of reliability tests, which suggest the variables are reliably coded. Our sample for the analyses using data on credit lines consists of 26,714 firm-year observations over the 1996 to 2008 period.

Tables VII and VIII provide the results of our 2SLS analyses using the credit line variables. The results for the first model in Table VII show that we continue to find that shorter maturity debt positively impacts firms' cash holdings. The second model provides results when the dummy variable for whether a firm has a credit line is included in both the debt maturity and cash models. As shown in this model, having a credit line negatively affects a firm's cash holdings, implying, on average, a substitute relationship between cash holdings and the presence of a credit line. The results also show that controlling for whether a firm has a line of credit has only a small effect on the association between debt maturity and cash holdings. The third model in Table VII reports similar findings for the 23,502 firm-years when a firm has a credit line. Finally, the fourth model in Table VII reports a negative coefficient on the dummy variable for whether a firm is using its credit line. This implies that firms that have a credit line and actually draw on it hold less cash, presumably because these firms substitute cash holdings usage with credit line use.

Table VIII provides evidence on whether firms with an unused credit line are likely to use the credit line rather than cash holdings to mitigate refinancing risk. In the first two models in Panel A of Table VIII, we compare firms that are using their credit line (Model 1) with firms that are not using their line (Model 2). The coefficients on the debt due variable in these two models are similar (3.835 vs. 4.726). The third model in Panel A includes the dummy variable for whether a firm is using at least some of its credit line and the interaction of this variable with the debt due variable. We find an insignificant coefficient on the interaction. This suggests that shorter maturity debt's positive impact

Table VII

Credit Lines and the Effect of Debt Maturity on Cash Holdings

Data are for Compustat industrial firms over the 1996 to 2008 period for which we collect data on credit lines. The table reports the second-stage results for the structural equation that explains cash holdings estimated using the 2SLS methodology. The variables and the debt maturity model that has long-term debt due over the next three years/total long-term debt as the dependent variable are defined in Table IV. In the Internet Appendix, we report how we create the credit line variables. The table reports regression results estimated using the 2SLS methodology. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

	All Firms		Firms with a Credit Line	
Model	1	2	3	4
Intercept	−5.145	−5.001	−5.161	−4.622
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Long-term debt due in next three years/total long-term debt	3.824	4.099	4.000	3.900
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Net working capital/book assets	−2.351	−2.221	−2.324	−2.269
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.241	0.267	0.260	0.249
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Market-to-book assets	0.133	0.121	0.145	0.131
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Research and development expenses/sales	0.519	0.466	0.621	0.641
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.703	−1.556	−1.689	−1.549
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Dividend paying dummy	−0.239	−0.230	−0.223	−0.239
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Operating income/book assets	0.424	0.514	0.292	0.186
	(<0.001)	(<0.001)	(0.019)	(0.125)
Total debt/book assets	−0.667	−0.534	−0.710	−0.491
	(0.001)	(0.009)	(0.002)	(0.026)
Industry cash flow risk	0.178	0.147	0.062	0.104
	(0.478)	(0.568)	(0.808)	(0.670)
Acquisition expense/book assets	−2.400	−2.271	−2.333	−2.146
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	−0.117	−0.092	−0.197	−0.156
	(0.323)	(0.456)	(0.125)	(0.213)
Net debt issuance/book assets	2.253	2.299	2.333	2.214
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Firm had its IPO during the prior five years dummy	−0.039	−0.040	−0.044	−0.032
	(0.290)	(0.299)	(0.273)	(0.410)
Firm has a credit line dummy		−0.596		
		(<0.001)		
Firm is using some of its credit line dummy				−0.712
				(<0.001)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
N	26,714	26,714	23,502	23,502

Table VIII

The Effect of Credit Line Usage on Firms' Propensities to Mitigate Refinancing Risk with Cash Holdings

Data are for Compustat industrial firms over the 1996 to 2008 period for which we collect data on credit lines. The table reports the second-stage results for the structural equation that explains cash holdings estimated using the 2SLS methodology. The variables and the debt maturity model that has long-term debt due over the next three years/total long-term debt as the dependent variable are defined in Table IV. In the Internet Appendix, we report how we create the credit line variables. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

