Bank Lines of Credit in Corporate Finance: An Empirical Analysis

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October 24th, 2005

Abstract

I use novel data collected from annual 10-K SEC filings to conduct the first large sample empirical examination of the use of bank lines of credit by public corporations. I find that the supply of lines of credit by banks to corporate borrowers is particularly sensitive to the borrower's historical profitability. Even among borrowers that have access to a bank line of credit, banks employ strict covenants on profitability, and the borrower loses access to the unused portion of the line of credit when it experiences a drop in profitability. The findings identify a specific constraint (the inability to obtain a line of credit) that causes low profitability firms to hold larger cash balances in their liquidity management strategies.

*I thank Heitor Almeida, Douglas Diamond, Michael Faulkender, Mark Flannery, Christopher James, Anil Kashyap, Aziz Lookman, David Matsa, Francisco Perez-Gonzalez, James Poterba, Joshua Rauh, Antoinette Schoar, Jeremy Stein, Philip Strahan, and Peter Tufano for helpful comments and discussions. This work benefited greatly from seminar participants at the Federal Reserve Bank of New York (Banking Studies), the University of Rochester (Simon), the University of Florida (Warrington), and the FDIC Center for Financial Research. I gratefully acknowledge financial support from the FDIC's Center for Financial Research.

How do firms ensure that financial resources are available to pursue valuable projects when they arrive in the future? This question has been the subject of two lines of research that, to a large extent, have not interacted. First, there is a growing body of theoretical and empirical research on the importance of cash holdings in corporate liquidity management (Almeida, Campello, and Weisbach, 2004; Faulkender and Wang, 2005; Opler, Pinkowitz, Stulz, and Williamson, 1999). Second, there exist theoretical papers that argue that bank lines of credit play an important role for corporations in overcoming frictions in credit markets at a future date (Boot, Thakor, and Udell, 1987; Holmstrom and Tirole, 1998; Martin and Santomero, 1997). While these two lines of research are important in our overall understanding of corporate liquidity, the lack of interaction between the two begs several empirical questions. Are bank lines of credit a perfect liquidity substitute for cash? What governs the choice between bank lines of credit and excess cash holdings? Does the inability to obtain a bank line of credit represent a constraint that leads some corporations to hold excess cash?

In this paper, I attempt to answer these questions by conducting the first large sample empirical examination of the use of bank lines of credit by public corporations. The results suggest that bank lines of credit are an important source of flexibility for the firms that have them; however, only firms with high profitability are able to obtain lines of credit. In other words, the supply of lines of credit by banks is particularly sensitive to the firm's historical profitability. In addition, lines of credit contain binding covenants on the firm's profitability; when a borrower experiences a drop in profitability, it often violates a covenant and loses access to the unused portion of the line of credit. This paper identifies a precise constraint that leads some corporate borrowers to hold excess cash: firms with low historical profitability that are unable to obtain bank lines of credit hold higher cash balances and retain a higher fraction of cash flow as cash holdings.

The exposition of these results proceeds in four steps. First, I document that bank lines of credit provide a unique source of flexibility to corporate borrowers that are able to obtain them. More specifically, I find evidence that draw downs (pay backs) on bank lines of credit are the source of marginal increases (decreases) in debt levels. Firms adjust the level of debt using bank lines of credit

more than any other debt instrument. I also find that firms use lines of credit at the margin to adjust leverage ratios. Theoretical research and survey data suggest that bank lines of credit are flexible; my empirical findings are consistent with these claims.

Lines of credit are the most flexible debt instrument for the firms that have them; in the second set of results, I explore which types of firms obtain them. I conduct a cross-section analysis and find that banks extend a larger quantity of lines of credit to more profitable corporate borrowers. Profitable firms maintain both higher *unused* and *used* lines of credit. This result holds among all firms, not just those that use some form of debt. The strongest result suggests that a firm with a 3-year average lagged EBITDA to assets ratio one standard deviation above the mean has a 20 percent higher total line of credit debt to total assets ratio, and has a 25 percent higher unused line of credit to total assets ratio.

One worry is that corporate *demand* for lines of credit might be positively related to a firm's profitability through the demand for liquidity: more profitable firms have more future investment projects that may require immediate action and therefore have a higher demand for lines of credit. The initial results may therefore not be conclusive in establishing the importance of borrower profitability in the banks' willingness to *supply* lines of credit. I attempt to isolate the supply effect by focusing on the borrower's ratio of unused lines of credit to unused lines of credit plus balance sheet cash holdings. This ratio, which I refer to as the *bank liquidity to total liquidity ratio*, isolates the specific supply of *bank* liquidity to the borrower relative to other sources of liquidity, and thus helps to partial out general corporate demand for liquidity. Scaling by the total liquidity of the firm, which includes cash holdings, also has the benefit of directly relating how cash holdings and bank lines of credit co-vary across the firm profitability distribution.

I confirm that the bank liquidity to total liquidity ratio is positively related to the historical profitability of the borrower. This relationship holds both in the cross-section and within a given firm over time. The strongest fixed effects estimate implies that a one standard deviation decrease in lagged profitability for a given firm decreases the bank liquidity to total liquidity ratio at the firm by 20 percent

at the mean. I also decompose the ratio and show that unused bank lines of credit and cash holdings co-vary negatively across the profitability distribution.

The third main empirical finding suggests that, even among the more profitable firms that obtain lines of credit, banks condition the availability of lines of credit on the maintenance of profitability measures. More specifically, I find that availability under lines of credit is contingent on numerous financial covenants, of which the maintenance of profitability is the most common. I also find evidence that covenants on lines of credit are "most" binding; the propensity of firms to violate financial covenants on lines of credit is 2 to 3 times higher than the propensity to violate covenants on any other debt instrument. I further explore covenant violations, and I document that a negative profitability shock leads to "technical defaults," or violations of these covenants by borrowing firms. I find that such violations are in turn associated with a restriction of the unused portion of the line of credit. In particular, a one standard deviation decrease in profitability increases the probability of technical default by 0.11 (on a mean of 0.08). In turn, a technical default for a given firm one year ago is associated with a reduced unused line of credit capacity of more than 30 percent at the mean. A bank line of credit ceases being a perfectly liquid substitute for cash if a firm experiences a drop in profitability and violates a covenant.

This finding suggests that, in practice, a line of credit is a different financial product then is assumed in much of the theoretical literature. Most of the theoretical literature assumes that lines of credit are unconditional obligations of banks (see for example Holmstrom and Tirole, 1998; Boot, Thakor and Udell, 1987; and Morgan, 1994). The findings of this paper suggest that banks have the ability to restrict access to unused portions of lines of credit when firms experience economic or financial distress. To further document this finding, I provide anecdotal evidence by exploring language in annual 10-K SEC filings that documents how closely lines of credit are managed by banks. Lines of credit provide liquidity, but that liquidity is carefully managed.

My results show that when profitability is lower (in the cross-section and for a given firm), banks restrict firms' access to lines of credit and firms hold higher balances of cash. The fourth set of results complements this finding by linking the findings with those of Almeida, Campello, and Weisbach (2004).

They develop a model with an important insight: firms that are likely to face constraints in obtaining future financing save cash out of cash flow. I sort my sample based on their measures of financial constraints, and show similar empirical results. In addition, I find similar results by splitting my sample based on whether the firm has access to a bank line of credit in all years. In other words, firms that have limited access to bank lines of credit have a higher propensity to save cash out of cash flows, which is consistent with their theoretical framework. Overall, the empirical results identify a precise constraint (the inability to obtain a bank line of credit) which leads firms with lower profitability to rely on cash to manage liquidity.

There is limited empirical research on the role of bank lines of credit in the corporate finance decisions of public firms. This is despite the fact that lines of credit are an integral component of corporate finance. Public firms in the United States utilize lines of credit more than any other debt instrument. Draw downs on lines of credit represent almost 30 percent of aggregate debt outstanding for public firms. Over 80 percent of bank financing extended to public firms is in the form of lines of credit, and unused lines of credit at corporations represent 10 percent of total assets. In addition to offering insight into the literature on cash holdings and liquidity, this paper presents novel empirical results on the factors that govern the distribution of this important financial product.

In the next section, I describe lines of credit, the data, and summary statistics. In Section II, I describe the theoretical framework that motivates the paper. Sections III through V present the empirical analysis. Section VI relates the findings with those from the literature on cash holdings, and Section VII concludes.

I. Lines of credit: description, data and summary statistics

A. Description

A firm that obtains a line of credit receives a nominal amount of debt capacity against which the firm draws funds. Lines of credit, also referred to as revolving credit facilities or loan commitments, are almost always provided by banks or financing companies. In the sample I describe below, 95 percent of the lines of credit described in annual 10-K SEC filings are explicitly listed as being from banks or

financing companies. The used portion of the line of credit is a debt obligation, whereas the unused portion of the line of credit remains off the balance sheet. In terms of pricing, the firm pays a commitment fee on the unused portion of the line of credit that is a percentage of the unused portion, and a pre-determined interest rate on any drawn amounts. Pricing data are not available directly from annual 10-K SEC filings; however, in a sample of 19,523 lines of credit obtained between 1996 and 2003 in the Dealscan data base by the Loan Pricing Corporation, the average commitment fee is 33 basis points, and the average interest rate on drawn funds is 195 basis points above LIBOR.

Existing lines of credit are detailed on annual 10-K SEC filings by corporations. For example, Lexent Inc., a broadband technology company, details their line of credit in their FY 2000 10-K filing as follows:

> At December 31, 2000, the Company had notes payable to banks aggregating $2.0 million under a $50 million collateralized revolving credit facility, which expires in November 2003. Borrowings bear interest at the prime rate or at a rate based on LIBOR, at the option of the Company. This credit facility is to be used for general corporate purposes including working capital. As of December 31, 2000, the prime rate was 9.5%.

In the 10-K filing, companies typically detail the existence of a line of credit and its availability in the liquidity and capital resources section under the management discussion, or in the financial footnotes explaining debt obligations.

Lines of credit may contain a variety of covenants that fall broadly into four categories: (1) covenants that require the borrower to maintain certain financial ratios, (2) covenants that require prepayment of the debt obligation if the firm sells assets, issues equity, or issues new debt ("sweeps covenants"), (3) covenants that restrict dividend payments or other uses of cash, and (4) covenants that restricts the total amount of the line of credit to a "borrowing base" of some asset of the firm. Covenants are an important component of understanding lines of credit, and something I explore in the results.

