Bank Lines of Credit in Corporate Finance: An Empirical Analysis

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August 2005

Abstract

Public firms utilize bank lines of credit, or revolving credit agreements, more than any other debt instrument. Using novel data collected directly from firms' annual 10-K SEC filings, I empirically evaluate the use of bank lines of credit in corporate finance. I find that bank lines of credit are a flexible source of debt financing; line of credit debt is adjusted upward and downward more often and in larger magnitude than any other debt instrument. The flexibility of bank lines of credit makes the standard agency problems of debt more severe. As a result, banks only extend lines of credit to firms with high profitability, and banks carefully manage the unused portion of the line of credit with covenants on profitability. Even among firms that have access to lines of credit, the firm often loses access to the unused portion when it experiences a negative profitability shock. Lines of credit provide flexibility, but that flexibility is closely managed.

*I thank Michael Faulkender, David Matsa, James Poterba, Antoinette Schoar, Jeremy Stein, and Philip Strahan for helpful comments and discussions. This work benefited greatly from seminar participants at the Federal Reserve Bank of New York (Banking Studies) and the University of Rochester (Simon). I gratefully acknowledge financial support from the FDIC's Center for Financial Research.

Public firms in the United States utilize bank lines of credit, or revolving credit agreements, 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 on corporate balance sheets represent 10 percent of total assets. Despite the importance of bank lines of credit, the absence of data has limited existing empirical research on their role in corporate financing decisions. While a number of articles discuss the theoretical foundations for the existence of lines of credit,[1] empirical evidence is limited.[2]

A line of credit, also referred to as a loan commitment or revolving credit facility, provides a firm with a nominal amount of debt capacity against which the firm draws funds. In this paper, I examine a novel data set to analyze how lines of credit fit into the overall financial structure of U.S. public firms. The data cover 300 randomly sampled Compustat firms from 1996 to 2003 for an unbalanced panel of 1,916 firm-year observations. In constructing this data set, I collect detailed information on the sources of corporate debt and the amount of used and unused bank lines of credit. I use this data set to explore which types of firms utilize lines of credit, how they use them, and how banks manage lines of credit. This paper is the first, to my knowledge, to explore these issues in a large sample of publicly traded firms.

Based on the empirical results, the central hypothesis I put forth in this paper is that bank lines of credit provide a unique source of financial flexibility to firms that obtain them. This flexibility, however, makes the standard agency problems of debt more severe. As a result, banks extend credit mainly to firms with higher profitability, and banks carefully manage lines of credit through covenants on profitability. My results suggest that bank lines of credit are not, as implicitly assumed in the existing literature, unconditional obligations of banks to firms. Instead, banks use financial covenants to condition

[1] Examples of articles that discuss the theoretical foundations of lines of credit include Berkovitch and Greenbaum (1991); Boot, Thakor, and Udell (1987); Duan and Yoon (1993); Holmstrom and Tirole (1998); Maksimovic (1990); Martin and Santomero (1994); Morgan (1994); and Shockley and Thakor (1997).

[2] Empirical papers that examine lines of credit in the corporate financing decisions of firms include Agarwal, Chomsisengphet, and Driscoll (2004) and Ham and Melnik (1987). Agarwal, Chomsisengphet, and Driscoll (2004) also note the lack of empirical research on the use of lines of credit by corporations.

lines of credit on the borrower's profitability, and borrowers often lose access to credit when they experience a negative earnings shock.

The exposition of this central finding is developed in three steps. First, I document that, consistent with theoretical research and survey data, a unique characteristic of bank lines of credit relative to other forms of debt is flexibility. 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. This finding suggests that lines of credit provide a particularly flexible source of financing for the firms that obtain them. Theoretical research hypothesizes that lines of credit are the marginal source of debt financing, and the results presented here are consistent with this hypothesis.

The rest of the paper analyzes the implications of this flexibility. The empirical results suggest that the flexibility provided by lines of credit makes the standard agency problems associated with debt particularly severe. In a world where actions were perfectly observable, bank lenders would condition the availability of the unused portion of a line of credit on the particular investment that the firm is undertaking. In other words, firms would be able to draw down on their unused line of credit only when projects are profitable and the bank is guaranteed a return. If banks cannot write such a contract, then lines of credit are especially prone to corporate abuse. For example, as in the model of Jensen and Meckling (1976), firms nearing financial distress may draw down on bank lines of credit to pursue risky projects with a high variance of returns. While this problem of "asset substitution" is generally true of all corporate debt, it is particularly acute for lines of credit because of their flexibility.

The second set of empirical results show that banks respond to these increased agency problems by extending lines of credit primarily to firms with an established record of profitability. I conduct a cross-section analysis of the debt profile of firms and find that more profitable firms use bank lines of credit to a greater degree. Profitable firms both hold higher *unused* balances of lines of credit, and maintain higher amounts of *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 line of credit debt to total assets ratio, and has a 25 percent higher unused bank lines of credit to total assets ratio. This result is particularly noteworthy given that previous empirical work finds that firms with higher profitability hold less debt generally (see, for example, Rajan and Zingales (1995)). I confirm in my sample that firms with higher profitability have lower ratios of other types of debt to total assets, while more heavily using bank lines of credit.

I also find that the positive relationship between earnings and the use of lines of credit is stronger among firms where problems of information asymmetry are more severe. The positive relationship between earnings and the use of lines of credit is particularly strong among smaller firms, firms not listed on a major exchange, and firms not listed in one of the three main S&P indices. Among firms with potentially severe agency problems of debt, banks extend lines of credit only to the most profitable firms.

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. Profitability covenants on lines of credit are not only common, but they are also the most likely to be violated.

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 0.11). 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. The results imply that banks contract

on profitability as the key performance measurement associated with the true return of incremental projects, and "manage" the unused portion of the line of credit through this measure.

This finding suggests that, in practice, a line of credit is a different financial product then is implicitly assumed in much of the theoretical literature. Most of the theoretical literature implicitly assumes that lines of credit are unconditional obligations of banks (see for example Holmstrom and Tirole (1998) and Boot, Thakor and Udell (1987)). 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 flexibility, but that flexibility is carefully managed.

Taken together, these three findings imply that lines of credit are a flexible source of financing used most heavily by firms with a polished record of profitability. Even among firms that obtain lines of credit, a negative profitability shock limits the availability of the unused portion. The findings suggest that lines of credit are closely monitored and managed by bank lenders, and that they may not be available to fund projects in times of economic or financial distress.