Panel A: Financially Constrained and Unconstrained Firms Analyzed Together

Model	1	2	3
Firm is using at least some of its credit line	Yes	No	–
Intercept	−5.171	−6.215	−4.698
	(<0.001)	(<0.001)	(<0.001)
Long-term debt due in next three years/total long-term debt	3.835	4.726	4.059
	(<0.001)	(0.002)	(<0.001)
Dummy for if a firm is using its credit line			−0.631
			(<0.001)
Long-term debt due in next three years/total long-term debt × Dummy for if a firm is using its credit line			−0.201
			(0.334)
Net working capital/book assets	−2.320	−1.921	−2.272
	(<0.001)	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.269	0.223	0.249
	(<0.001)	(0.023)	(<0.001)
Market-to-book assets	0.166	0.051	0.130
	(<0.001)	(0.048)	(<0.001)
Research and development expenses/sales	0.606	0.697	0.641
	(<0.001)	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.476	−1.685	−1.551
	(<0.001)	(0.025)	(<0.001)
Dividend paying dummy	−0.211	−0.421	−0.240
	(<0.001)	(<0.001)	(<0.001)
Operating income/book assets	0.118	0.566	0.181
	(0.364)	(0.047)	(0.135)
Total debt/book assets	−0.660	0.836	−0.484
	(0.002)	(0.324)	(0.027)
Industry cash flow risk	0.020	0.308	0.106
	(0.944)	(0.457)	(0.665)
Acquisition expense/book assets	−1.841	−3.573	−2.156
	(<0.001)	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	−0.229	0.259	−0.152
	(0.124)	(0.353)	(0.224)
Net debt issuance/book assets	2.020	3.032	2.213
	(<0.001)	(<0.001)	(<0.001)
Firm had its IPO during the prior five years dummy	−0.032	−0.011	−0.034
	(0.469)	(0.887)	(0.392)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
N	18,186	5,316	23,502

(*Continued*)

Table VIII—*Continued*

Panel B: Financially Constrained and Unconstrained Firms Analyzed Separately

Model	1	2	3	4	5	6
Firm has a bond rating	No	No	No	Yes	Yes	Yes
Firm is using at least some of its credit line	Yes	No	–	Yes	No	–
Intercept	−4.963	−4.642	−4.251	−1.504	0.135	−0.999
	(<0.001)	(0.003)	(<0.001)	(0.032)	(0.890)	(0.117)
Long-term debt due in next three years/total long-term debt	3.370	3.138	3.228	3.484	−1.187	3.758
	(0.002)	(0.007)	(<0.001)	(<0.001)	(0.534)	(<0.001)
Dummy for if a firm is using its credit line			−0.831			−0.451
			(<0.001)			(0.004)
Long-term debt due in next three years/total long-term debt × Dummy for if a firm is using its credit line			0.216			−0.525
			(0.442)			(0.491)
Net working capital/book assets	−2.367	−2.154	−2.346	−2.040	−2.260	−1.930
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	0.300	0.142	0.216	−0.114	−0.180	−0.128
	(0.002)	(0.062)	(<0.001)	(0.002)	(<0.001)	(<0.001)
Market-to-book assets	0.153	0.055	0.121	0.303	0.164	0.272
	(<0.001)	(0.013)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Research and development expenses/sales	0.564	0.638	0.597	1.040	3.107	1.098
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Capital expenditures/book assets	−1.839	−2.523	−1.941	−1.280	−1.590	−1.286
	(<0.001)	(<0.001)	(<0.001)	(0.061)	(0.072)	(0.031)
Dividend paying dummy	−0.125	−0.372	−0.167	−0.319	−0.203	−0.319
	(0.091)	(<0.001)	(0.006)	(<0.001)	(0.049)	(<0.001)
Operating income/book assets	−0.061	0.579	0.026	−0.618	−1.182	−0.693
	(0.639)	(0.021)	(0.832)	(0.130)	(0.025)	(0.059)
Total debt/book assets	−1.253	−0.305	−1.107	−0.700	−1.810	−0.695
	(<0.001)	(0.654)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Industry cash flow risk	−0.158	0.517	−0.002	0.540	0.084	0.393
	(0.621)	(0.278)	(0.993)	(0.186)	(0.801)	(0.227)
Acquisition expense/book assets	−1.663	−3.349	−2.008	−2.586	−3.968	−2.684
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Commercial and industrial loan rate spread	−0.044	0.152	−0.034	−0.519	0.074	−0.384
	(0.796)	(0.570)	(0.808)	(0.018)	(0.836)	(0.042)
Net debt issuance/book assets	2.271	3.217	2.523	1.584	0.802	1.589
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.089)	(<0.001)
Firm had its IPO during the prior five years dummy	−0.110	0.023	−0.092	0.129	−0.126	0.011
	(0.056)	(0.750)	(0.064)	(0.729)	(0.271)	(0.886)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	13,207	3,895	17,102	4,979	1,421	6,400

on cash holdings does not differ significantly between firms with or without an unused credit line. This could reflect the possibility that, for many financially constrained firms, credit lines are not a viable substitute for cash holdings, particularly to mitigate refinancing risk. As reported earlier, during tight credit periods, when refinancing risk is highest, many financially constrained firms face the risk that access to their lines of credit may become restricted. Thus,

during periods when credit is not tight, financially constrained firms with a significant amount of shorter maturity debt choose to hold larger cash reserves, regardless of whether they have an unused credit line. This allows these firms to mitigate potential refinancing difficulties during tight credit periods when access to their lines of credit could become restricted.