B. Data

The existing empirical research on lines of credit is limited partially due to the lack of data. I attempt to bridge this gap by collecting data directly from annual 10-K SEC filings of corporations. The

most commonly used database for financial characteristics of public corporations is Compustat. Although Compustat contains valuable information regarding the debt structure of firms, it does not contain sufficient detail for my analysis. More specifically, using Compustat alone, it is not possible to determine whether debt comes from public issues, banks, private placements, shareholders, or from non-bank private sources. In addition, there is no record on the existence of unused bank lines of credit. These data are available, however, in the debt schedules of annual 10-K SEC filings. As Johnson (1997) notes, Regulation S-X of the U.S. Securities and Exchange Commission requires that firms identify the sources of long-term debt.[1] For example, the firm almost always reports the amount of a given debt issue or loan, if it is public or private, the source of the debt, and whether the debt obligation is from a bank or other institution. In addition, Regulation S-K of the U.S. Securities and Exchange Commission requires firms to discuss explicitly their liquidity, capital resources, and result of operations (Kaplan and Zingales, 1997). All firms filing with the SEC therefore provide detailed information on the used and unused portions of bank lines of credit.

This paper is not the first to collect data on the sources of debt from annual 10-K SEC filings. Johnson (1997) collects these data for a cross-section of 847 firms in 1989. In two papers, Houston and James (1996, 2001) use a sample of 250 firms for which they collect these data in years 1980, 1985, and 1990. Cantillo and Wright (2000) collect data for 291 firms, which they follow from 1974 through 1992. Asquith, Gertner, and Scharfstein (1994) collect these data for a sample of 102 financially-distressed junk bond issuers which they follow during the late 1980s and early 1990s. In the data appendix, I directly compare the data that I collect to that of Houston and James (1996).

The data set begins with 7,723 non-financial, U.S.-based, independent Compustat firms with non-missing, strictly positive asset data between 1996 and 2003. I then form a sampling universe; it contains firms with at least 4 consecutive years of positive data on total assets (*item 6*), and 4 consecutive years of non-missing data on total liabilities (*item 181*), total sales (*item 12*), operating income before depreciation (*item 13*), share price (*item 199*), shares outstanding (*item 25*), preferred stock (*item 10)*, deferred taxes (*item 35*), and convertible debt *(item 79*). These data limitations are governed by the necessity of these

variables in constructing basic characteristics of the firm. I also require firms to have 4 consecutive years of book leverage ratios between 0 and 1.

I focus on the 1996 to 2003 period because annual 10-K SEC filings are available electronically for all firms in the years after 1995, which makes the costs of data collection much lower for this time period. I restrict the sample to firms with at least 4 consecutive years of data because I am particularly interested in how line of credit use evolves within a given firm over time. The universe of Compustat firms that meet these criteria includes 4,681 firms. I then randomly sample 300 firms from this universe, and follow them from 1996 through 2003, for a total unbalanced panel of 2,180 firm-year observations. The random sample employed in this paper represents 6.4 percent of the firms in the sampling universe.

The random sample begins with an unbalanced panel of 300 firms and 2,180 firm-year observations. For these 300 firms, I collect detailed data on the sources of debt and used and unused lines of credit from annual 10-K SEC filings. Firms filing their initial 10-K with the SEC typically include up to 2 years of historical data in their initial 10-K. Although these historical data generate Compustat observations with non-missing information on earnings and assets, the actual 10-Ks for these firm-year observations do not exist. I include only firm-year observations where an actual 10-K exists. I drop 91 firm-year observations due to this restriction. I also drop 67 observations where book leverage is greater than 1. Finally, I drop 106 firm-year observations where share price (*item 199*), tangible assets (*item 8*), or EBITDA (*item 13*) is missing. The final sample includes 300 firms and 1,916 firm-year observations.

Core financial variables are calculated from Compustat and are defined as follows. Book debt is short term debt plus long term debt (*item 34 + item 9*), all divided by total assets (*item 6*). Balance sheet cash is measured using *item 1*. A measure of asset tangibility is defined as tangible assets (*item 8*) divided by total assets. The market to book ratio is defined as total assets less the book value of equity plus the market value of equity, all divided by total assets. The book value of equity is defined as the book value of assets (*item 6*) less the book value of total liabilities (*item 181*) and preferred stock (*item 10*) plus deferred taxes (*item 35*). The market value of equity is defined as common shares outstanding (*item 25*) multiplied by share price (*item 199*). Finally, the primary measure of profitability is EBITDA (*item 13*),

divided by total assets. In the majority of the data analysis, I use the 3-year lagged average EBITDA to total assets ratio as the primary measure of profitability.[2] In order to reduce the influence of outliers, I follow the literature and Winsorize the market to book ratio and profitability at the 1st and 99th percentile.

I summarize here the categorization of different types of debt from annual 10-K SEC filings; a more detailed analysis is in the data appendix. The data collected on lines of credit and debt structure come from two places on the annual 10-K SEC filing: the "Liquidity and Capital Resources" section in the "Management Discussion," and the financial footnotes that address debt. I categorize the types of debt into 6 groups. The first broad category is bank debt. Bank debt includes debt held by commercial banks, financing companies, credit corporations, and unspecified "financial institutions." Bank debt is split into draw-downs on lines of credit, and term loans, and I also collect data on unused lines of credit.

The annual 10-K SEC filings of 95 percent of firm-year observations with any type of line of credit explicitly state that the line of credit is from a commercial bank or financing company. Approximately 4 percent do not list the source of the line of credit, and 1 percent state that the line of credit is from an affiliated non-financial business. I include the former as bank lines of credit, whereas the latter is considered private non-bank debt. It is important to note that I do not distinguish lines of credit provided by commercial banks primarily funded with deposits and lines of credit provided by financing companies primarily funded with commercial paper or equity.[3] This is due to a data limitation; the language in the annual 10-K SEC filings usually refers to financing companies as "banks" and often simply states that the line of credit is from a "financial institution."

The second broad category of debt is arm's length debt, which includes public debt, most private placements, industrial revenue bonds, and commercial paper. Private placements that are held by 2 or fewer institutions are excluded from this category. The third, fourth, and fifth broad categories of debt are convertible debt, non-bank private debt, and capitalized leases. Non-bank private debt includes debt to related parties, shareholders, customers, vendors, insurance companies, private placements held by 2 or fewer institutions, and most promissory notes associated with acquisitions. The sixth category of debt includes mortgage debt, debt to state or municipal governments, and debt that is unclassifiable. The data

appendix gives a more comprehensive description of the exact types of debt in each category. In the data appendix, I also show results from a series of tests to test the validity of the data collection procedure.

C. Summary statistics

[TABLE 1]

Table 1 contains the summary statistics for the sample of 300 firms from 1996 to 2003, for a total unbalanced panel of 1,916 firm-year observations. Bank lines of credit are on average more than 15 percent of book assets, with the used portion being 5.6 percent and the unused portion 9.8 percent. The average *bank liquidity to total liquidity ratio*, which is the ratio of unused lines of credit to unused lines of credit plus balance sheet cash, is 0.44. Despite the fact that unused lines of credit represent almost half of the overall liquidity available to firms, the availability of lines of credit generally has not been recognized in the existing research on the importance of cash in providing liquidity to firms. The average book debt to total assets ratio is 0.21 in the sample, and I use the data collected from annual 10-K SEC filings of firms to break down the debt into various categories. Term bank debt represents 3.4 percent of assets. Arm's length debt accounts for 6.1 percent of total assets, or almost 30 percent of total book debt. Convertible debt accounts for about 1.9 percent of total assets, and non-bank private debt accounts for 1.6 percent of total assets.

In column (3) of Table 1, I present the mean fraction of all firm-year observations where the type of debt obligation in question is greater than 0. About 81 percent of firm-year observations have some type of debt. Almost 71 percent of firm-year observations have positive unused lines of credit, and 48 percent have used lines of credit. Overall, 74 percent of firm-year observations have some unused or used line of credit, and 82 percent of firms in the sample have a line of credit some time between 1996 and 2003; these numbers are higher than the numbers for any other type of debt instrument. Term bank debt is used by 33 percent of firm-year observations, whereas public debt and commercial paper are used by only 14 percent and 5 percent respectively. These statistics confirm a basic fact that is becoming more recognized in recent literature: the majority of public firms do not use public sources of debt (see, for example, Faulkender and Petersen, 2005).

[TABLE 2]

Table 1 shows that 74 percent of firm-year observations in a random sample of Compustat firms have a bank line of credit. Table 2 presents cross-utilization rates to emphasize this broad use of lines of credit. Each column in Table 2 represents a conditional sample, where the sample has the type of debt listed at the top of the column. The rows display what other types of debt firms have conditional on having the type of debt in the column. The first row of the table shows that 88 percent of firm-year observations with term bank debt also have a bank line of credit, and 96 percent of firm-year observations with public debt also have a bank line of credit. Even among firm-year observations with no outstanding debt, 30 percent have an unused line of credit.

II. Motivation for the empirical analysis

In this section, I motivate the empirical analysis of bank lines of credit by discussing the existing empirical and theoretical research in two areas: the literature on bank lines of credit and the literature on cash holdings in corporate liquidity management. More specifically, I focus on how an empirical analysis of lines of credit can help resolve unanswered questions in both of these areas.

A. Bank lines of credit

Theoretical research on bank lines of credit follows the optimal contracting literature; it attempts to describe reasons that corporations demand lines of credit relative to other forms of debt.[4] The first class of models uses problems of time inconsistency between borrowers and future creditors to motivate corporate demand for lines of credit. These papers include Berkovitch and Greenbaum (1991); Boot, Thakor, and Udell (1987); Duan and Yoon (1993); Holmstrom and Tirole (1998); Morgan (1994); and Shockley (1995).

I focus here on two of these papers that I believe demonstrate the core intuition of these models. The paper by Holmstrom and Tirole (1998) motivates the use of lines of credit by embedding a moral hazard problem within a three-period model where a liquidity shock is realized in the second period. When the liquidity shock is realized in the second period, the borrower must retain a large enough portion of the third period return to motivate her to be diligent; in other words, there a standard moral hazard

problem that forces the borrower to retain a large stake in the project. Given this agency problem, the first best is unattainable. If the liquidity shock is large enough, the borrower will not be able to obtain funds even if the project has positive NPV, given that she must retain enough of the project return to maintain diligence. In the second best solution, the borrower buys liquidity insurance. One mechanism is a line of credit.[5] In the first period, borrowers obtain a commitment to lend in the second period up to a certain point. When the liquidity shock is realized, the borrower has access to committed funds. In some states of the world, the creditors end up losing money in the second period, but they break even in expectation. This is the intuition of the liquidity insurance in the model.