As an extension, I also offer preliminary evidence on how unused lines of credit fit into the growing body of literature on the role of cash in hedging against future income shortfalls (Almeida, Campello, and Weisbach (2004); Acharya, Almeida, and Campellow (2005)). I find evidence that firms without a bank line of credit hold higher cash balances, and this effect is strong, both in magnitude and statistical significance. On average, firms without a line of credit have a cash to assets ratio that is almost one full standard deviation higher (0.17) than firms that have a line of credit. In preliminary work, Rauh and Sufi (2005) explore more directly how firms use cash and unused lines of credit to hedge against potential cash flow shocks, and how firms with and without lines of credit differentially respond to liquidity shocks.

Existing empirical research on the use of lines of credit by borrowers is limited. There are two articles that are directly related to the research presented here. 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. Their analysis focuses only on firms that obtain lines of credit. They find evidence that firms with higher interest rates and fees have smaller credit lines. They also find that firms with higher profitability and higher working capital obtain larger credit lines. Finally, they find that firms that experience more uncertainty in their funding needs commit to smaller credit lines. There is also empirical research examining the supply side of lines of credit. Shockley and Thakor (1997) and Kashyap, Rajan, and Stein (2002) focus on contract structure of credit lines and the types of financial institutions that provide them. Saidenberg and Strahan (1999) and Gatev and Strahan (2005) use aggregate data on loans and commercial paper to show that lines of credit are drawn when commercial paper markets experience negative supply shocks.

This paper represents several innovations to the empirical literature on lines of credit and the role of banks in corporate finance. First, it is the first paper, to my knowledge, to systematically analyze balances of used and unused bank lines of credit at corporations. Kaplan and Zingales (1997) and Houston and James (1996) present data on unused lines of credit, but do not explore the relationship between lines of credit and firm characteristics. Unused lines of credit are a higher percentage of total assets for public firms than outstanding bank debt, yet have not been addressed systematically in the literature on the role of banks in corporate finance. Second, this paper is the first, to my knowledge, that analyzes the details of debt structure for public firms in any year after 1993. Third, this paper documents the use and violations of bank covenants, and explores the effect on the subsequent use of bank financing. Covenants are an important restriction associated with the use of debt, and have been explored in the literature (Bradley and Roberts (2004)); however, this paper is the first, to my knowledge, that explicitly collects and analyzes data on covenant violations and subsequent debt structure.

The rest of the paper is outlined as follows. In the next section, I describe bank lines of credit and the data, and I present summary statistics. The second section builds the basic theoretical framework that I use to motivate the empirical analysis. The third section documents that lines of credit are the marginal source of debt financing. The fourth section examines the characteristics of firms that most heavily utilize bank lines of credit. The fifth section presents evidence on how banks manage lines of credit by using financial covenants. The sixth section explores the effect on cash balances of obtaining a line of credit, and the seventh section concludes.

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

A. Description

Bank lines of credit are among the most widely used financial products among public corporations. 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 reports 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 above LIBOR, 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%. The line of credit is secured by substantially all of the Company's assets, including its membership interests and stock in its subsidiaries, and is senior to $5.1 million of subordinated indebtedness to a principal common stockholder (Lexent Inc. (2000)).

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 liquid asset of the firm (cash, accounts receivable, etc.). Covenants are an important component of understanding lines of credit, and something I explore further in the results.

B. Data

Despite the prominence of bank lines of credit in corporate finance, the existing empirical research on lines of credit is limited partially due to the lack of data. I attempt to bridge this gap in the existing research 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. Compustat contains valuable information regarding the debt structure, but does not detail the source of the debt or whether the debt is in the form of a line of credit. Compustat *item 34* represents "debt in current liabilities," and is broken down into "notes payable" (*item 206*) and "debt—due in one year" (*item 44*). Compustat *item 9* represents "long-term debt," and is broken down into "convertible debt" (*item 79*), "debt—subordinated" (*item 80*), "debt—notes" (*item 81*), "debt—debentures" (*item 82*), "long-term debt—other" (*item 83*), and "long-term debt—capitalized lease obligations" (*item 84*).

Using these variables, 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 whatsoever 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.[3] For example, the firm almost always reports the amount of a given debt issue or loan, if it is public or private, what is the source of the debt, and, in particular, whether the debt obligation is from a bank or other institution. Although all of this information is available in 10-K filings, none of these variables are available in Compustat. 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). To my knowledge, this paper is the first to collect these data on a large sample of public firms after 1993. In addition, although Houston and James (1996) and Kaplan and Zingales (1997) collect data on used and unused bank lines of credit, to my knowledge, this paper is the first to collect this information *and* systematically analyze it in a large sample of public firms.

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

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 years of continuous positive data on total assets (*item 6*), and 4 years of consecutive 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. More specifically, these variables are necessary in constructing the market to book ratio, book leverage, a measure of earnings, asset tangibility, and a measure of firm size (assets or sales). Finally, 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 for two reasons. First, existing research by Houston and James (1996, 2001), Johnson (1997), and Cantillo and Wright (2000) focuses on earlier periods. Second, 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 years of continuous data because I am particularly interested in how debt structure 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-K and financial footnotes on debt are not available for these historical data. I therefore include only firm-year observations where an actual 10-K exists for the year in question. 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. This dataset has almost twice the number of firm-year observations of any other study using similar data from annual 10-K SEC filings, with the exception of Cantillo and Wright (2000), who have a sample of 5,592 firm-years (291 firms).

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*). 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. In the analysis beginning in the next section, I follow the literature and Winsorize the market to book ratio and profitability measure at the 1st and 99th percentile. Outliers are common in Compustat data, and this is the standard procedure used in the literature to minimize the influence of extreme outliers.

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 of debt 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 bank debt, and I also collect data on unused lines of credit (which do not show up as used debt).

As mentioned above, 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. The line of credit data that is presented in this paper focus only on bank lines of credit. 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.[4] This is mainly 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, respectively. 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 I 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

[4] 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. An unfortunate aspect of the data set is that it does not allow me to evaluate these findings.

percent of book assets, with the used portion being 5.6 percent and the unused portion 9.8 percent. The average book debt to total assets ratio is 0.21, 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 I, I present the mean fraction of all firm-year observations where the type of debt obligation in question is greater than 0. Almost 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 financial 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 overwhelming majority of public firms do not use public sources of debt (see, for example, Faulkender and Petersen (2005)).

Table I shows that 74 percent of firm-year observations in a random sample of Compustat firms have a bank line of credit. Table II presents cross-utilization rates to emphasize this broad use of lines of credit by corporations. Each column in Table II 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. Table II demonstrates that there is widespread use of bank lines of credit across all types of public firms.