In Panel B of Table VIII, we use the existence of a bond rating to examine the issue separately for financially constrained and not financially constrained firms. The first three models in this panel provide results for only firms without a bond rating. The insignificant coefficient on the interaction variable in the third model reveals that, as expected, for firms without a bond rating, the positive impact of short-maturity debt on cash holdings is not affected by whether all of the funds in a firm's credit line are unused. The fourth, fifth, and sixth models in Panel B of Table VIII consider only firms with bond ratings. The results for the fourth model show that the positive association between debt maturity and cash holdings remains for rated firms using their credit line. However, the results for the fifth model document that, for rated firms with untapped credit lines, there is an insignificant relation between debt maturity and cash holdings. The findings for the sixth model in this panel show that the coefficients on the debt due variable in the fourth and fifth models do not differ significantly. Nevertheless, the result of an insignificant coefficient on this variable in the fifth model supports the proposition that the availability of a large amount of untapped credit line funds could be a viable substitute for cash holdings to mitigate refinancing risk for financially unconstrained firms.[19] As such, our findings with respect to credit lines are consistent with recent work that suggests financially unconstrained firms are more likely than are constrained firms to view credit lines and cash holdings as substitutes (e.g., Sufi (2009), Campello, Graham, and Harvey (2010), Lins, Servaes, and Tufano (2010)).

F. Refinancing Risk and a Firm's Propensity to Save Cash Out of Its Cash Flows

Our hypothesis that firms with shorter maturity debt hold more cash to mitigate refinancing risk also leads to the prediction that these firms have a higher propensity to save cash from their cash flows. To test this prediction, we use the Almeida, Campello, and Weisbach (2004) model to calculate a firm's propensity to save cash out of current cash flows. In their model, the annual change in cash holdings scaled by book assets is regressed on annual cash flow scaled by book assets and control variables. The regression coefficient on the cash flow variable represents the extent to which a firm saves cash out of current cash flows. Debt maturity and the extent to which a firm saves

[19] The finding that the coefficients on the debt due variable in the fourth and fifth models of Panel B do not significantly differ is due in part to a very large standard error for the coefficient on this variable in the fifth model. Specifically, in the fourth and fifth models in this panel the standard errors relative to the regression coefficients on this variable are, respectively, 0.904 versus 3.484 and 1.906 versus −1.187.

cash from its cash flows are likely to be determined simultaneously. Thus, we calculate fitted values of debt maturity. We do so by using a slightly modified version of the first model in Table II (we use separate year dummies in place of the time trend variable representing the observation's year). To examine whether firms with greater refinancing risk save more cash out of their cash flows, we include a dummy variable for whether a firm's fitted value for the fraction of its long-term debt due in the next three years is in the top sample quintile over a particular year. We then interact this variable with the cash flow variable.

Following Almeida, Campello, and Weisbach (2004), we include the following control variables in our model: market-to-book assets, the natural logarithm of real book assets, capital expenditures/book assets, acquisition expense/book assets, and the current-year change in net working capital/book assets. Instead of controlling for the current-year change in short-term debt/book assets as they do, we control for net debt issuance/book assets, as in our prior regression models. Finally, because a firm's prior-year cash holdings should influence how much cash the firm saves from its current-year cash flows, we also control for lagged cash holdings.

The first model in Table IX documents that, on average, our sample firms save approximately 4 cents out of every dollar of cash flow. The findings for the second model show that firms in the bottom four quintiles for the predicted fraction of long-term debt due in the next three years save on average about 3.4 cents out of every dollar of cash flow. The significant coefficient on the interaction variable in this model indicates that firms that are in the top quintile for this predicted fraction save on average 5.1 cents (=3.4 + 1.7) per dollar of cash flow. The finding that firms with higher instrumented shorter maturity debt save more cash from their cash flows is additional evidence in support of the proposition that firms with greater refinancing risk try to mitigate this risk by holding more cash.