Boot, Thakor, and Udell (1987) also use a basic agency problem to motivate corporate demand for lines of credit. They employ a three-period model with an agency problem, where borrowers select an effort level in the first period and choose whether to invest or not in the second period. The moral hazard problem arises because the effort decision is unobservable to creditors. In the Boot, Thakor, and Udell (1987) model, there is stochastic interest rate realized in the second period that serves the same purpose as the liquidity shock in Holmstrom and Tirole (1998). If interest rates are too high in the second period, borrowers anticipate a low expected return from the project and thus choose low effort. In other words, high interest rates in the second period lower the return to effort, which leads managers at borrowing firms to shirk. In the second period, banks fully predict such behavior, and thus ration credit. A line of credit signed in the first period solves this problem by charging an up-front fee and guaranteeing a low rate of interest in the second period. Thus, the line of credit serves as interest rate protection which can guarantee that borrowers put in high effort initially.

There are three main empirical implications of these models. First, the models assume that basic agency problems due to information asymmetry motivate corporate demand for lines of credit. In other words, firms where management actions are less transparent are more likely to use lines of credit. Second, banks cannot renegotiate the line of credit in the interim period if the contract is to improve on spot-market financing. The critical motivation for a line of credit in these models is a time inconsistency that leads spot market creditors at a future date to deny credit. If a line of credit is conditional on future

outcomes, then lenders extending the line of credit also deny credit. In the models described above, the optimal behavior for the bank in some states of the interim period is to restrict access to the line of credit. According to these models, if bank lines of credit are to solve problems of time inconsistency, they must be extended unconditionally.

The third main empirical hypothesis that comes from these models is that it can be difficult for firms to raise capital in spot markets when investment opportunities arrive or change. Lines of credit provide a particularly flexible source of debt financing that can be drawn upon with fewer difficulties. At the margin, lines of credit are more easily and quickly drawn than other types of debt.

Martin and Santomero (1997) provide a different approach to motivate corporate demand for lines of credit. They begin with the assumption that firms desire speed and secrecy in pursuing investment opportunities. The value of arriving investment opportunities decays rapidly, and spot market financing requires more time than the use of a line of credit. The first empirical prediction is that firms in high growth industries more heavily utilize lines of credit. The second empirical prediction is similar to the third prediction of the models discussed above; firms use lines of credit because of their speed and flexibility, and lines of credit should therefore be the incremental source of debt financing.

There is a subtle distinction between the "liquidity" of a bank line of credit in the models of Holmstrom and Tirole (1998) and Boot, Thakor, and Udell (1987) and the "flexibility" of a line of credit in Martin and Santomero (1997). In the former models, a line of credit is "liquid" because it is available for a cheaper price when the firm is faced with capital market frictions in the future. (Indeed, spot market financing in these models is so "expensive" that projects are not undertaken if a line of credit is not in place.) In the latter model, a line of credit is "flexible" because it can be drawn more quickly. The assumption of Martin and Santomero (1997) that projects decay rapidly in value implies that the "flexibility" of a bank line of credit reduces its implicit price relative the price of raising financing in spot markets in the future. In other words, flexibility implies liquidity. I follow this intuition and use the two terms interchangeably.

Despite the existence of testable hypotheses, empirical research on the role of bank lines of credit in corporate finance is limited. Ham and Melnik (1987) collect data from a direct survey of 90 corporate treasurers. Based on answers to the survey, they estimate a drawn line of credit demand function, and find that draw downs on lines of credit are inversely related to interest rate cost and positively related to total sales. Agarwal, Chomsisengphet, and Driscoll (2004) examine the use of lines of credit for 712 privately-held firms that obtained loans from FleetBoston Financial Corporation. They find evidence that firms with higher profitability obtain larger lines of credit, which is consistent with the analysis presented here. Gatev and Strahan (2005) and Sundaresan and Wang (2004) provide empirical evidence on the role of bank lines of credit with respect to aggregate liquidity shocks. These papers do not focus on how bank lines of credit provide liquidity when firms are faced with firm-specific, as opposed to aggregate, shocks. A primary goal of this paper is to empirically analyze the hypotheses developed in the theoretical research on bank lines of credit.

B. Cash and corporate liquidity

Almeida, Campello, and Weisbach (2004), henceforth ACW, argue that cash holdings represent a safeguard against the inability to obtain financing when valuable opportunities arise in the future. They build a three period model, in which investment opportunities arrive in the first and second periods. Firms are either financially constrained or unconstrained; firms fall into one of these categories based on the level of cash flows and the value of collateral that the firm can pledge to creditors. In the initial period, unconstrained firms have no reason to save cash out of initial cash flows; they can reduce dividends or raise more external finance in the second period to pursue investment opportunities. Constrained firms, on the other hand, retain a portion of their first-period cash flows to "hedge" against the inability to raise external financing in the second period. The optimal level of saving out of cash flow balances the cost of reducing investment in the first period with the benefit of more investment in the second period. Constrained firms should therefore save a higher proportion of their initial cash flows relative to unconstrained firms.

Empirical support for this framework is found in ACW (2004); Faulkender and Wang (2005) (henceforth, FW); and Opler, Pinkowitz, Stulz, and Williamson (1999) (henceforth OPSW). ACW (2004) sort their sample based on observable measures of financial constraints (payouts, size, and the existence of third-party credit ratings), and find that more constrained firms save more cash out of cash flow. FW (2005) find that shareholders place higher value on an additional dollar of cash within financially constrained firms, where the measures of financial constraints used are similar to those in ACW (2004). OPSW (1999) find that larger firms and those with credit ratings hold less cash.

While the theoretical and empirical results of the literature on cash and corporate liquidity management are instructive, there are two shortcomings which I directly address in this paper. First, what is the role of bank lines of credit? As mentioned above, the existing theoretical research on bank lines of credit posits that this financial product is designed precisely to solve financial frictions as described in the model of ACW (2004). Firms that face a potential inability to raise future financing obtain lines of credit as a hedging device. Neither the empirical nor theoretical research on cash and corporate liquidity addresses the role of bank lines of credit in reducing the need for firms to use cash. As a related shortcoming, the empirical literature on cash and corporate liquidity does not provide direct insight into the precise "financing" constraint that prevents firms from accessing external funds. The theoretical frameworks of ACW (2004) and FW (2005) rely only on a non-specific "limitation in [the] capacity to raise external finance" (ACW, p 1781). They do not take an empirical stand on what the limitation is.

These two shortcomings together are a primary motivation of this paper. In the spirit of the theoretical literature on bank lines of credit, the empirical analysis of this paper focuses on bank lines of credit as an important financial instrument used in corporate liquidity management. I examine the distribution of bank lines of credit among firms to explore whether they are a substitute for cash in corporate liquidity management. The empirical analysis seeks to identify a specific constraint (the inability to obtain a bank line of credit) that leads firms to hold higher balances of cash and save cash out of cash flows.

III. Lines of credit and flexibility

Theoretical models on bank lines of credit hypothesize that they are a particularly flexible source of debt financing. I evaluate this hypothesis in this section. In Table 3, I explore which type of debt financing firms adjust when adjusting their overall level of debt. In other words, I am interested in answering the following question: when firms adjust their levels of debt, what type of debt is the marginal source of the adjustment? If firms adjust using lines of credit more than any other type of debt, then the evidence supports the theoretical hypothesis that lines of credit provide flexibility and are the marginal source of debt financing.

[TABLE 3]

Consistent with these models, Table 3 presents evidence that lines of credit are the marginal source of debt financing. I split the sample into two types of firms: firms that have a line of credit at any point in the sample (left side) and all firms (right side). In Panel A, I explore adjustments in the level of debt, scaled by lagged assets. I follow Leary and Roberts (2005) and Korajczyk and Levy (2003) and categorize firms based on how large of an adjustment upward or downward they make in total debt, scaled by lagged assets. More specifically, I split the sample into 4 groups based on the size of the adjustment: firms that decrease their debt scaled by lagged assets by more than 0.05, firms that decrease their debt scaled by lagged assets by 0.01 to 0.05, firms that increase debt scaled by lagged assets by 0.01 to 0.05, and firms that increase their debt scaled by lagged assets by more than 0.05.

Among firms that use lines of credit at any point in the sample, approximately 15 percent of firm-years have a decrease in the aggregate debt scaled by lagged assets by more than 0.05, and 30 percent have an increase in debt scaled by lagged assets by more than 0.05. Among these firms with large adjustments upward and downward, lines of credit are the largest source of these adjustments. For example, when firms experience an adjustment downward of more than 0.05, firms pay down their used lines of credit by 0.058. The adjustment downward in used lines of credit is more than any other type of debt instrument. Similarly, firms that increase their debt increase their use of lines of credit more than any other debt instrument. The same results hold in the unconditional sample of all firms. Even in relatively small adjustments upward and downward, lines of credit are the largest source of the

adjustment. It is important to note that these firms on average have a higher percentage of their debt in the form of arm's length debt, but lines of credit appear to be the largest source of changes in debt levels.

In Panel B, I analyze the change in the leverage ratio. The trends in the data are quite similar. When firms adjust their leverage ratio upward or downward, they use lines of credit more than any other type of financing. Overall, in *every* category of adjustment in either leverage ratios or the levels of debt, lines of credit are the largest source of the adjustment in debt. The evidence suggests that firms use lines of credit as the marginal source of debt financing, and that flexibility is a key characteristic of this financial product. The evidence is consistent with the theoretical frameworks described above. The results are also consistent with survey evidence described in Avery and Berger (1991); respondents in the survey suggest that flexibility and speed of action are their primary reasons for obtaining lines of credit. The findings suggest that lines of credit are a liquid debt instrument for the firms that obtain them.

IV. To which firms do banks extend lines of credit?

Table 3 provides evidence that lines of credit are the most flexible source of debt financing for the firms that are able to obtain them. In view of the literature on cash holdings and corporate liquidity management, a key question is whether lines of credit are a viable substitute for cash for all firms. In this section, I attempt to address this question by conducting a series of linear regressions in which a measure of lines of credit is regressed on firm characteristics. The general specification in Tables 4 and 5 follows:

$$Lines_{it} = \alpha_t + \beta X_{i,t-1} + \alpha_i + \varepsilon_{it} \qquad (1)$$

The dependent variable is a measure of lines of credit scaled by total assets, total debt, or total liquidity. The matrix *X* contains variables that are dictated by the existing theoretical research on bank lines of credit. First, the existing theoretical research implies that firms with a greater degree of information asymmetry have a stronger demand for lines of credit. I construct measures of information asymmetry that are consistent with measures in Faulkender and Petersen (2005) and Sufi (2005).[6] Firms with equity that is not traded on a major exchange receive less analyst coverage and media attention. Likewise, firms that are not in one of the three main S&P indices (the S&P 500, the S&P Midcap 400, and the S&P

Smallcap 600) also receive less attention. I use an indicator variable for whether the firm's equity trades only over the counter and I use an indicator for whether the firm is NOT included in one of the main S&P indices to measure information asymmetry. Older firms are also more likely to be known to capital markets. I include the natural logarithm of 1 + the years since the firm's IPO as an additional measure of information asymmetry.