II. Theoretical framework

What is the role of bank lines of credit in corporate finance? In this section, I develop hypotheses based on previous theoretical research that attempts to answer this question. The first class of models from previous theoretical research uses problems of time inconsistency between borrowers and future creditors to motivate the use of lines of credit. These papers are in the spirit of the optimal contracting literature, and 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 ideas 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 an interim 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 him 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 high enough, the borrower will not be able to obtain funds even if the project has positive NPV, given that he must retain enough of the project return to maintain diligence. The second best solution requires that the borrower buy 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 then has access to 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 also have 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

[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.

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 the use of 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 actually refuse to allow the line of credit to be drawn. According to these models, if bank lines of credit are to solve these 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 and/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 should be the incremental form of debt financing.

Martin and Santomero (1997) provide a different approach to motivate the existence of lines of credit; they motivate lines of credit by assuming that firms desire speed and secrecy in pursuing investment opportunities. Given the need for speed and secrecy, their model assumes that lines of credit are optimal relative to other forms of debt, and explores the types of firms that will use lines of credit.

There is an implicit assumption that spot market financing requires time and makes investment decisions known to the product market competitors of the borrower. 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. Unlike the models above, the model by Martin and Santomero (1997) does not require lines of credit to be unconditional obligations, because there is no interim agency problem for the borrower.

While the existing theoretical research on lines of credit hypothesizes that lines of credit are notable because of their flexibility, none explore the potential agency problems associated with such flexibility. In this paper, I argue that an additional hypothesis is that the flexibility of lines of credit makes potential agency problems particularly severe. There are three examples of such agency problems: asset substitution, debt overhang, and private managerial benefits of operation. First, following Jensen and Meckling (1976), managers (representing shareholders) with outstanding debt obligations have incentives to engage in activities with small probabilities of large payoffs because they have a call option on the value of the firm. In this asset substitution theoretical framework, management (representing shareholders) experiences no downside to failure and thus has a strong incentive to draw down on the line of credit to pursue risky projects when bankruptcy is imminent. Second, similar to the debt overhang problem described by Myers (1977), managers may draw upon bank lines of credit to pay off senior debt claims that may be close to default. Third, if information asymmetry exists and managers have private benefits of ownership, then management may pursue non-profitable projects using lines of credit.

These agency problems are generally true of all debt obligations, *but they are especially severe with lines of credit*. Lines of credit are existing obligations against which firms can draw with speed and discretion. Alternative types of term debt require investigation by the debt holders upon initiation of the contract, and rigorous documentation. Lines of credit are especially prone to abuse precisely because of their flexibility. The case of Enron Corporation provides an interesting anecdote. In late October 2001, Enron drew down $3 billion on syndicated bank lines of credit (Emshwiller, Smith, and Sapsford (2001)).

Four days later, Moody's downgraded Enron's debt, and two weeks later, the SEC announced its accounting investigation that would eventually lead to the demise of the corporation. Upon the Chapter 11 filing in December, 2001, JPMorganChase announced that it had over $500 million in unsecured exposure and Credit Lyonnais had over $250 million in unsecured exposure.

Problems of asset substitution, debt overhang, and private benefits of operation are particularly severe for firms with low profitability; these agency problems imply that banks are less likely to extend lines of credit to firms that have low profitability. An additional implication is that banks will condition the availability of lines of credit on the maintenance of profitability measures.

III. Lines of credit and adjustments in debt

In this section, I examine the common hypothesis in the theoretical models described above that lines of credit are a unique source of financial flexibility. In Table III, I test this hypothesis by exploring 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.

Consistent with these models, Table III 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 upwards or downwards 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, used 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 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.

IV. Which types of firms use lines of credit?

In this section, I examine the cross-section patterns in the use of lines of credit by corporations. I empirically examine the theoretical hypotheses developed above in Section II, and focus in particular on the implications of the flexibility of lines of credit.

A. Empirical specification

I conduct a series of linear regressions in which a measure of lines of credit is regressed on firm characteristics. In particular, Tables IV through VI present estimated coefficients from the following specification:

$$Lines_{it} = \alpha_t + \beta X_{i,t-1} + \gamma * \Pr ofits_{i,t-1} + \delta * InfAsymmetry_{i,t-1} + \varepsilon_{it} \quad (1)$$

The left hand side variables are measures of lines of credit used by the firm. Lines of credit are scaled by total assets and total debt in alternative specifications. The measures of lines of credit are regressed on a series of lagged firm characteristics. The control variables included in the matrix *X* follow the existing 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 industry indicator variables. I am particularly interested in the effect of firm profitability on the use of firm lines of credit. 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*.[6] In the remainder of the text, I refer to this measure as simply "firm profitability." The coefficient γ measures the effect of firm profitability on the use of lines of credit. I also include a measure of the variability of profits. The exact measure 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 existing theoretical research implies that firms with a greater degree of information asymmetry use lines of credit more heavily. I construct measures of transparency that are consistent with measures in Faulkender and Petersen (2005) and Sufi (2005). Firms with equity listed on the New York Stock Exchange or available through NASDAQ receive wider analyst coverage and media attention. Likewise, firms 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 more attention. I use an indicator variable for whether the firm's equity trades

[6] I use an average of 3-year lagged profitability instead of a one-year lagged measure to capture a more rich history of the firm's profitability. The measure I use can also be thought of as an established historical reputation for profitability.

on the NYSE or NASDAQ and whether the firm is 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.

The estimation in equation (1) is carried out using pooled OLS regressions, where standard errors are adjusted for the correlation of unobservable errors across years for the same firm using clustering. This technique takes into account that unobservable errors are likely to be correlated for the same firm across years. 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).

B. Results

Table IV contains the estimated coefficients from the core regression specifications, where all measures of debt and lines of credit are scaled by total assets. In column (1), I report estimated coefficients from the regression of the book debt to total assets ratio on the independent variables; this can be viewed as the benchmark regression. The results are largely consistent with the findings in previous empirical research (Baker and Wurgler (2002), Rajan and Zingales (1995)). Firms with higher profitability and higher profit variability use less debt. Consistent with debt overhang, firms with higher growth opportunities, as measured by the market to book ratio, use less debt. Firms with more tangible assets are able to pledge a greater degree of collateral and therefore obtain more debt, and larger firms more heavily use debt. Finally, more transparent firms use less debt.

Columns (2) through (4) present coefficient estimates where measures of lines of credit are the dependent variables. The largest difference in the effect of firm characteristics on the use of lines of credit and debt generally is the effect of firm profitability. The estimate in column (2), which is statistically significant at the 1 percent level and has a *t*-statistic of 4.2, 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 about 22 percent at the mean of the dependent variable. The coefficient estimates in columns (3) and (4) 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. This result is particularly notable given that firms with higher profitability generally use less debt. It is worth emphasizing that the sample employed in Table IV is an unconditional sample of all Compustat firms, not just those that use debt.