G. The Effect of Debt Maturity on the Importance of Cash Holdings for Investment

As discussed earlier, our hypothesis predicts that larger cash holdings should mitigate underinvestment problems more for firms with higher refinancing risk. Table X provides the results of empirical tests of this prediction using the basic investment model employed in Faulkender and Petersen (2012). In their model, investment is defined as the sum of capital expenditures and research and development and advertising expenses. As control variables, they include the natural logarithm of the market value of assets, market-to-book assets, and preinvestment earnings/book assets, where preinvestment earnings are defined as earnings before interest, taxes, and depreciation plus research and development and advertising expenses. In addition, we include a dummy variable for whether the fraction of a firm's long-term debt due in the next three years is in the highest sample quintile for that year. This variable is meant to identify firm-years with high refinancing risk. We also include lagged

Table IX

Debt Maturity and the Propensity to Save Cash Out of Current Cash Flows

Data are for Compustat industrial firms over the 1980 to 2008 period. The table reports OLS regressions of the change in cash holdings on current cash flow, a dummy variable for whether the fitted value for the fraction of long-term debt due in the next three years is in the top sample quintile over a particular year, an interaction term between this dummy variable and current cash flow, and control variables. The dependent variable is the change in cash and short-term investments scaled by book assets. Cash flow is earnings before extraordinary items and depreciation minus dividends scaled by book assets. The fitted value used in Model 2 is from a regression model explaining long-term debt due in the next three years/total long-term debt, where the independent variables are total debt/book assets, the natural logarithm of real book assets, market-to-book assets, the difference between the yield on a government 10-year and six-month bond, future year abnormal earnings, weighted average maturity of a firm's assets, industry cash flow risk, net debt issuance/book assets, whether a firm had its IPO during the prior five years, Fama-French (1997) 48 industry dummy variables, and year dummy variables. Cash holdings are not included in the change in net working capital variable. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

Model	1	2
Intercept	0.043	0.020
	(<0.001)	(<0.001)
Cash flow	0.040	0.034
	(<0.001)	(<0.001)
Fitted value of long-term debt due fraction is in the top sample quintile		0.026
		(<0.001)
Cash flow × fitted value of long-term debt due fraction is in the top sample quintile		0.017
		(<0.001)
Market-to-book assets	0.010	0.009
	(<0.001)	(<0.001)
Natural logarithm of real book value of assets	−0.002	0.001
	(<0.001)	(<0.001)
Capital expenditures/book assets	−0.241	−0.236
	(<0.001)	(<0.001)
Acquisition expense/book assets	−0.332	−0.333
	(<0.001)	(<0.001)
Change in net working capital/book assets relative to prior year	−0.051	−0.055
	(<0.001)	(<0.001)
Net debt issuance/book assets	0.045	0.064
	(<0.001)	(<0.001)
Prior year cash holdings/book assets	−0.272	−0.276
	(<0.001)	(<0.001)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
R^2-adjusted	0.245	0.252
N	79,077	79,077

cash holdings/book assets and the interaction of this variable with the high refinancing risk variable. Because issuing debt can affect both investment and the maturity of a firm's debt, we also control for net debt issuance/book assets during the year. We attempt to deal with the potential endogeneity of cash

Table X
The Effect of Debt Maturity on the Importance of Cash Holdings for Investment

The table reports OLS 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 preinvestment 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 to 2008 period with required data for the regressions. Investment is defined as the sum of capital expenditures, acquisition expenses, research and development expenses, and advertising expenses scaled by book assets. Preinvestment 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, except that it is run using data for only the five 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 to 2008 sample period. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

	Full Sample	Tight Credit Market Conditions
Model	1	2
Constant	0.105	0.144
	(<0.001)	(<0.001)
Fifth quintile of long-term debt due in next three years	−0.005	−0.016
	(0.004)	(0.005)
Cash holdings$_{t-1}$	0.127	0.121
	(<0.001)	(<0.001)
Fifth quintile of long-term debt due in next three years × Cash holdings$_{t-1}$	0.020	0.074
	(0.005)	(<0.001)
Net debt issuance/book assets	0.214	0.159
	(<0.001)	(<0.001)
Natural logarithm of real market value of assets	−0.001	−0.003
	(0.210)	(0.162)
Market-to-book-assets	0.002	−0.048
	(<0.001)	(0.002)
Preinvestment earnings/book assets	0.063	0.144
	(<0.001)	(<0.001)
Year fixed effects	Yes	No
Firm fixed effects	Yes	Yes
R^2-adjusted	0.167	0.177
N	56,252	10,153

holdings and investment by including lagged rather than current-year cash holdings in the investment model and also including firm fixed effects.

The results from the first model in Table X show that the coefficients on the lagged cash holdings variable and its interaction with the high refinancing risk dummy variable are both positive and significant. The significant interaction term implies that, consistent with our prediction, cash holdings have a more pronounced positive effect on investment for firms with greater refinancing risk. Based on the first model in Table X, an incremental dollar of cash

reserves in the prior year leads to an extra 12.7 cents in investment in the current year for firms that do not face significant refinancing risk. However, for firms with significant refinancing risk, an incremental dollar of cash reserves in the prior year leads to 14.7 cents in investment in the current year, an economically significant increase.[20] These findings are consistent with the conclusion that sometimes firms with greater refinancing risk need to draw on their cash reserves to pay off debt coming due 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 avoiding underinvestment for these firms.