More profitable firms should be able to obtain external financing more easily through a supply effect; banks should be willing to extend larger lines of credit to more profitable firms. To measure the supply elasticity of lines of credit with respect to firm profitability, I include a profitability measure as an independent variable. I measure firm profitability for firm *i* in year *t* by averaging firm *i*'s EBITDA to total assets ratio for years *t-3* to *t-1*. In the remainder of the text, I refer to this measure as *firm profitability*. I use this measure for two reasons: first, it represents a historical "reputation" of the borrower and serves as a measure of the probability that the firm enters into distress. Second, as I show below, banks rely on measures of profitability more heavily than any other measure when establishing covenants on lines of credit.[7] I also include a measure of the variability of profits, which is based on the measure used in Mackie-Mason (1990). It represents the standard deviation of annual changes in the level of EBITDA over a lagged 4 year period, scaled by average total assets in the lagged period.

The additional control variables included in the matrix *X* follow the literature on capital structure that explores the impact of firm characteristics on leverage (Rajan and Zingales, 1995). More specifically, the matrix *X* contains the lagged market to book ratio, the tangible assets to total assets ratio, and the natural logarithm of total sales. The matrix *X* also includes 1-digit SIC industry indicator variables. All regressions also include year indicator variables. The estimation in equation (1) is carried out using both pooled OLS and fixed effects regressions.[8] In all specifications, standard errors are adjusted for the correlation of unobservable errors across years for the same firm using clustering.

A. Lines of credit scaled by assets and total debt

[TABLE 4]

In columns (1) through (6) of Table 4, I present coefficient estimates from specifications where the dependent variables are measures of lines of credit and other types of debt scaled by total assets. The effect of firm profitability on the balances of lines of credit is strong. The estimate in column (1), which is statistically distinct from 0 at the 1 percent level with a *t*-statistic of 4.3, suggests that a one standard deviation increase in profitability increases the total line of credit to assets ratio by (0.21*0.16=) 0.034, which is 22 percent at the mean of the dependent variable. The coefficient estimates in columns (2) and (3) imply that the result holds for both used and unused lines of credit. In terms of magnitudes, the estimates imply that a one standard deviation increase in firm profitability increases the used and unused line of credit to total assets ratio by 20 percent and 23 percent at their respective means.

In terms of information asymmetry, the results in columns (1) through (3) imply that younger firms and firms that are NOT in a major S&P index hold higher balances of used and unused lines of credit. The coefficient estimates on firm age are particularly strong in magnitude and statistical significance; they suggest that younger firms use lines of credit more heavily in their financing decisions. While these results appear to support the hypothesis that firms with a greater degree of information asymmetry more heavily use lines of credit, I urge caution given the coefficient estimates in column (4). The effect of information asymmetry on the use of *term* bank debt is also strong and positive, which is consistent with theoretical and empirical research (Diamond, 1991, Houston and James, 1996). In addition, firm size, which is likely to be a measure of information asymmetry, has a positive effect on the use of bank lines of credit, but no effect on term bank debt. The results in column (5) do not support a *unique* effect of information asymmetry on the use of bank lines of credit relative to term bank debt.

One of the key findings in columns (1) through (3) is that firm profitability has a quantitatively large impact on bank supply of lines of credit to the firm. One worry is that this result is trivial: any lender is worried about potential default which is negatively correlated with firm profitability, and thus supply should be quite elastic with respect to profitability. In columns (4) through (8), I provide evidence that the magnitude of the supply effect is particularly strong with bank lines of credit relative to other forms of debt. While the point estimate of the effect of profitability on the use of term bank debt is

positive in column (4), it is lower in magnitude and not statistically distinct from 0 at a reasonable confidence level. In columns (5) and (6), the estimated coefficient on firm profitability implies that more profitable firms use less arm's length debt and less convertible debt. An alternative method for showing the same result is to see how firm profitability affects the proportion of total debt that is in the form of lines of credit. In columns (7) and (8), I isolate the sample to firms where total debt is at least 5 percent of total assets, and I scale used and unused lines of credit by total debt. The coefficient estimate on profitability in columns (7) and (8) implies that a one standard deviation increase in firm profitability leads to a 30 and 35 percent increase in the used and unused line of credit to total debt ratio at the means of the left hand side variables, respectively.

The results in columns (4) through (8) suggest that, relative to other forms of debt, the supply elasticity of lines of credit with respect to profitability is particularly high. There are two caveats. First, I do not want to interpret the negative effect of profitability on arm's length and convertible debt as evidence that supply in these markets is a decreasing function of profitability. There are likely demand-related reasons (such as debt overhang) that firms with higher profitability prefer not to have high balances of arm's length debt or convertible debt. Second, the negative effect of profitability on arm's length debt may be due to a legacy effect; firms that were profitable when they issued longer maturity arm's length debt subsequently experience drops in profitability while the debt is still outstanding. Even with these caveats, the results in Table 4 provide preliminary evidence that credit suppliers may rely more heavily on profitability when deciding to extend credit than suppliers of other debt instruments. The discrepancy between the effect of profitability on the availability of term bank debt and bank lines of credit is particularly suggestive, given that the lenders, maturity, and amounts of these two debt instruments are similar. I discuss future research that more directly examines this question in the conclusion. It is important to emphasize that none of the core results in this paper rely on the finding that the supply of bank lines of credit is more sensitive to firm profitability than other forms of debt.

B. Bank liquidity to total liquidity ratio

Table 4 shows evidence that firms with higher profitability have increased access to bank lines of credit. My interpretation is that this result represents a *supply* effect; banks are only willing to extend large lines of credit to firms with an established record of profitability. One concern with the results in Table 4 is that they also measure a *demand* effect. Firms with historically high profitability have a stronger demand for flexible financing (Martin and Santomero, 1997). One therefore witnesses an equilibrium where bank lines of credit are used more heavily by profitable firms, but this is not due to supply decisions made by banks.

In this section, I use the bank liquidity to total liquidity ratio (defined as the ratio of unused lines of credit to unused lines of credit plus cash) to isolate the effect of a firm's profitability on the willingness of banks to supply lines of credit. The identifying assumption is the following: absent supply effects, a firm with higher profitability is not more likely to demand a line of credit than it is to demand any other source of liquidity, such as cash. In other words, there is no reason that higher profitability should shift corporate demand for lines of credit relative to other sources of liquidity. In the price-quantity space, an increase in the profitability of a firm should uniquely shift the supply of bank lines of credit relative to other sources of liquidity toward the right, but should not affect corporate demand for lines of credit relative to other sources of liquidity.[9] A positive relationship between the bank liquidity to total liquidity ratio and firm profitability should therefore uniquely capture an increase in the willingness of banks to supply lines of credit.[10]

In addition to identifying a supply effect, the bank liquidity to total liquidity ratio also directly examines how bank lines of credit relate to the literature on cash and corporate liquidity management. Systematic differences in the bank liquidity to total liquidity ratio across the sample may help determine why bank lines of credit are not a perfect substitute for cash, and which types of firms are unable to obtain external sources of liquidity.

[FIGURE 1]

Panel A of Figure 1 displays the relationship between sources of liquidity and profitability. It demonstrates a key finding of the paper: there is an inverse relationship between cash holdings and the

availability of lines of credit across the profitability distribution. Firms in the low profitability deciles hold more cash and less bank liquidity, and the relationship reverses as firms become more profitable. Panel B maps the bank liquidity to total liquidity ratio across the profitability distribution; it shows a positive relationship between the proportion of liquidity held in bank lines of credit and the firm's profitability. Figure 1 also provides evidence that the results in Table 4 are driven by supply effects; as mentioned above, the identifying assumption is that, absent supply effects, there is no reason why more profitable firms *demand* unused lines of credit *relative* to other sources of liquidity.

[TABLE 5]

In Table 5, I report coefficient estimates from an empirical specification identical to (1), except I use the bank liquidity to total liquidity ratio as the dependent variable. In column (1), the effect of firm profitability on the bank liquidity to total liquidity ratio is positive and statistically significant at the 1 percent level. In other words, more profitable firms have a higher proportion of their total liquidity in the form of bank lines of credit. This result suggests that firms with lower profitability hold higher balances of cash because they are unable to obtain adequate liquidity in the form of bank lines of credit.[11]

Why do banks restrict access to firms with low profitability? The results in columns (2) and (3) of Table 5 show that banks rely on profitability to a greater degree when firms are more likely to enter financial or economic distress. In regressions reported in columns (2) and (3), I split the sample based on the book debt to total assets ratio of the firm. The results show that the positive effect of firm profitability on the willingness of banks to extend lines of credit is concentrated among firms with high book debt to asset ratios. The coefficient estimate in column (2) implies that a one standard deviation increase in profitability among this sub-sample increases the bank liquidity to total liquidity ratio by (0.14*0.78) = 0.11, which is almost 20 percent at the mean. The effect of firm profitability among firms with low book debt ratios is not statistically distinct from 0 at a reasonable confidence level, and the coefficient estimates in the two samples are distinct from one another at the 1 percent level.[12] I find similar results when splitting the sample based on Altman's Z Score (1968) measure of the probability of default (unreported, but available from the author upon request). The results suggest that firms with low profitability and a

high probability of distress are unable to obtain adequate liquidity from external sources. These firms rely more heavily on cash in corporate liquidity management.

In columns (4) through (6), I present coefficient estimates from fixed effects regressions of the bank liquidity to total liquidity ratio on 1-period lagged profitability. In other words, these estimates answer the following question: when a *given* firm experiences a drop in profitability relative to its own average profitability, do banks become less willing to supply lines of credit to that firm? The fixed effects specification removes unobservable variation across firms that does not vary across time; it therefore produces an estimate of the effect of firm profitability on the willingness of banks to supply lines of credit that is less subject to unobservable variable bias. The coefficient estimate in column (4) implies that a drop in profitability for a given firm reduces the bank liquidity to total liquidity ratio. In columns (5) and (6), I estimate the fixed effects specification separately using samples of firms with average book debt ratios across all years that are above and below the median, respectively. Consistent with the results in columns (1) through (3), the coefficient estimate on profitability is positive and statistically significant among firms with high average book debt ratios; there is a weaker effect among firms with low average book debt ratios. The coefficient estimates on profitability in the two samples are statistically distinct from one another at the 6 percent confidence level.