The effect of variability of earnings does not appear to have a significant effect on the use of lines of credit. In terms of information asymmetry, the results in columns (2) through (4) imply that older firms and firms that are in a major S&P index hold lower balances of used and unused lines of credit, and the estimates are statistically distinct from 0. The coefficient estimates on firm age are particularly strong in magnitude, which suggests that older firms use lines of credit less heavily in their financing decisions. These results support the hypothesis that firms with a greater degree of information asymmetry more heavily use lines of credit.

In columns (5) and (6), I examine the effect of firm characteristics on the other two largest sources of debt, term bank debt and arm's length debt. While the effects of information asymmetry and other firm characteristics on the use of lines of credit and term bank debt are largely similar, there is a discrepancy when it comes to profitability. While the point estimate of the effect of profitability on the use of term bank debt is positive, it is not statistically distinct from 0 at a reasonable confidence level. In addition, the variability of profitability has a negative effect on the use of term bank debt. In column (6) the estimated coefficient on firm profitability implies that more profitable firms use less arm's length debt. The coefficient estimate is strong both in terms of magnitude and statistical significance; my results

imply the result in the literature that high profitability firms use less debt is driven primarily by arm's length debt.[7]

In Table V, I attempt to disentangle two distinct effects of firm profitability. The first is the effect of firm profitability on overall leverage ratios of firms, which I find to be negative in Table IV. The second is the propensity of profitable firms to use lines of credit versus *other types of debt*. In Table V, I isolate the latter effect by examining the line of credit to total *debt* ratio. I isolate the sample to only firm-year observations where the debt to total assets ratio is 0.05 or greater. The results in Table V show that more profitable firms are more likely to use lines of credit relative to other types of debt. The effect of profitability is both statistically and economically significant. For example, a one standard deviation increase in firm profitability leads to a (0.16*0.54=) 0.09 increase in the used line of credit to total debt ratio, which is (100*[0.09/0.30]=) 30 percent at the mean. Table V also shows that younger firms use more lines of credit relative to other forms of debt.

One of the hypotheses developed in Section II implies that banks extend larger lines of credit to profitable firms because of the agency problems associated with the flexibility of lines of credit. In Table VI, I attempt to more directly analyze this hypothesis by examining the interaction of profitability with measures of information asymmetry. The logic behind the interaction is as follows; if banks only extend credit to profitable firms primarily because of agency problems, the basic effect of profitability on the use of lines of credit should be strongest among less transparent firms. In Table VI, I report results from a regression of the used line of credit to total assets ratio on the same controls with the addition of interaction terms of firm profitability and information asymmetry. The level effect of firm profitability should be interpreted as the effect for "opaque" firms, and the effect of the interaction term shows whether this effect is distinct for "transparent" firms. Column (1) shows that the effect of profitability on the use of lines of credit is particularly large for small firms. The interaction term is negative, which implies that firm profitability has a smaller effect on the use of lines of credit for larger firms. Columns

[7] In unreported results, I also document that there exists a strong negative effect of firm profitability on the use of convertible debt. The negative effect of firm profitability on total debt is driven by the strong negative effect of firm profitability on the use of arm's length debt and convertible debt.

(2) and (3) show similar results when I use whether a firm has equity traded on the NYSE or through NASDAQ, or whether the firm is included in an S&P major index. When I use firm age, the results are less conclusive; the coefficient estimate on the interaction term is negative, but is only statistically distinct from 0 at the 12 percent level of confidence. Overall, the coefficient estimates in Table VI imply that the positive effect of profitability on the use of lines of credit is strongest among informational-opaque firms.

V. How banks manage lines of credit

The previous section demonstrates that, unlike other debt instruments, lines of credit are utilized primarily by firms with high profitability. In this section, I show that, even among firms that obtain lines of credit, banks condition the availability of the line of credit on measures of firm profitability.

A. Large sample evidence

In the theoretical section, I argue that lines of credit are especially prone to corporate abuse and agency problems given their flexibility. In this section, I show that banks understand these agency problems and employ covenants to address them. In particular, I focus on financial covenants, or covenants that require the maintenance of specified 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.

Table VII 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. According to interviews with employees of the Loan Pricing Corporation, the data in Dealscan represent a lower bound for the frequency of covenants. In other words, lines of credit often contain covenants that are not reported in Dealscan.

The factors leading the presence of covenants on bank debt are explored by Bradley and Roberts (2004). They find evidence that small borrowers, highly-levered borrowers, and borrowers with high growth opportunities are more likely to have covenants on their bank credit agreements. They interpret this as evidence that supports the agency theory of covenants; covenants on debt prevent opportunistic behavior by managers acting on behalf of shareholders and at the expense of debt holders. Their evidence is consistent with the interpretation of covenants provided in this paper. Covenants exist to prevent corporate abuse by management at the expense of the bank providing the line of credit.

In Table VII, I display covenant data from Dealscan, and not directly from 10-Ks, because companies are not always 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 VIII displays the material covenant violation data directly collected from annual 10-K SEC filings. To be more exact, the data in Table VIII represent any missed interest payment or any financial covenant default.[8] 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. In fact, the frequency of a line of credit default is between 2 and 3 times more likely than the next highest financial instrument. Table VIII presents evidence that covenants on lines of credit are the most "binding;" they are violated most often by firms.

Table IX explores why line of credit covenants are violated, and it explores the implications of such violations. In columns (1) and (2) of Table IX, I report coefficient estimates from fixed effects regressions that attempt to determine 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:

[8] 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.

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

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 (1) includes only firm-years where a line of credit is present, and standard errors are heteroskedasticity-robust, clustered at the firm level.

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.

Column (1) shows that a negative profitability shock 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) through (5), I am interested in how default at time *t* affects the amounts available under the line of credit at time *t+1*. More specifically, I estimate:

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

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 (2) using the total lines of credit (both used and unused) to asset ratio. The point estimate implies a drop in the total amount of lines of credit, but the result is not statistically distinct from 0 at a reasonable level. When I break out lines of credit into used and unused, I find 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. It is not surprising that I find no drop in the used portion of the line of credit after a default; firms that default are usually unable to pay down the drawn portion of the line of credit, and so it remains on the balance sheet as a debt obligation.

The results in Tables VII through Table IX imply that lines of credit are closely managed by banks. In particular, a negative shock to profitability leads to default on covenants, which in turn reduces availability under the line of credit. These results are consistent with the theoretical framework associated with agency problems and flexibility. Given that lines of credit are flexible debt instruments that are the incremental source of debt financing, banks carefully manage the unused portion of the line of credit through covenants. The findings of this section also weaken the assumption in theoretical work that bank lines of credit are unconditional obligations. Banks appear to have a variety of tools that make restriction of credit possible.