The second model in Table X reports the results when we estimate our regression using data for only the five years during which the C&I rate spread is in the highest quintile from 1980 to 2008. Consistent with our hypothesis, we find that, when credit market conditions tighten, the incremental effect of cash holdings on investment for firms with higher refinancing risk becomes even larger. Specifically, the coefficient estimates from this model suggest that, under tight credit market conditions, an incremental dollar of cash reserves in the prior year leads to an extra 12.1 cents in investment in the current year for firms that do not face significant refinancing risk. However, for firms with significant refinancing risk, an incremental dollar of cash reserves in the prior year leads to 19.5 cents in investment in the current year.

H. The Impact of Debt Maturity on the Contribution of Cash Holdings to Firm Value

The results from Tables IV to X support the hypothesis that firms with shorter maturity debt hold more cash to mitigate potential costs stemming from refinancing risk. As an additional test of this hypothesis, we examine whether 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 a firm's market value using the approach developed by Faulkender and Wang (2006). For this purpose, we use a sample of 58,433 firm-year observations from 1980 to 2008 for which we are able to construct the variables required for the analysis.

Table XI 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). The results for this model show that the coefficient on the change in

[20] The findings for the first model in Table X also show that the coefficient on the dummy variable identifying firms with higher refinancing risk is significant and negative, which is consistent with the Almeida et al. (2012) finding that, during the 2007 financial crisis, firms that had more debt coming due soon 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 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 shorter maturity debt outweighs the benefits for corporate investment of shortening debt maturity in an attempt to reduce debt overhang.

Table XI

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 long-term 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 to 2008 period with required data for the regressions. The dependent and independent variables are defined as in Faulkender and Wang (2006). A delta (Δ) indicates that the variable is calculated as the change from year $t-1$ to t. The first model 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 due in the next three years is in the top sample quintile for that year, and also include the interaction of this dummy variable with Δ Cash holdings. The third model is the same as the second model, except that it is run using data for only the five 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 to 2008 sample period. Significance levels for whether coefficient estimates are different from zero are in parentheses. The standard errors of the coefficients are adjusted for clustering of observations at the firm level.

	Full Sample		Tight Credit Market Conditions
Model	1	2	3
Constant	0.040	0.058	0.044
	(<0.001)	(<0.001)	(<0.001)
Δ Cash holdings	1.201	1.128	1.264
	(<0.001)	(<0.001)	(<0.001)
Fifth quintile of long-term debt due in next three years		−0.061	−0.046
		(<0.001)	(<0.001)
Fifth quintile of long-term debt due in next three years × Δ Cash holdings		0.247	0.345
		(<0.001)	(<0.001)
Δ Earnings	0.664	0.659	0.672
	(<0.001)	(<0.001)	(<0.001)
Δ Net assets	0.036	0.036	0.026
	(<0.001)	(<0.001)	(<0.001)
Δ Research and development expenses	0.546	0.506	0.430
	(<0.001)	(<0.001)	(<0.001)
Δ Interest expense	−1.557	−1.511	−1.352
	(<0.001)	(<0.001)	(<0.001)
Δ Dividends	0.152	0.295	3.005
	(0.689)	(0.004)	(<0.001)
Cash holdings$_{t-1}$	0.444	0.444	0.385
	(<0.001)	(<0.001)	(<0.001)
Leverage	−0.430	−0.457	−0.324
	(<0.001)	(<0.001)	(<0.001)
Net financing	0.238	0.233	0.110
	(<0.001)	(<0.001)	(<0.001)
Cash holdings$_{t-1}$ × Δ Cash holdings	−0.902	−0.918	−1.211
	(<0.001)	(<0.001)	(<0.001)
Leverage × Δ Cash holdings	−0.730	−0.616	−0.526
	(<0.001)	(<0.001)	(<0.001)
R^2-adjusted	0.098	0.100	0.105
N	58,433	58,433	10,603

current-year cash holdings is significant and positive, which indicates that the marginal value of an extra dollar of cash is positive.

The second model investigates whether the contribution of cash holdings to firm value is larger for firms with greater refinancing risk. To examine this issue, we include the dummy variable used in Table X for firms with high refinancing risk and its interaction with the change in current-year cash holdings. We find that the coefficient on the interaction variable is significantly positive, implying that the marginal value of an extra dollar of cash is significantly higher for firms with greater refinancing risk. We evaluate the economic importance of this result. To do so, we use the regression coefficients on the change in current-year cash holdings and its interactions with other variables in the second model of Table XI and also use the mean values of market leverage and of lagged cash holdings as a percentage of market value of equity (0.223 and 0.107). For the group of firms with higher refinancing risk, 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 other firms this marginal value equals \$0.89 ($=1.128 + [-0.918 * 0.107] + [-0.616 * 0.223]$), revealing an economically important difference.