The results in Tables 4 and 5 identify why bank lines of credit may not serve as a substitute for cash for all firms. Firms with low historical profitability are able to obtain less of their liquidity from bank lines of credit, and rely more heavily on cash in their corporate liquidity management. When a given firm experiences a drop in profitability, it increases its use of cash relative to bank lines of credit.

C. Robustness

There are two residual concerns with the interpretation of results. First, marginal corporate tax rates are not considered. Firms with high profitability typically also face the highest marginal corporate tax rates. As FW (2005) argue, "because the corporate tax rate is generally higher than the personal tax rate paid on interest income, investors are better off if they hold excess cash themselves rather than the firm." If the cost of holding a line of credit relative to cash is decreasing in firm profitability because of

taxes, then profitable firms hold a higher proportion of their liquidity in lines of credit relative to cash. The results in Table 5 partially mitigate this concern; they show that the effect of firm profitability on the use of lines of credit relative to cash is strongest among firms with the highest leverage ratios. Firms with the highest leverage ratios already have large interest deductions; taxes should therefore have less of an effect among this group.

In a robustness check, I match John Graham's data on marginal tax rates after interest deductions to 1,525 (out of 1,916) of the firm-year observations in the sample.[13] In unreported results available from the author upon request, I show that the marginal corporate tax rate does have a positive effect on the use of lines of credit relative to other sources of liquidity; at the same time, the effect of firm profitability remains almost identical even after controlling for the marginal corporate tax rate.

The second residual concern is corporate governance. If corporate governance is worse for more profitable firms, then shareholders of more profitable firms may force management to hold more lines of credit relative to cash in order to prevent extraction of firm wealth. The assumption that corporate governance is worse for profitable firms runs counter to analysis of Gompers, Ishii, and Metrick (2003) who show that poorly governed firms perform worse relative to well-governed firms. In addition, a working paper by Harford, Mansi, and Maxwell (2005) demonstrates that poorly governed firms (which have lower profitability) hold *less* cash than well governed firms. This suggests that *low* profitability firms hold *less* cash due to governance considerations, and should therefore have a *higher* bank liquidity to total liquidity ratio. This suggests that any bias in the effect of profitability on bank liquidity due to governance works against finding a positive coefficient. The results from fixed effects specifications in Table 5 also mitigate the corporate governance concern. The estimates show that when a *given* firm experiences a drop in profitability, it loses access to its line of credit. Corporate governance measures vary only slightly over time for the same firm, and therefore cannot explain the within-firm result.

V. Are lines of credit unconditional liquidity?

A. Large sample evidence

The results in the previous section suggest that bank lines of credit are not an available source of liquidity for firms with low profitability and a higher probability of financial distress. In this section, I examine the degree to which a line of credit provides unconditional liquidity to the firms that obtain them. In other words, I examine whether lines of credit are a perfectly liquid substitute for cash in all potential future states. I focus in particular on the role of financial covenants, or covenants that require the maintenance of financial ratios. Financial ratios are specified in the initial contract, and the borrower is in default of the loan agreement if a ratio is not satisfied. These defaults are typically referred to as "technical defaults," and the lender has the legal right to accelerate the loan. While most technical defaults are renegotiated, the terms of the loan can change significantly.

[TABLES 6 & 7]

Table 6 presents evidence from Dealscan by the Loan Pricing Corporation on financial covenants. The sample includes 19,523 sole lender and syndicated lines of credit obtained by non-financial business from 1996 to 2003. Almost half of all lines of credit in the sample have covenants based on financial ratios. The most common type of financial covenant is a cash flow or profitability based covenant, occurring on 38 percent of the lines of credit. Covenants on total net worth and balance sheet based covenants are also common. The most common covenant in the Dealscan sample is a debt to cash flow covenant, which is on 24 percent of the lines of credit. Banks rely heavily on firm profitability when placing covenants on the lines of credit they extend to firms.

In Table 6, I display covenant data from Dealscan, and not directly from 10-Ks, because companies are not required to detail the debt covenants present on their loan agreements in their SEC filings. However, the SEC does require firms to report covenant *defaults*. More specifically, "companies that are, or are reasonably likely to be, in breach of such covenants must disclose material information about that breach and analyze the impact on the company if material (SEC, 2003)." Table 7 displays the material covenant violation data directly collected from annual 10-K SEC filings.[14] A covenant on some debt agreement is violated in 9 percent of the firm-year observations in the sample. A covenant default is more likely to occur on a line of credit (8 percent) than any other debt instrument. The frequency of a line

of credit default is between 2 and 3 times higher than the next highest instrument. Table 7 presents evidence that covenants on lines of credit are the most "binding;" they are violated most often by firms.

[TABLE 8]

Table 8 explores why line of credit covenants are violated, and it explores the implications of such violations. In columns (1) and (2) of Table 8, I report coefficient estimates from fixed effects regressions that show why defaults on covenants occur. The exact specification is a linear probability fixed effects model, where the left hand side variable is 0 if no default occurs and 1 if default occurs. Formally, I estimate:

$$Default_{it} = \alpha_i + \alpha_t + \beta X_{it} + \varepsilon_{it} \qquad (2)$$

In this specification, X_{it} represents a matrix of firm profitability, net worth, and leverage measures. As documented above, these measures are subject to covenants. The vector of coefficient estimates of β examines whether reductions in profitability, reductions in net worth, or increases in leverage lead to technical defaults of covenants associated with lines of credit. The sample for the estimation of (2) includes only firm-years where a line of credit is present, and standard errors are heteroskedasticity-robust, clustered at the firm level.[15]

Column (1) shows that a drop in profitability is associated with a higher probability of default on a covenant. The coefficient estimate implies that a one standard deviation decrease in profitability (0.21) increases the probability of default by (0.21*0.53 =) 0.11 on the mean of the left hand side variable of 0.11. In column (2), I examine how a fall in net worth and rise in leverage affects the probability of default. The coefficient estimates imply that a one standard deviation drop in net worth to total assets ratio (1.9) increases the probability of default by (1.9*0.019 =) 0.04 and a one standard deviation increase in leverage (0.20) increases the probability of default by (0.20*0.44=) 0.09. Even with the lower coefficient estimate on profitability in column (3), a one standard deviation in profitability still leads to almost a 0.08 increase in the probability of default.

In columns (3) and (4), I examine how default at time *t* affects the amounts available under the line of credit at time *t+1*. More specifically, I estimate:

$$Line_{it} = \alpha_i + \alpha_t + \beta X_{i,t-1} + \gamma * Default_{i,t-1} + \varepsilon_{it} \quad (3)$$

The sample includes only those firm-year observations where a line of credit was present at *t-1*, and standard errors are heteroskedasticity-robust, clustered at the firm level. Column (3) estimates equation (3) using the unused line of credit to total asset ratio. The point estimate implies that unused lines of credit fall by 0.04 when the firm defaults on its covenants, a result that is statistically distinct from 0 at the 1 percent level. In this sample, the mean of the left hand side variable is 0.13, which implies that a covenant default reduces the unused portion of the line of credit by over 30 percent at the mean. In Column (4), I use the bank liquidity to total liquidity measure as the dependent variable and find similar results: a covenant default reduces the bank liquidity to total liquidity ratio by 0.128, which is almost 25 percent at the mean of the dependent variable.

Overall, the results in Tables 6 through 8 suggest that a bank line of credit ceases being a perfectly liquid substitute for cash if a firm experiences a drop in profitability. In particular, a drop in profitability leads to default on covenants, which in turn reduces availability under the line of credit. This finding helps explain why firms rely more heavily on cash in corporate liquidity management when experiencing a drop in profitability. The findings of this section also undermine the hypothesis in theoretical work that bank lines of credit are unconditional obligations. Banks use covenants to restrict credit.

B. Anecdotal evidence from 10-Ks

Firms discuss their available bank lines of credit and cash holdings together in the liquidity and capital resources sections of their annual 10-K SEC filings. In this section, I present anecdotal evidence based on quotations from the annual 10-K SEC filings that complement the large-sample statistical evidence presented above. The anecdotal evidence suggests that lines of credit are conditional on

maintenance of high profitability, and that lines of credit are not a perfectly liquid substitute for cash in all potential future states.

First, companies often stress the importance of profitability in their ability to maintain compliance with line of credit covenants and avoid default. For example, Pioneer Companies, in their FY 2003 annual 10-K SEC filing, notes with respect to its bank line of credit:

> If the required Lender-Defined EBITDA level under the Revolver is not met and the lender does not waive our non-compliance, we will be in default under the terms of the Revolver. Moreover, if conditions constituting a material adverse change occur, our lender can refuse to make further advances. Following any such refusal, customer receipts would be applied to our borrowings under the Revolver, and we would not have the ability to reborrow *(sic)*. This would cause us to suffer a rapid loss of liquidity, and we would lose the ability to operate on a day-to-day basis.

The language in Pioneer's filing implies that profitability is the key to avoidance of default, and it emphasizes how serious a potential default on the line of credit is to the company. Mace Security makes a similar point in their FY 2002 annual 10-K SEC filing with respect to its bank line of credit arrangements:

> The Company's ongoing ability to comply with its debt covenants under its credit arrangements and refinance its debt depends largely on the achievement of adequate levels of cash flow. Our cash flow has been and can continue to be adversely affected by weather patterns and the economic climate. In the event that non-compliance with the debt covenants should reoccur, the Company would pursue various alternatives to successfully resolve the non-compliance, which might include, among other things, seeking additional debt covenant waivers or amendments, or refinancing of debt with other financial institutions.

Banks often condition the availability of the line of credit on profitability, and a drop in profitability makes the violation of bank covenants more likely. The anecdotal evidence suggests that, even among firms that have access to lines of credit, management understands the pressure to maintain high profitability to allow for additional bank financing. Metretek, Inc. discusses the revolving credit facility of one of its subsidiaries in its FY 2001 filing:

> Our current Credit Facility has a number of financial covenants that Southern Flow must satisfy. Southern Flow's ability to satisfy those covenants depends principally upon its ability to achieve positive operating performance. If Southern Flow is unable to fully satisfy the financial covenants of the Credit Facility, it will breach the terms of the Credit Facility … Any breach of these covenants could result in a default under the Credit Facility and an acceleration of payment of all outstanding debt owed, which would materially and adversely affect our business.