B. Anecdotal evidence from 10-Ks

In this section, I present 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 closely managed through the use of covenants, and availability of unused portion of the line of credit is contingent on profitability.

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. In addition, a default under the Revolver would allow our lender to accelerate the outstanding indebtedness under the Revolver and would also result in a cross-default under our Senior Notes which would provide the holders of our Senior Notes the right to accelerate the $197.6 million in Senior Notes outstanding and demand immediate repayment.

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 the FY 2002 annual 10-K SEC filing with respect to its bank 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 negative profitability shock 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 bank 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. The Company is currently negotiating with several banks for a replacement line of credit.

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. The anecdotes support the hypothesis that banks closely manage and regulate lines of credit, and that negative profitability shocks lead to a restriction in the availability of the unused portion of the line of credit.

VI. Lines of credit and cash holdings

What are the implications for firms with low profitability that are unable to obtain bank lines of credit? A complete analysis of this question is beyond the scope of this paper, and preliminary work by Rauh and Sufi (2005) more directly attempts to answer this question. In this section, I present

preliminary evidence on the relationship between unused lines of credit and cash holdings by companies. I find evidence of a strong inverse relationship which suggests that low profitability firms that are unable to obtain lines of credit hold larger cash balances.

The motivation behind examining how unused lines of credit and cash holdings are related comes from recent work by Almeida, Campello, and Weisbach (2004) and Acharya, Almeida, and Campellow (2005) that emphasizes the importance of cash in hedging against future income shortfalls. Given their flexibility, unused lines of credit can be viewed as a substitute to holding cash to hedge against such shortfalls. The question I attempt to answer in this section is this: do firms that appear to be unable to obtain lines of credit because of low profitability hold higher cash balances? Table X presents evidence that there exists such a tradeoff. Column (1) of Table X replicates the coefficient estimates from column (4) of Table IV; the coefficient estimate on firm profitability shows that firms with high profitability hold larger balances of unused lines of credit. Column (2) reports coefficient estimates from a regression of the cash to total assets ratio on identical independent variables. The point estimate on firm profitability implies that a one standard deviation decrease in firm profitability *increases* the cash to total assets ratio by (0.21*0.21=) 0.044, or over 20 percent at the mean of the dependent variable. Column (3) more directly examines the tradeoff by including as an independent variable an indicator variable for whether the firm has a line of credit. The coefficient estimate on the indicator variable is large in terms of magnitude, statistical significance, and explanatory power. More specifically, the point estimate implies that firms with a line of credit have a cash to total assets ratio that is 0.18 lower, or almost 100 percent at the mean. The *t*-statistic of the coefficient estimate is over 8, and the R^2 of the overall regression increases from 0.47 to 0.55. There is a large and statistically powerful inverse relationship between the availability of a line of credit and cash holdings.

Figure 1 maps the inverse relationship between the cash to total assets ratio and the unused lines of credit to total assets ratio across the profitability distribution. The lines represent the mean levels of these ratios for each decile of the profitability distribution. Firms in the lowest profitability deciles hold low balances of unused lines of credit while holding high balances of cash. The relationship reverses as

profitability increases. Another interesting fact from Figure 1 is that the total of unused lines of credit and cash is much higher for firms in the lower profitability deciles that hold more cash. This implies that firms without access to lines of credit must hold very high cash balances in place of the line of credit. While this evidence is preliminary, it suggests that unused lines of credit are more efficient than cash in hedging against future income shocks.

While the evidence presented in this section should be viewed as preliminary, it suggests that firms with low profitability are unable to obtain lines of credit and therefore hold higher cash balances to hedge against future income shortfalls.

VII. Conclusion

Bank lines of credit are used by more public corporations than any other debt instrument, and represent a larger fraction of total assets than any other debt instrument. Despite the importance of bank lines of credit in corporate finance, there is, to my knowledge, no empirical research that analyzes the use of lines of credit in a large sample of public firms. This paper attempts to bridge this gap in the existing research by analyzing a unique data set collected directly from annual 10-K SEC filings. The data cover a random sample of 300 firms from 1996 through 2003, and detail the firms' debt structure and use of lines of credit. I use this data set to empirically examine the basic characteristics of lines of credit, which types of firms use lines of credit, and how banks manage the unused portion of a line of credit.

The empirical findings suggest that bank lines of credit provide a unique source of financial flexibility. Firms that adjust their levels of debt and leverage ratios use bank lines of credit more often than any other financial product. The central hypothesis I put forth is that the flexibility of bank lines of credit makes them especially prone to agency problems and corporate abuse. As a result, banks extend lines of credit primarily to corporations with a proven track record of profitability. I find evidence that both used and unused bank lines of credit are more heavily employed by firms with higher historical profitability. This is true despite the fact that debt is generally used less by firms with higher historical profitability. This result is strongest among firms where information asymmetry between management

and creditors is most severe. In other words, when corporate abuse and agency problems are potentially larger problems, banks extend lines of credit only to firms with high historical profitability.

I provide further support of this hypothesis by examining how banks manage lines of credit. When extending lines of credit, banks employ covenants on profitability more than any other type of covenant; in addition, covenants on lines of credit are violated more often than covenants on any other debt instrument. I also provide evidence that, among the firms that obtain lines of credit, a negative profitability shock leads to covenant violations and restrictions in the availability of the line of credit by the bank. A covenant violation on a line of credit is associated with a 30 percent reduction in the availability of unused lines of credit at the mean. Finally, I show preliminary evidence that firms with low profitability that do not have access to lines of credit hold high cash balances; this behavior suggests that firms with low profitability hold cash as a substitute to unavailable lines of credit in order to hedge against future income shocks.

The findings confirm the hypothesis found in previous theoretical research and survey data that lines of credit are a unique source of financial flexibility. However, the findings imply that lines of credit are not unconditional obligations extended by banks, as is assumed in many articles in the theoretical literature. Instead, lines of credit are carefully managed by banks, and banks retain the ability to restrict unused lines of credit if the firm experiences negative shocks to its profitability or net worth.

The findings of this paper point to several future avenues of research, two of which I outline here. First, there is a large body of theoretical and empirical research on the extent to which financing constraints prevent firms from undertaking positive NPV projects (see, for example, Kaplan and Zingales (1997) and Rauh (2005)). The findings here imply that firms with high historical profitability obtain unused lines of credit that may alleviate financing constraints; at the same time, banks may reduce the availability of the line of credit precisely when firms need it most. In other words, the findings here do not provide conclusive evidence of whether bank lines of credit alleviate potential financing constraints. The findings suggest a more rigorous examination of how firms use lines of credit when experiencing large liquidity shocks. Second, the empirical literature on capital structure increasingly focuses on how

adjustment costs in levels of debt may explain the long-term persistence of capital structure (see, for example, Leary and Roberts (2005)). The findings here imply that bank lines of credit are the marginal source of both increases and decreases in debt levels and leverage ratios. The availability of bank lines of credit may be a key determinant in estimating the capital structure adjustment costs facing firms.