The third model in Table XI provides evidence on whether this difference becomes more pronounced when credit market conditions tighten. This model is the same as the second model, except that it is estimated using data for only those years during which the C&I rate spread is in the highest quintile from 1980 to 2008. The results from this analysis show once again that the market's valuation of a dollar of cash holdings is significantly higher for firms with higher refinancing risk. During tight credit years, the marginal value of an extra dollar of cash equals \$1.37 ($=1.264 + (-1.211 * 0.105) + (-0.526 * 0.209) + 0.345$) for firms with high refinancing risk, 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, during tight credit years the difference between the market value of an extra dollar of cash holdings for firms with high refinancing risk and the value for other firms increases from 0.25 to 0.34. Overall, the Table XI findings are strong evidence that larger cash holdings are particularly valuable for firms with shorter maturity debt because they can help mitigate refinancing risk.

I. Robustness Tests

We conduct several robustness tests and tabulate the results of these tests in the Internet Appendix. First, we examine the sensitivity of our results to changing our measure of debt maturity. Specifically, we reestimate the main models in Tables IX, X, and XI defining debt maturity as the fraction of a firm's long-term debt due in the next one or five years or as the fraction of a firm's *total* debt due in the next three years. We find that the main results from these tables (that firms with shorter maturity debt save more cash from their cash flows, that the positive effect of cash holdings on investment is more pronounced for these firms, and that the value of cash is higher for these firms) are robust to the use of these alternative proxies for debt maturity.

Table II shows that firms shorten the maturity of their long-term debt over our sample period and Table IV establishes that shorter maturity debt positively affects cash holdings. To ensure that these results are not driven by changes in the population of Compustat firms over time, we reestimate the models from these two tables on only the 273 firms in our sample that survive our 1980 to 2008 sample period. We find that the results are robust to only considering this group of firms.

Although agency problems are potentially lower in firms with shorter maturity debt, it is still possible that they could explain some of our results. For instance, asymmetric information and agency problems (resulting from managerial discretion) could be greater in firms with large cash reserves, resulting in greater refinancing risk for these firms. Thus, we perform sensitivity tests to examine whether agency problems could be related to the positive association between shorter maturity debt and cash holdings. In the 2SLS cash and debt maturity equations, we include a firm's value for the G-index (e.g., Gompers, Ishii, and Metrick (2003)), the E-index (e.g., Bebchuk, Cohen, and Ferrell (2009)), the fraction of the board of directors made up of independent directors, or the percentage equity ownership of directors and officers. We find that including these measures in our models does not affect the positive association between shorter maturity debt and cash holdings. We also form subsamples using each of these measures based on whether a firm's value for a measure is above or below the median sample value for the measure over a particular year. We find that the coefficient on the variable representing the fraction of a firm's long-term debt due in the next three years does not significantly differ between the subsamples formed on the basis of the governance measures.

III. Conclusion

We hypothesize that firms mitigate the refinancing risk resulting from shorter maturity debt by holding larger cash reserves. Supporting this hypothesis, we find that shorter maturity debt positively impacts a firm's propensity to hold a large cash balance and to save more cash from its cash flows. In conjunction with these findings, we also document that, from 1980 to 2008, the maturity of the long-term debt of U.S. firms has significantly decreased and that this phenomenon can help to explain an important fraction of the contemporaneous large increase in the cash holdings of U.S. firms.

We perform a number of other tests to confirm the validity of our hypothesis. We find that the positive association between shorter maturity debt and cash holdings is more pronounced for firms with more debt, for which refinancing risk should be a greater concern. Consistent with cash holdings' role of mitigating costs resulting from refinancing risk, we document that the positive effect of cash holdings on investment is more pronounced for firms with shorter maturity debt. We further document that the marginal value of an incremental dollar of cash is greater for these firms. We also examine whether the additional liquidity provided by bank lines of credit reduces firms' need to mitigate

refinancing risk with large cash holdings and find only limited evidence supporting this proposition.