This language is very common when management discusses covenants on bank lines of credit in the annual report. At the same time, managers rarely mention any concern with meeting covenants on *non-bank* debt agreements such as private placements or public issues. The anecdotal evidence suggests that binding covenants and prohibitive restrictions are associated with line of credit debt more than any other type of debt instrument.

The coefficient estimates in the previous section show that violations of covenants on lines of credit have a material effect on the availability of unused lines of credit. Anecdotal evidence provides complementary evidence of this fact. With respect to its syndicated line of credit, Total Renal Care Holdings notes in its FY 1999 annual 10-K SEC filing:

> When measured as of December 31, 1999, the company was not in compliance with certain formula-based covenants in the credit facilities. If the lenders do not waive this failure to comply, a majority of the lenders could declare an event of default, which would allow the lenders to accelerate payment of all amounts due under the credit facilities. Additionally, this noncompliance will result in higher interest costs, and the lenders may require additional concessions from the company before giving a waiver … Under these conditions, the company is currently unable to draw additional amounts under the credit facilities.

Bank creditors sometimes terminate the line of credit altogether when covenants are violated. As Tab Products notes in its FY 1999 filings:

> The Company does not currently maintain a line of credit. An unsecured revolving line of credit of $5.0 million was terminated as of June 22, 2000. The Company was out of compliance with two covenants under the line of credit at May 31, 2000.

While I urge caution in interpreting these anecdotes in isolation, I believe they provide complementary evidence when viewed in relation to the large sample statistical evidence presented above. Only firms that maintain high profitability avoid covenant defaults. Covenant defaults often lead to a restriction in the amount of credit available. The evidence suggests that bank lines of credit are not a perfectly liquid substitute for cash when firms experience drops in profitability.

VI. Relationship to research on cash holdings

Bank lines of credit are an integral component of corporate liquidity management, yet have not been addressed in the literature on cash holdings and liquidity. In this section, I relate my findings with the empirical findings of ACW (2004). Their important insight, described above in Section II, is that

financially constrained firms are more likely to save cash out of cash flow. They empirically examine their model by sorting firms into financially constrained and unconstrained categories based on four measures: the payout ratio of firms, the size of firms, whether the firm has bond rating, and whether the firm has commercial paper rating.[16] I replicate their sorting procedure in my sample. In addition, I sort my sample based on access to lines of credit: those firms that have access to a line of credit throughout the sample are considered unconstrained and those that do not are considered constrained. Given that theoretical research emphasizes the importance of bank lines of credit in reducing potential financing constraints and providing liquidity, this categorization is a natural extension of their analysis.

[TABLE 9]

Table 9 presents the unconditional correlations between the measures of financial constraints used in ACW (2004) and the measure based on access to lines of credit. As the first column demonstrates, the measures are highly correlated. In terms of magnitudes, the bank line of credit access measure is most correlated with the size measure of financial constraints. This is consistent with the evidence in Tables 4 and 5 that larger firms more heavily utilize lines of credit. The correlations suggest that the measures of financial constraints used in ACW (2004) may be proxies for the availability of lines of credit.

[TABLE 10]

Table 10 examines the cash flow sensitivity of cash for various sub-samples based on measures of financial constraints used in ACW (2004). More specifically, the coefficient estimates presented in Table 10 are the outcome of firm fixed effects regressions relating the difference in cash holdings from *t-1* to *t* on cash flow, a measure of investment opportunities (*Q)* and the natural logarithm of total assets, all measured at time *t*. The estimations replicate the estimations that generate results reported in Table III of ACW (2004). Row (1) shows that firms without access to lines of credit in all years of the sample save a positive amount of cash out of cash flow, a result that is statistically distinct from 0 at the 1 percent level. There is no such effect for firms that have access to bank lines of credit. The coefficient estimates for the two samples are statistically distinct from one another at the 10 percent level. I also examine whether the cash-cash flow sensitivity is higher in the constrained samples based on categorizations used in ACW

(2004). The coefficient estimates in rows (2) through (5) demonstrate that the cash-cash flow sensitivity results of ACW (2004) are robust in my sample, with the exception of the bond rating categorization. In terms of statistical significance, the cash-cash flow sensitivity estimates are statistically distinct between the constrained and unconstrained samples at the 8 percent level for the size categorization and the 4 percent level for commercial paper rating categorization. Given that firms are required to have back-up lines of credit to obtain a commercial paper rating, the last result is closely related to the line of credit measure of financial constraints.

The results in Table 10 are not meant to show that access to a line of credit is a "better" measure of financial constraints, in a statistical sense, than the ACW (2004) measures. Instead, the use of access to lines of credit as a measure of constraints helps isolate a precise mechanism, grounded in theoretical research, which helps to explain the results of their paper. There are two advantages of using limited access to lines of credit as a measure of financial constraints. First, theoretical research argues that the primary function of bank lines of credit is to hedge against future capital market frictions. While there are theoretical justifications for why larger firms or firms with high payout ratios are less subject to capital market frictions, they are less direct and more difficult to defend (see, for example, Kaplan and Zingales, 1997). Second, there are a number of reasons that firms are larger or have higher payout ratios; identification of the reasons why certain firms are financially constrained is therefore more difficult using these measures. Alternatively, the reasons that firms may or may not have access to lines of credit are more quantifiable; quantifying these reasons is a main contribution of this paper.

The results presented in Table 10 show that access to bank lines of credit is a measure of constraints that is consistent with the results in ACW (2004). The findings in earlier sections help to quantify why some firms are constrained and others are not. More specifically, I find that firms with low profitability and higher probabilities of economic or financial distress are unable to obtain bank lines of credit. Even firms that have lines of credit may lose access to liquidity if they experience a drop in profitability. The results quantify a mechanism through which the findings of ACW (2004) operate; firms that are unable to obtain lines of credit (due to low profitability) save higher cash out of cash flows.

VII. Conclusion

This paper empirically examines the distribution of bank lines of credit among corporations. It makes contributions to both the literature on bank lines of credit and the literature on cash and corporate liquidity management. I provide empirical support for existing theoretical models on bank lines of credit by showing that this financial product is characterized by flexibility. Bank lines of credit are the marginal source of debt financing and changes in leverage ratios. I also find that the supply of lines of credit by banks is particularly sensitive to the profitability of the borrower. Banks are less willing to extend lines of credit to firms with low historical profitability, and this result is strongest among firms with a higher probability of financial or economic distress. Finally, bank lines of credit are not unconditional liquidity insurance, as is assumed in much of the theoretical literature. Banks employ financial covenants on profitability, and reduce the availability of the unused portion when a firm violates covenants.

This paper also contributes to the literature on cash holdings and corporate liquidity. The existing literature maintains that firms that face difficulties in obtaining financing at a future date hold more cash balances, and save more cash out of cash flows. The existing literature does not address whether bank lines of credit can reduce future financial market frictions, and thus reduce the need to hold cash as a source of liquidity. My findings imply that bank lines of credit are an available substitute for cash in the liquidity management of only profitable firms with low probabilities of financial distress. Even among firms that obtain a line of credit, the line of credit is a poor substitute for cash in future states where profitability drops. Although theoretical research argues that bank lines of credit provide insurance against frictions in future spot markets, the empirical findings presented here suggest that such insurance is available only to firms that maintain high profitability. I therefore identify a precise constraint that leads some firms to hold higher cash balances as liquidity protection: firms without access to a line of credit (due to low profitability) hold higher cash balances and save more of their cash flows as cash.

The results presented here point to two avenues of future research. First, I find preliminary evidence that the supply of bank lines of credit is more sensitive to firm profitability than the supply of any other type of debt instrument. It may be the case that the flexibility of bank lines of credit makes

them especially prone to abuse by management in times of financial or economic distress. Term bank debt or public sources of debt require intense investigation when an additional dollar of credit is extended, whereas borrowers can draw down quickly and easily on an existing line of credit. Potential abuse may explain why the supply of bank lines of credit is more sensitive to firm profitability than other debt instruments. A theoretical framework is needed to formalize this intuition, and further empirical analysis is needed to confirm the preliminary evidence.

Second, I accept in this paper the argument in ACW (2004) that the cash flow sensitivity of cash is a measure of financial constraints, and not simply a proxy for the investment opportunities of the firm. The findings of this paper suggest that the ability to obtain a bank line of credit is a main determinant of whether firms show a higher cash flow sensitivity of cash. Does the inability to obtain a bank line of credit represent a "financial" constraint, or simply lower investment opportunities? In other words, is there a quantifiable capital market imperfection that leads some firms to be unable to obtain a bank line of credit? For example, it could be the case that information asymmetry between banks and borrowers is very severe; as a result banks place extremely tight covenants on lines of credit and ration credit to borrowers (who may have good projects) that have observably low historical profitability. The findings of this paper suggest that further research into possible frictions in the market for bank lines of credit may prove fruitful in understanding the nature of financial constraints.

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Total Renal Care Holdings, 1999, 10-K, Available from Thomson Research.

[1] Although corporations are only required to report the details of long-term debt, almost all corporations also provide information on their short-term debt.

[2] Compustat items 13 and 6 are available for the previous 3 years for 1,838 of the 1,916 firm-year observations, and for the previous 2 years for 1,914 firm-year observations. When not available for the previous 3 years, I use whichever of the 3 years are available to construct the average.

[3] Kashyap, Rajan, and Stein (2002) and Carey, Post, and Sharpe (1998) provide theoretical and empirical results that commercial banks and financing companies are distinct in their propensity to provide lines of credit and in their general lending behavior. Unfortunately, these data do not allow me to evaluate these findings.

[4] There is also research on the supply of bank lines of credit. Boot, Greenbaum, and Thakor (1993) discuss why discretion can be optimal in financial contracting. Their model can be interpreted as support for why banks maintain a level of discretion in deciding whether or not to allow a borrower to draw down on a line of credit. Kashyap, Rajan, and Stein (2002) focus on the supply of lines of credit by banks, but do not explore how borrower characteristics influence the willingness to supply.

[5] Holmstrom and Tirole (1998) emphasize that the line of credit must be irrevocable, and that the liquidity shock is verifiable. In other words, there is no possibility that borrowers misallocate the funds available under the line of credit. In addition, Holmstrom and Tirole (1998) emphasize that other types of financing arrangements may serve the purpose of a bank line of credit in their model, as long as the arrangement provides unconditional financing.

[6] Based on feedback from seminar participants and readers, I have used slightly different measures from those in the previous literature.