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Table I
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.

	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
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
Mortgages	0.007	0.034	0.116
Government debt	0.001	0.015	0.037
Unclassifiable	0.005	0.017	0.326
Earnings measures			
EBITD/assets	0.055	0.221	
Average of 3-year lagged EBITD/assets	0.058	0.213	
EBITD variance (Mackie-Mason)	0.092	0.109	
Measure of information asymmetry			
In NASDAQ or NYSE indicator	0.773	0.419	
In S&P 500, midcap 400, smallcap 600	0.311	0.463	
Firm age (years since IPO)	2.365	0.872	
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 II
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 III
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 IV
Line of Credit to Total Assets Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled regressions relating the line of credit to total assets ratio to characteristics of the firm. All dependent variables are scaled by total assets. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable, scaled by assets:	Book debt	Total line of credit	Used line of credit	Unused Line of credit	Term bank debt	Arm's length debt
Earnings measures						
Average of 3-year lagged EBITDA/assets	-0.109**	0.161**	0.053**	0.108**	0.026	-0.118**
	(0.039)	(0.038)	(0.017)	(0.030)	(0.016)	(0.022)
EBITDA variance	-0.277**	-0.044	-0.049	0.005	-0.067**	-0.010
	(0.057)	(0.063)	(0.031)	(0.050)	(0.024)	(0.025)
Measure of information asymmetry						
In NASDAQ or NYSE indicator	-0.085**	-0.021	-0.023	0.003	-0.027**	0.004
	(0.022)	(0.021)	(0.014)	(0.014)	(0.010)	(0.012)
In S&P 500, madcap 400, smallcap 600	-0.093**	-0.054**	-0.037**	-0.016	-0.034**	-0.014
	(0.021)	(0.017)	(0.009)	(0.013)	(0.010)	(0.015)
Ln[1+Firm age (years since IPO)]	-0.028*	-0.052**	-0.025**	-0.027**	-0.014**	0.017*
	(0.011)	(0.009)	(0.005)	(0.006)	(0.005)	(0.008)
Other firm characteristics						
Market to book ratio (lagged)	-0.012**	-0.009**	-0.004**	-0.005**	-0.003**	-0.002
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Tangible assets to total assets ratio (lagged)	0.197**	0.064	0.043	0.021	0.020	0.061
	(0.047)	(0.036)	(0.025)	(0.024)	(0.023)	(0.040)
Ln[Total sales ($M)] (lagged)	0.041**	0.017**	0.006*	0.010**	0.006*	0.032**
	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)
N	1916	1916	1916	1916	1916	1916
R^2	0.33	0.20	0.16	0.14	0.10	0.38

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

Table V
Line of Credit to Total Debt Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled regressions relating the line of credit to total debt ratio to characteristics of the firm. The sample employed in these regressions includes only firm-year observations where the total debt to total assets ratio is greater than or equal to 0.05. All dependent variables are scaled by total debt. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

Dependent variable, scaled by total debt:	(1) Total line of credit	(2) Used line of credit	(3) Unused Line of credit	(4) Term bank debt	(5) Arm's length debt
Earnings measures					
Average of 3-year lagged EBITDA/assets	1.761**	0.542**	1.219**	0.241*	-0.210*
	(0.463)	(0.126)	(0.399)	(0.099)	(0.087)
EBITDA variance	1.421	0.216	1.205	-0.092	0.219
	(1.058)	(0.195)	(0.984)	(0.157)	(0.180)
Measure of information asymmetry					
In NASDAQ or NYSE indicator	0.111	0.034	0.077	-0.028	0.037
	(0.152)	(0.043)	(0.136)	(0.038)	(0.037)
In S&P 500, midcap 400, smallcap 600	0.054	-0.060	0.114	-0.067*	0.062
	(0.109)	(0.045)	(0.090)	(0.033)	(0.054)
Ln[1+Firm age (years since IPO)]	-0.186**	-0.075**	-0.111*	-0.011	0.070**
	(0.053)	(0.022)	(0.046)	(0.016)	(0.024)
Other firm characteristics					
Market to book ratio (lagged)	-0.002	0.004	-0.007	-0.012	-0.005
	(0.025)	(0.009)	(0.022)	(0.006)	(0.006)
Tangible assets to total assets ratio (lagged)	-0.497*	-0.099	-0.398*	-0.047	0.138
	(0.248)	(0.090)	(0.201)	(0.067)	(0.095)
Ln[Total sales ($M)] (lagged)	-0.023	-0.018	-0.005	-0.014	0.085**
	(0.029)	(0.011)	(0.024)	(0.009)	(0.011)
N	1260	1260	1260	1260	1260
R^2	0.12	0.16	0.09	0.08	0.44

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

Table VI
Information Asymmetry and the Use of Lines of Credit

This table presents coefficient estimates for pooled regressions relating the used line of credit to total assets ratio to characteristics of the firm. In particular, this table explores how the interaction between information asymmetry and profitability affects the use of lines of credit. All dependent variables are scaled by total assets. All regressions include on-year lagged measures of the natural log of total sales, the market to book ratio, and the tangible assets to total assets ratio. year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	(1)	(2)	(3)	(4)
Dependent variable, scaled by total assets:	Used line of credit	Used line of credit	Used line of credit	Used line of credit
Average of 3-year lagged EBITDA/assets	0.094**	0.093**	0.060**	0.084**
	(0.026)	(0.025)	(0.018)	(0.028)
Ln[Total sales ($M)] (lagged)	-0.001			
	(0.002)			
Average of 3-year lagged EBITDA/assets * Ln[Total sales ($M)] (lagged)	-0.018*			
	(0.007)			
In NASDAQ or NYSE indicator		-0.021		
		(0.014)		
Average of 3-year lagged EBITDA/assets *In NASDAQ or NYSE indicator		-0.074*		
		(0.029)		
In S&P 500, midcap 400, smallcap 600			-0.034**	
			(0.010)	
Average of 3-year lagged EBITDA/assets * In S&P 500, midcap 400, smallcap 600			-0.069*	
			(0.033)	
Ln[1+Firm age (years since IPO)]				-0.023**
				(0.005)
Average of 3-year lagged EBITDA/assets * Ln[1+Firm age (years since IPO)]				-0.022
				(0.015)
N	1916	1916	1916	1916
R^2	0.10	0.10	0.10	0.12

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

Table VII
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 VIII
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 IX
Earnings, Covenant Defaults, and Restrictions on Unused Lines of Credit