Credit market conditions are important. We show that the positive association between shorter maturity debt and cash holdings is more pronounced during years when credit market conditions are weakening and refinancing risk is consequently increasing. In the tightest credit years, firms with greater refinancing risk draw on their cash holdings, eliminating the positive association between shorter maturity debt and cash during those years. Likewise, we document that the more positive effect of cash holdings on investment for firms with greater refinancing risk is heightened when credit market conditions are tight. Finally, we show that the positive association between shorter maturity debt and the incremental value of a dollar of cash holdings is more pronounced during tight credit years. These findings are further evidence consistent with firms increasing their cash holdings to mitigate refinancing risk. Overall, our findings imply that larger cash holdings are valuable for firms with shorter maturity debt and that these firms trade off costs of holding a large cash balance with the benefits resulting from a decrease in refinancing risk.

Initial submission: August 3, 2011; Final version received: November 4, 2013
Editor: Campbell Harvey

REFERENCES

Acharya, Viral V., Douglas Gale, and Tanju Yorulmazer, 2011, Rollover risk and market freezes, *Journal of Finance* 66, 1177–1209.

Almeida, Heitor, Murillo Campello, Bruno Laranjeira, and Scott Weisbenner, 2012, Corporate debt maturity and the real effects of the 2007 credit crisis, *Critical Finance Review* 1, 3–58.

Almeida, Heitor, Murillo Campello, and Michael S. Weisbach, 2004, The cash flow sensitivity of cash, *Journal of Finance* 59, 1777–1804.

Barclay, Michael J., and Clifford W. Smith Jr., 1995, The maturity structure of corporate debt, *Journal of Finance* 50, 609–631.

Barnea, Amir, Robert A. Haugen, and Lemma W. Senbet, 1980, A rationale for debt maturity structure and call provisions in the agency theoretic framework, *Journal of Finance* 35, 1223–1234.

Bates, Thomas W., Kathleen M. Kahle, and René M. Stulz, 2009, Why do U.S. firms hold so much more cash than they used to? *Journal of Finance* 64, 1985–2021.

Bebchuk, Lucian, Alma Cohen, and Allen Ferrell, 2009, What matters in corporate governance? *Review of Financial Studies* 22, 783–827.

Billett, Matthew T., Tao-Hsien Dolly King, and David C. Mauer, 2007, Growth opportunities and the choice of leverage, debt maturity, and covenants, *Journal of Finance* 62, 697–730.

Brick, Ivan E., and S. Abraham Ravid, 1985, On the relevance of debt maturity structure, *Journal of Finance* 40, 1423–1437.

Brockman, Paul, Xiumin Martin, and Emre Unlu, 2010, Executive compensation and the maturity structure of debt, *Journal of Finance* 65, 1123–1161.

Brunnermeier, Markus K., and Motohiro Yogo, 2009, A note on liquidity risk management, *American Economic Review* 99, 578–583.

Campello, Murillo, Erasmo Giambona, John R. Graham, and Campbell R. Harvey, 2011, Liquidity management and corporate investment during a financial crisis, *Review of Financial Studies* 24, 1944–1979.

Campello, Murillo, John R. Graham, and Campbell R. Harvey, 2010, The real effects of financial constraints: Evidence from a financial crisis, *Journal of Financial Economics* 97, 470–487.

Choi, Jaewon, Dirk Hackbarth, and Josef Zechner, 2013, Granularity of corporate debt, Working paper, University of Illinois.

Custódio, Cláudia, Miguel A. Ferreira, and Luís Laureano, 2013, Why are U.S. firms using more short-term debt? *Journal of Financial Economics* 108, 182–212.

Denis, David J., and Valeriy Sibilkov, 2010, Financial constraints, investment, and the value of cash holdings, *Review of Financial Studies* 23, 247–269.

Diamond, Douglas W., 1991, Debt maturity and liquidity risk, *Quarterly Journal of Economics* 106, 709–737.

Diamond, Douglas W., 1993, Seniority and maturity of debt contracts, *Journal of Financial Economics* 33, 341–368.

Dittmar, Amy, and Jan Mahrt-Smith, 2007, Corporate governance and the value of cash holdings, *Journal of Financial Economics* 83, 599–634.

Duchin, Ran, Oguzhan Ozbas, and Berk A. Sensoy, 2010, Costly external finance, corporate investment, and the subprime mortage credit crisis, *Journal of Financial Economics* 97, 418–435.

Fama, Eugene F., and Kenneth R. French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Faulkender, Michael, 2005, Hedging or market timing? Selecting the interest rate exposure of corporate debt, *Journal of Finance* 60, 931–962.

Faulkender, Michael, and Mitchell A. Petersen, 2006, Does the source of capital affect capital structure? *Review of Financial Studies* 19, 45–79.

Faulkender, Michael, and Mitchell Petersen, 2012, Investment and capital constraints: Repatriations under the American Jobs Creation Act, *Review of Financial Studies* 25, 3351–3388.

Faulkender, Michael, and Rong Wang, 2006, Corporate financial policy and the value of cash, *Journal of Finance* 61, 1957–1990.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein, 1993, Risk management: Coordinating corporate investment and financing policies, *Journal of Finance* 48, 1629–1658.