[7] I have used the interest coverage ratio and Altman's Z Score (1968) as alternative measures of the supply elasticity of lines of credit with respect to firm quality and obtained similar results (unreported).

[8] Between, or firm-means, estimation produces coefficient estimates and levels of significance that are very similar to the pooled OLS regressions. Given that the dependent variables have a minimum value of 0, I also use maximum likelihood tobit estimation which yields very similar results (unreported).

[9] This informal argument also implies that firms with higher profitability obtain lines of credit at cheaper prices. I use quantities in the empirical analysis instead of prices for two reasons: first, prices are not directly available from annual 10-K SEC filings, and only a small number of firms can be directly linked to price datasets such as Dealscan

by the Loan Pricing Corporation. Second, the price at which a bank is willing to supply a line of credit is unobserved when the borrower does not obtain a line of credit.

[10] In a robustness section at the end of this section, I consider two issues which may cause corporate demand for lines of credit relative to cash to shift with profitability: corporate tax considerations and corporate governance considerations.

[11] By construction, the *bank liquidity to total liquidity ratio* is simply *1 – (cash to total liquidity ratio).* The coefficient estimates are the same in magnitude and statistical significance but with the opposite sign if one examines *cash to total liquidity ratio* as the left hand side variable.

[12] Throughout this paper, levels of significance that compare coefficient estimates across samples are obtained by grouping all firms into one sample, and estimating a fully interacted model. This produces identical coefficient estimates, and the levels of significance are based on the interaction terms.

[13] I thank John Graham for providing these data. The data are described more fully in Graham (1996).

[14] Unfortunately, companies do not always detail on their 10-K *why* a covenant default occurs. They will often just relay that they have violated a debt covenant, but will often not give a further explanation.

[15] I estimate equation (1) above using a linear probability specification instead of maximum likelihood probit or logit specification for two reasons. First, probit fixed effects estimation suffers from the incidental parameters problem, which leads to intractable estimation of firm fixed effects (see Greene (2000), 837). Second, most specifications in this paper are linear, and I want to remain consistent in interpretations of coefficients as marginal linear changes at the mean. Finally, I estimate equation (1) using fixed effects in a maximum likelihood logit specification, and find almost identical results to the linear probability model reported.

[16] For details, see ACW (2004), pages 1789-1790.

Table 1
Summary Statistics

This table presents summary statistics for a random sample of 300 firms from 1996 through 2003, for a total unbalanced panel of 1,916 firm-year observations. Data on lines of credit and the portfolio of debt come from direct examination of annual 10-K SEC filings. All other data are from Compustat. *Bank liquidity to total liquidity* is the ratio of unused bank lines of credit to the sum of unused bank lines of credit and balance sheet cash holdings.

	Mean	Standard Deviation	Fraction with type of debt
Lines of credit, scaled by total assets			
Total line of credit	0.154	0.168	0.735
Used line of credit	0.056	0.097	0.481
Unused line of credit	0.098	0.124	0.706
Bank liquidity to total liquidity	0.438	0.374	
Portfolio of debt, scaled by total assets			
Total debt	0.206	0.199	0.812
Used line of credit	0.056	0.097	0.481
Term bank debt	0.034	0.085	0.334
Arm's length debt	0.061	0.126	0.304
Public debt	0.032	0.091	0.142
Private placements	0.022	0.078	0.130
Industrial revenue bonds	0.004	0.016	0.115
Commercial paper	0.003	0.020	0.045
Convertible debt	0.019	0.070	0.134
Private non-bank debt	0.016	0.056	0.224
Capitalized leases	0.007	0.026	0.330
Other debt	0.014	0.042	0.397
Earnings measures			
EBITDA/assets	0.055	0.221	
Average of 3-year lagged EBITDA/assets	0.058	0.213	
EBITDA variance (Mackie-Mason)	0.092	0.109	
Measures of information asymmetry			
Equity traded over the counter	0.141	0.348	
NOT in S&P 500, mid 400, or small 600	0.689	0.463	
Firm age (years since IPO)	14.2	12.5	
Other firm characteristics			
Market to book ratio	2.017	1.875	
Tangible assets to total assets ratio	0.279	0.220	
Total sales ($M)	1503	5034	

Table 2
Cross-Utilization Patterns For Types of Debt

This table presents cross-utilization rates for different types of debt. The columns represent the conditional sample, and the rows represent which other types of debt firms in the conditional sample have. For example the figure in column 1, row 4 means that a fraction of 0.400 firms that have a line of credit also have outstanding term bank debt.

	Conditional on having:			
	Line of credit	Term bank debt	Arm's length debt	No debt
Also have:				
Line of credit	1.000	0.880	0.960	0.300
Used portion of line of credit	0.654	0.673	0.627	0.000
Unused portion of line of credit	0.960	0.822	0.943	0.300
Term bank debt	0.400	1.000	0.419	0.000
Arm's length debt	0.397	0.381	1.000	0.000
No debt	0.077	0.000	0.000	1.000

Table 3
The Flexibility of Lines of Credit

This table reports the frequency of annual adjustments in debt levels and leverage ratios, and decomposes the adjustment by type of debt. For example, 0.147 of all firm-year observations for firms with lines of credit experienced a reduction in the debt to lagged assets ratio of more than 0.05, and these firms reduced their line of credit to lagged assets ratio by 0.058. Firms with lines of credit include any firm that has a line of credit in any year of the sample.

Panel A: Adjustments to debt, as percentage of lagged assets

$$\frac{X_t - X_{t-1}}{A_{t-1}}$$

	Firms with lines of credit						All Firms					
	Fraction with adjustment	Line of credit	Term bank	Arm's length	Conv. Debt	Private non-bank	Fraction with adjustment	Line of credit	Term bank	Arm's length	Conv. Debt	Private non-bank
Adjustment <= - 0.05	0.147	-0.058*	-0.022	-0.014	-0.005	-0.008	0.128	-0.054*	-0.021	-0.014	-0.009	-0.012
-0.05 <Adjustment<= -0.01	0.172	-0.010	-0.008	-0.003	-0.001	-0.003	0.152	-0.010	-0.007	-0.002	-0.001	-0.003
0.01 <=Adjustment< 0.05	0.119	0.016*	0.002	0.009	-0.001	-0.001	0.104	0.010	0.004	0.007	-0.001	0.003
0.05 <=Adjustment	0.300	0.084*	0.046	0.047	0.019	0.006	0.241	0.075*	0.045	0.044	0.029	0.009

Panel B: Adjustments to leverage ratio

$$\frac{X_t}{A_t} - \frac{X_{t-1}}{A_{t-1}}$$

	Firms with lines of credit						All Firms					
	Fraction with adjustment	Line of credit	Term bank	Arm's length	Conv. Debt	Private non-bank	Fraction with adjustment	Line of credit	Term bank	Arm's length	Conv. Debt	Private non-bank
Adjustment <= - 0.05	0.156	-0.049*	-0.019	-0.015	-0.010	-0.008	0.134	-0.045*	-0.018	-0.014	-0.014	-0.012
-0.05 <Adjustment<= -0.01	0.217	-0.011	-0.007	-0.006	0.000	-0.002	0.189	-0.011*	-0.006	-0.005	0.000	-0.003
0.01 <=Adjustment< 0.05	0.159	0.013*	0.003	0.007	0.005	-0.001	0.139	0.010	0.004	0.006	0.004	0.001
0.05 <=Adjustment	0.209	0.060*	0.024	0.020	0.014	0.002	0.176	0.049*	0.025	0.020	0.021	0.005

* Significantly different from all other categories of adjustment at 10 percent level

Table 4
Line of Credit to Total Assets Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled regressions relating lines of credit to characteristics of the firm. All dependent variables in columns (1) through (6) are scaled by total assets. Dependent variables in columns (7) and (8) are scaled by total debt, and the sample includes only firm-year observations where the book debt to assets ratio is at least 0.05. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	Scaled by Total Assets, Full Sample						**Scaled by Total Debt, Debt to Assets >= 0.05**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Total line	Used line	Unused line	Term bank	Arm's length	Convertible	Used line	Unused line
Earnings measures								
Average of 3-year lagged EBITDA/assets	0.161**	0.055**	0.105**	0.027	-0.118**	-0.050**	0.543**	1.224**
	(0.038)	(0.017)	(0.029)	(0.016)	(0.022)	(0.016)	(0.126)	(0.395)
EBITDA variance	-0.043	-0.054	0.011	-0.070**	-0.011	-0.054	0.219	1.272
	(0.065)	(0.032)	(0.051)	(0.024)	(0.025)	(0.030)	(0.197)	(1.014)
Measure of information asymmetry								
Equity traded over the counter	0.013	0.032	-0.020	0.029*	-0.001	-0.001	-0.036	-0.218
	(0.023)	(0.018)	(0.012)	(0.012)	(0.009)	(0.008)	(0.049)	(0.121)
NOT in S&P 500, mid 400, or small 600	0.056**	0.039**	0.017	0.036**	0.014	-0.005	0.058	-0.106
	(0.017)	(0.009)	(0.013)	(0.010)	(0.015)	(0.008)	(0.045)	(0.090)
Ln[1+Firm age (years since IPO)]	-0.050**	-0.024**	-0.026**	-0.013*	0.017*	-0.002	-0.076**	-0.107**
	(0.008)	(0.005)	(0.006)	(0.005)	(0.008)	(0.003)	(0.022)	(0.044)
Other firm characteristics								
Market to book ratio (lagged)	-0.009**	-0.004**	-0.005**	-0.003**	-0.002	0.000	0.005	-0.008
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.009)	(0.022)
Tangible assets to total assets ratio (lagged)	0.066	0.045	0.021	0.023	0.060	-0.004	-0.105	-0.419*
	(0.036)	(0.025)	(0.024)	(0.023)	(0.041)	(0.012)	(0.089)	(0.197)
Ln[Total sales ($M)] (lagged)	0.016**	0.006**	0.010**	0.006	0.032**	0.000	-0.017	-0.010
	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)	(0.011)	(0.021)
N	1916	1916	1916	1916	1916	1916	1260	1260
R^2	0.20	0.16	0.14	0.08	0.38	0.07	0.16	0.09

**, * signify that the coefficient estimate is significantly different than 0 at the 1 and 5 percent confidence level, respectively