This table reports coefficient estimates from firm fixed effects regressions. Columns (1) and (2) relate the probability of default at time *t* on 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. Columns (3) through (5) relate the amount of used and unused lines, scaled by total assets, at time t to whether a default occurred at *t-1*. The sample for columns (3) through (5) include all firm-years where the firm had a line of credit at *t-1*. Standard errors are heteroskedasticity-robust, clustered at the firm level

	(1)	(2)	(3)	(4)	(5)
Sample	Has line $_t$	Has line $_t$	Had line $_{t-1}$	Had line $_{t-1}$	Had line $_{t-1}$
Dependent Variable	Default$_t$	Default$_t$	(Total line/assets)$_t$	(Used line/assets)$_t$	(Unused line/assets)$_t$
(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 $_{t-1}$			-0.021	0.021	-0.041**
			(0.017)	(0.013)	(0.010)
(EBITDA/assets) $_{t-1}$			0.041	-0.054	0.094
			(0.061)	(0.028)	(0.056)
Market to book $_{t-1}$			0.001	0.005**	-0.004
			(0.003)	(0.002)	(0.003)
(Tangible assets/total assets)$_{t-1}$			0.091	0.121*	-0.030
			(0.070)	(0.047)	(0.062)
Ln(firm sales) $_{t-1}$			0.000	0.018	-0.019
			(0.019)	(0.010)	(0.017)
# Firm-years	1409	1409	1203	1203	1203
# Firms	252	252	249	249	249
R^2	0.23	0.26	0.63	0.65	0.54

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

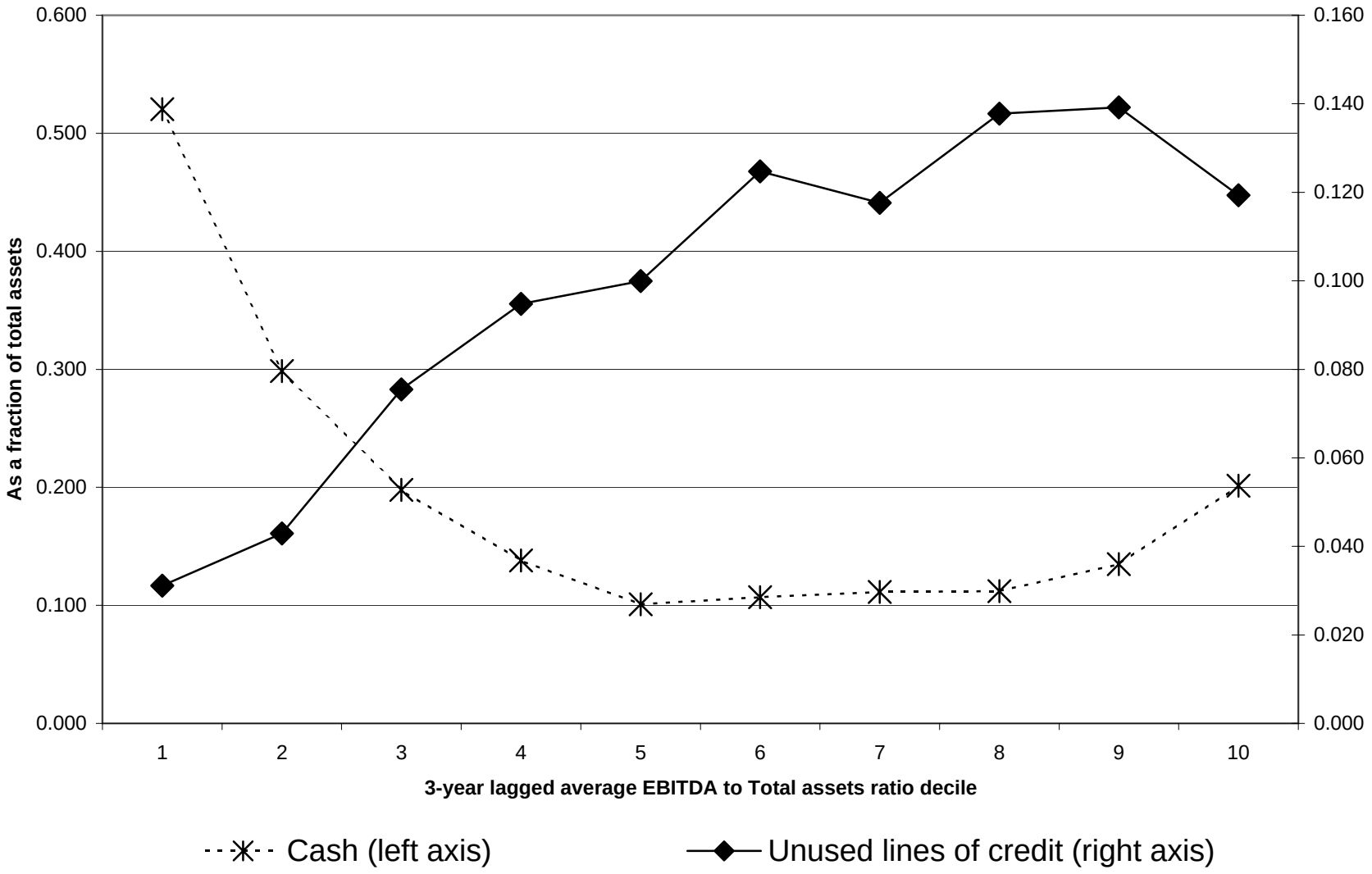
Table X
Unused Lines of Credit and Cash Holdings

This table presents coefficient estimates for pooled regressions relating the unused line of credit to total assets ratio and cash holdings to characteristics of the firm. All dependent variables are scaled by total assets. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	(1)	(2)	(3)
Dependent variable, scaled by assets:	Unused Line of credit	Cash	Cash
Has a bank line of credit			-0.176**
			(0.021)
Earnings measures			
Average of 3-year lagged EBITDA/assets	0.108**	-0.206**	-0.131*
	(0.030)	(0.054)	(0.051)
EBITDA variance	0.005	0.126	0.081
	(0.050)	(0.092)	(0.088)
Measure of information asymmetry			
In NASDAQ or NYSE indicator	0.003	0.097**	0.089**
	(0.014)	(0.023)	(0.021)
In S&P 500, midcap 400, smallcap 600	-0.016	0.071**	0.058**
	(0.013)	(0.021)	(0.018)
Ln[1+Firm age (years since IPO)]	-0.027**	-0.001	-0.004
	(0.006)	(0.011)	(0.010)
Other firm characteristics			
Market to book ratio (lagged)	-0.005**	0.017**	0.013**
	(0.002)	(0.003)	(0.003)
Tangible assets to total assets ratio (lagged)	0.021	-0.238**	-0.199**
	(0.024)	(0.049)	(0.043)
Ln[Total sales ($M)] (lagged)	0.010**	-0.038**	-0.027**
	(0.003)	(0.006)	(0.005)
N	1916	1916	1916
R^2	0.14	0.47	0.55

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

Figure 1: Cash and unused lines of credit across the profitability distribution



DATA APPENDIX

In this data appendix, I provide additional detail into how the data are collected and categorized from annual 10-K SEC filings of corporations. In the first section, I describe in detail how the debt data are categorized. In the second section, I conduct a few comparisons and tests to validate the data collection procedure.