Gompers, Paul, Joy Ishii, and Andrew Metrick, 2003, Corporate governance and equity prices, *Quarterly Journal of Economics* 118, 107–155.

Graham, John R., and Campbell R. Harvey, 2001, The theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics* 60, 187–243.

Guedes, Jose, and Tim Opler, 1996, The determinants of the maturity of corporate debt issues, *Journal of Finance* 51, 1809–1833.

Harford, Jarrad, 1999, Corporate cash reserves and acquisitions, *Journal of Finance* 54, 1969–1997.

Harford, Jarrad, 2005, What drives merger waves? *Journal of Financial Economics* 77, 529–560.

Harford, Jarrad, Sattar A. Mansi, and William F. Maxwell, 2007, Corporate governance and firm cash holdings in the U.S., *Journal of Financial Economics* 87, 535–555.

Harvey, Campbell R., Karl V. Lins, and Andrew H. Roper, 2004, The effect of capital structure when expected agency costs are extreme, *Journal of Financial Economics* 74, 3–30.

Ivashina, Victoria, and David Scharfstein, 2010, Bank lending during the financial crisis of 2008, *Journal of Financial Economics* 97, 319–338.

James, Christopher, 1987, Some evidence on the uniqueness of bank loans, *Journal of Financial Economics* 19, 217–235.

Jensen, Michael C., 1986, Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* 76, 323–329.

Johnson, Shane A., 2003, Debt maturity and the effects of growth opportunities and liquidity risk on leverage, *Review of Financial Studies* 16, 209–236.

Kayhan, Ayla, and Sheridan Titman, 2007, Firms' histories and their capital structures, *Journal of Financial Economics* 83, 1–32.

Kim, Chang-Soo, David C. Mauer, and Ann E. Sherman, 1998, The determinants of corporate liquidity: Theory and evidence, *Journal of Financial and Quantitative Analysis* 33, 335–359.

Leland, Hayne E., and Klaus Bjerre Toft, 1996, Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads, *Journal of Finance* 51, 987–1019.

Lins, Karl V., Henri Servaes, and Peter Tufano, 2010, What drives corporate liquidity? An international survey of cash holdings and lines of credit, *Journal of Financial Economics* 98, 160–176.

Lown, Cara S., Donald P. Morgan, and Sonali Rohatgi, 2000, Listening to loan officers: The impact of commercial credit standards on lending and output, *FRBNY Economic Policy Review* 6, 1–16.

Lummer, Scott L., and John J. McConnell, 1989, Further evidence on the bank lending process and the capital-market response to bank loan agreements, *Journal of Financial Economics* 25, 99–122.

McConnell, John J., and Henri Servaes, 1995, Equity ownership and the two faces of debt, *Journal of Financial Economics* 39, 131–157.

Marsh, Paul, 1982, The choice between equity and debt: An empirical study, *Journal of Finance* 37, 121–144.

Myers, Stewart C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

Officer, Micah S., 2007, The price of corporate liquidity: Acquisition discounts for unlisted targets, *Journal of Financial Economics* 83, 571–598.

Opler, Tim, Lee Pinkowitz, René Stulz, and Rohan Williamson, 1999, The determinants and implications of corporate cash holdings, *Journal of Financial Economics* 52, 3–46.

Rajan, Raghuram, and Andrew Winton, 1995, Covenants and collateral as incentives to monitor, *Journal of Finance* 50, 1113–1146.

Rauh, Joshua D., and Amir Sufi, 2010, Capital structure and debt structure, *Review of Financial Studies* 23, 4242–4280.

Roberts, Michael R., and Amir Sufi, 2009, Renegotiation of financial contracts: Evidence from private credit agreements, *Journal of Financial Economics* 93, 159–184.

Sharpe, Steven A., 1991, Credit rationing, concessionary lending, and debt maturity, *Journal of Banking and Finance* 15, 581–604.

Stohs, Mark Hoven, and David C. Mauer, 1996, The determinants of corporate debt maturity structure, *Journal of Business* 69, 279–312.

Stulz, René M., 2000, Does financial structure matter for economic growth? A corporate finance perspective, Working paper, Ohio State University.

Sufi, Amir, 2007, Information asymmetry and financing arrangements: Evidence from syndicated loans, *Journal of Finance* 62, 629–668.

Sufi, Amir, 2009, Bank lines of credit in corporate finance: An empirical analysis, *Review of Financial Studies* 22, 1057–1088.

Taggart, Robert A. Jr., 1977, A model of corporate financing decisions, *Journal of Finance* 32, 1467–1484.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Appendix S1: Internet Appendix