Table 5
Bank Liquidity to Total Liquidity Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled regressions relating the unused line of credit to unused line of credit plus balance sheet cash ratio (the bank liquidity to total liquidity ratio) to characteristics of the firm. Columns (1) through (3) report coefficient estimates from pooled regressions; columns (2) and (3) split the sample based on the debt to total assets ratio (*D/A*) of the firm-year observation. Columns (4) through (6) report coefficient estimates from fixed effects regressions; columns (5) and (6) split the sample based on the *average* debt to total assets ratio (*D/A*) of the firm over the sample. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	Pooled			**Fixed effects**		
	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	Full	High D/A	Low D/A	Full	High D/A	Low D/A
Dep. Variable (scaled by total liquidity):	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity
Earnings measures						
Average of 3-year lagged EBITDA/assets	0.208**	0.783**,+	0.120			
	(0.076)	(0.119)	(0.090)			
EBITDA/assets (lagged)				0.134**	0.319**,+	0.087
				(0.049)	(0.111)	(0.056)
EBITDA variance	-0.233	0.207	-0.216	-0.104	0.136	-0.209
	(0.123)	(0.301)	(0.118)	(0.143)	(0.346)	(0.151)
Measure of information asymmetry						
Equity traded over the counter	0.050	-0.059	0.084			
	(0.044)	(0.065)	(0.052)			
NOT in S&P 500, mid 400, or small 600	0.067	-0.016+	0.114*			
	(0.038)	(0.037)	(0.052)			
Ln[1+Firm age (years since IPO)]	-0.026	-0.026	-0.002			
	(0.017)	(0.019)	(0.025)			
Other firm characteristics						
Market to book ratio (lagged)	-0.021**	-0.025	-0.013**	-0.002	-0.004	0.000
	(0.006)	(0.013)	(0.005)	(0.002)	(0.008)	(0.002)
Tangible assets to total assets ratio (lagged)	0.239**	0.011+	0.250	0.286*	0.145	0.441**
	(0.079)	(0.082)	(0.131)	(0.113)	(0.149)	(0.142)
Ln[Total sales ($M)] (lagged)	0.069**	0.047**	0.052**	-0.001	-0.023	0.018
	(0.009)	(0.010)	(0.015)	(0.015)	(0.024)	(0.017)
N	1916	958	958	1916	933	983
R^2	0.37	0.32	0.30	0.74	0.73	0.60

**,* distinct from 0 at 1 and 5 percent, respectively; + distinct from low D/A sample at 10 percent or better

Table 6
Covenant Data from Dealscan

This table presents the fraction of lines of credit that have various types of financial covenants. The sample includes 19,523 sole lender and syndicated lines of credit obtained by non-financial businesses from 1996 to 2003, and comes from Dealscan by the Loan Pricing Corporation. Lines of credit can have more than one type of financial covenant.

Type of covenant	Fraction of loans	Type of covenant	Fraction of loans	Type of covenant	Fraction of loans
Cash flow/profitability based	0.381	Net worth based	0.232	Balance sheet based	0.192
Fixed charge coverage	0.180	Total net worth	0.122	Leverage ratio	0.064
Debt service coverage	0.060	Financial net worth	0.110	Current ratio	0.084
Interest coverage	0.185			Debt to equity	0.005
Cash interest coverage	0.009			Debt to total net worth	0.073
Debt to cash flow	0.237				
Senior debt to cash flow	0.045				
Any financial covenant	**0.487**				

Table 7
Covenant Default Data from Annual 10-K SEC Filings

This table presents the fraction of firm-year observations in the random sample of 300 firms (1,916 firm-year observations) where a "default" on a debt agreement has taken place. Any missed interest payment or technical financial covenant violation is considered a default.

Any	Line of credit	Term bank	Arm's length	Non-bank private	Convertible
0.092	0.079	0.033	0.002	0.006	0.001

Table 8
Earnings, Covenant Defaults, and Restrictions on Unused Lines of Credit

This table reports coefficient estimates from fixed effects regressions. Columns (1) and (2) relate the probability of default at time *t* to various financial measures at time *t*. The sample for columns (1) and (2) include all firm-year observations where the firm has a line of credit. Column (3) relates the amount of unused lines scaled by total assets at time *t* to whether a default occurred at *t-1*. Column (4) relates the amount of unused lines scaled by unused lines plus balance sheet cash (the bank liquidity to total liquidity ratio) at time *t* to whether a default occurred at *t-1*. The sample for columns (3) and (4) include all firm-years where the firm had a line of credit at *t-1*. Standard errors are heteroskedasticity-robust, clustered at the firm.

	(1)	(2)	(3)	(4)
Sample	Has line $_t$	Has line $_t$	Had line $_{t-1}$	Had line $_{t-1}$
Dependent Variable	Default$_t$	Default$_t$	(Unused line/assets)$_t$	(Bank liquidity/ Total liquidity)$_t$
(EBITDA/assets) $_t$	-0.531**	-0.369*		
	(0.151)	(0.156)		
(Net worth/assets) $_t$		-0.019*		
		(0.007)		
(Book debt/assets) $_t$		0.441**		
		(0.134)		
Default $_{t-1}$			-0.041**	-0.128**
			(0.010)	(0.038)
(EBITDA/assets) $_{t-1}$			0.094	0.155
			(0.056)	(0.086)
Market to book $_{t-1}$			-0.004	-0.010
			(0.003)	(0.005)
(Tangible assets/total assets)$_{t-1}$			-0.030	0.298
			(0.062)	(0.160)
Ln(firm sales) $_{t-1}$			-0.019	-0.013
			(0.017)	(0.033)
# Firm-years	1409	1409	1203	1203
# Firms	252	252	249	249
R^2	0.23	0.26	0.54	0.63

**,* signify that the coefficient estimate is significantly different that 0 at the 1 and 5 percent confidence level, respectively

Table 9
Correlation with Other Measures of Financial Constraints

	Access to line of credit	Payout decile	Size decile	Bond rating
Payout ratio decile	0.256			
Size decile	0.330	0.378		
Bond rating	0.262	0.271	0.639	
CP rating	0.186	0.265	0.406	0.480

*Note: All correlations are statistically distinct from 0 at the 1 percent level.

Table 10
Availability of Bank Lines of Credit and the Cash Flow Sensitivity of Cash

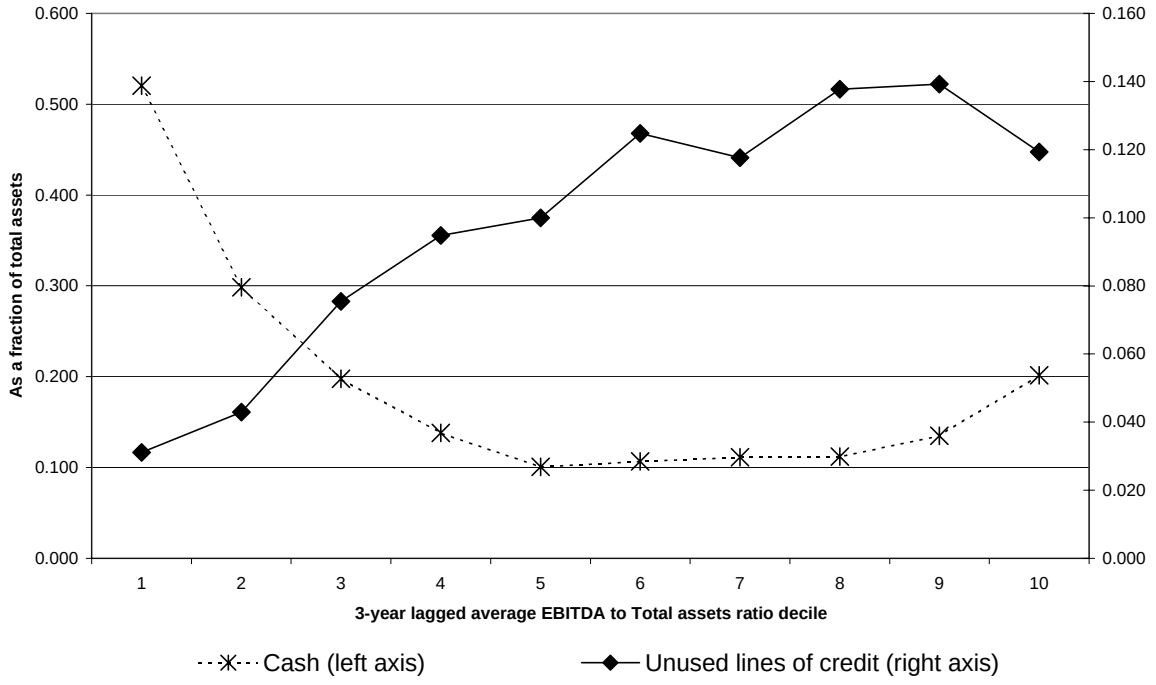
This table presents coefficient estimates from a regression relating the change in cash holdings to cash flow. The estimation follows that of Almeida, Campello, and Weisbach (2004), which they describe in their equation (8) and Table III. All estimations include year and firm fixed effects. Standard errors are heteroskesticity-robust, clustered at the firm.

Dependent variable Δ Cash Holdings	Cash Flow	Q	Size	R^2
1. Lines of credit				
Not available in all years	0.117**,+	0.000	-0.024*	0.14
	(0.043)	(0.004)	(0.012)	
Available in all years	0.020	-0.002	-0.007	0.14
	(0.041)	(0.007)	(0.007)	
2. Payout ratio				
Lowest 3 deciles	0.136*	0.000	-0.021	0.21
	(0.053)	(0.006)	(0.013)	
Highest 3 deciles	0.044	0.002	-0.011	0.35
	(0.092)	(0.006)	(0.015)	
3. Firm size (assets)				
Smallest 3 deciles	0.107*,+	0.000	-0.015	0.18
	(0.051)	(0.006)	(0.020)	
Largest 3 deciles	-0.057	0.005	0.002	0.22
	(0.073)	(0.005)	(0.010)	
4. Bond ratings				
Has a rating	0.092**	-0.003+	-0.024*,+	0.15
	(0.035)	(0.004)	(0.010)	
Does not have a rating	0.102	0.014*	0.009	0.12
	(0.117)	(0.006)	(0.012)	
5. Commercial paper ratings				
Has a rating	0.091**,+	-0.001	-0.019*	0.13
	(0.033)	(0.004)	(0.008)	
Does not have a rating	-0.202	0.003	-0.002	0.16
	(0.136)	(0.004)	(0.007)	

**,* distinct from 0 at 1 and 5 percent, respectively; + distinct from unconstrained sample at 10 percent or better

Figure 1

Panel A: Cash and unused lines of credit across the profitability distribution



Panel B: Unused lines of credit to unused lines of credit plus balance sheet cash ratio (Bank liquidity to total liquidity ratio)