A. Categorization of debt claims

Overall, I gather information on the sources of debt from three locations. First, the grand majority of debt items are detailed directly on the annual 10-K SEC filing. Second, the exhibits (8-K filings) that describe debt issues and loans often relay the precise source of debt obligations. Finally, I use the SDC Platinum database to distinguish public debt from private placements.

Bank debt includes any debt instrument from a bank or financing company. It also includes a small number debt items that are not explicitly listed as being from a bank or financing company. More specifically, there are a small number of equipment loans, loan and security agreements, and overdrafts that are counted as bank debt. In addition, there are a small number of lines of credit (4 percent of all firm-year observations where a line of credit is present) where the source is not available. These are counted as bank debt.

For lines of credit, the firm must discuss the line of credit in the liquidity and capital resources section or the debt financial footnotes for the line of credit to be included in the analysis. “Informal” or “uncommitted” lines of credit are not considered lines of credit. Lines of credit from non-financial institutions are extremely rare and are usually from related parties or related affiliates. These are not considered lines of credit, and are instead included in private non-bank debt. In addition, I do not include in my measure of bank lines of credit leasing lines of credit, vendor credit lines, or equity lines of credit. If the firm has multiple bank lines of credit, I aggregate them.

Non-bank private debt includes debt from vendors, related parties, sellers, customers, shareholders, and insurance companies. It also includes vendor finance obligations, floor plan notes, not to compete related debt, arbitration payments, and most debt related to acquisition payments. Promissory notes that are not explicitly defined as being from financial institutions or from a disperse set of debt-holders are categorized as non-bank private debt. Non-bank private debt also includes private placements that are issued to 2 or fewer parties.

I distinguish public debt issues from private placements using three sources: language directly from annual 10-K SEC filings, the 8-K exhibits of the company, and the "Market" field in SDC Platinum data base. If I cannot distinguish between a private placement and a public debt issue because they are aggregated, I count the debt as public debt.

B. Data collection validity tests

In order to provide a base line comparison for the data collection, I directly compare the summary statistics from Houston and James (1996) with the summary statistics from this paper. There are several differences in the sample construction between Houston and James (1996) and this paper. First, Houston and James (1996) analyze only companies that have equity listed on the New York Stock Exchange, the American Stock Exchange, or the National Association of Securities Dealers. Second, Houston and James (1996) include only firms with some long term debt outstanding. Finally, the Houston and James (1996) sample covers an earlier time period; they evaluate 250 firms in 1980, 1985, and 1990.

Appendix Table 1 compares the summary statistics of their paper and my paper, after making the necessary adjustments in my sample to make the samples comparable. The leverage ratio of firms in my sample is lower (0.25 versus 0.39) and the market to book ratios are slightly higher (1.66 versus 1.38). The public debt to total debt ratio, and the commercial paper to total debt ratio both are very similar. In addition, the unused lines of credit to total assets ratio is very similar across both samples. There is an important discrepancy in the bank debt to total debt ratio. Houston and James (1996) report a higher statistic (0.64) than the comparable statistic in

my sample (0.48). As they note, their measure of bank borrowing includes "private borrowing where the identity of the lender is not provided," and that "as a result, [their] measure of bank borrowing is likely to overstate the amount of borrowing from commercial banks" (1870). The difference appears to be made up in my sample with private placements and convertible debt.

I also test the validity of the data collection procedure using data directly from Compustat. The Compustat database contains a measure of convertible debt (*item 79*) and capitalized leases (*item 84*). However, the Compustat measures include only convertible debt and capitalized leases that are in the long-term portion of debt. My data collection procedure collects both short-term and long-term convertible debt and capitalized leases. In Appendix Table II, I report the coefficient estimate from regressing the natural logarithm of 1 + the Compustat measures on the natural logarithm of 1 + my measures. As is expected, the coefficients are less than 1; the Compustat figures do not include *short-term* convertible debt or capitalized leases and are therefore expected to be smaller. Nonetheless, the coefficient estimates are strong both in magnitude and statistical significance. The *t*-statistics are between 8 and 10 in both specifications, and the R^2 is above 0.83 for convertible debt and 0.73 for capitalized leases. Overall, the measures of fitness and statistical significance of the coefficient estimates imply that the data match the Compustat data closely.

Appendix Table I
Sufi (2005) versus Houston and James (1996)

This table directly compares the summary statistics in Houston and James (1996) with the sample in Sufi (2005), where the latter sample is adjusted to most closely replicate that of the former. The sample includes only firms that are on the NYSE, American Exchange, or NASDAQ. The sample includes only firms with some long term debt (*item 9*). Total debt equals short plus long term debt less industrial revenue bonds, mortgages, and capitalized leases.

	Houston and James (1996)		Sufi (2005)	
	Mean	Median	Mean	Median
Leverage	0.39	0.35	0.25	0.24
Market to book	1.38	1.08	1.66	1.34
Bank debt/total debt	0.64	0.77	0.48	0.42
Public debt/total debt	0.15	0.00	0.15	0.00
Commercial paper/total debt	0.02	0.00	0.01	0.00
Other private/total debt	0.13	0.01	0.08	0.00
Private placements/total debt			0.10	0.00
Convertible debt/total debt			0.09	0.00
Unused lines of credit/assets	0.13	0.07	0.12	0.09
Percent with public debt	39		23	
Percent with commercial paper	7.6		7.0	

Appendix Table II
Sufi (2005) versus Compustat

This table directly compares the convertible debt and capitalized leases data collected from 10-K's in Sufi (2005) with data available from Compustat. Compustat *item 79* and *item 84* record convertible long term debt and long-term debt in the form of capitalized leases. In each column, the natural logarithm of 1 + the Compustat measures is regressed on the natural logarithm of 1 + the Sufi (2005) collected data.

	Ln[1+CStat Conv. debt]	Ln[1+CStat Capitalized Leases]
Ln[1+Sufi (2005) Conv. Debt]		
Coefficient	0.84	
Standard Error	(0.009)	
R^2	0.83	
Ln[1+Sufi (2005) Capitalized Leases]		
Coefficient		0.81
Standard Error		(0.011)
R^2		0.73