Cyclicality of Credit Supply: Firm Level Evidence

Bo Becker
Harvard University and NBER

Victoria Ivashina
Harvard University and NBER

First draft: May 19, 2010
This draft: October 21, 2010

Theory predicts that there is a close link between bank credit supply and the evolution of the business cycle. Yet this effect has been hard to quantify in the time-series. While loan issuance falls in recession, it is not clear if this is due to demand or supply. We focus on firms' substitution between bank debt and public bonds using firm-level data from 1990 to 2009. Any firm that raises new debt must have a positive demand for external funds. If the same firm switches from loans to bonds, we conclude that this is due to a contraction in bank credit supply. We find strong evidence of substitution from loans to bonds at times characterized by tight lending standards, high levels of non-performing loans to bank equity, low bank share prices and tight monetary policy. Although the bank-to-bond substitution can only be measured for firms with access to bond markets, we show that this substitution has strong predictive power for bank borrowing and investments by small, out-of-sample firms.

Key words: Banks; Financial Markets and the Macroeconomy; Business Fluctuations; Cycles
JEL Codes: E32; E44; G21

We are grateful to Murillo Campello, Erik Hurst, Mitchell Petersen, Jeremy Stein, René Stulz, Vikrant Vig, and seminar participants at Harvard Business School, Federal Reserve Bank of St. Louis and Bank of Canada for helpful comments. We thank Chris Allen and Baker Library Research Services for assistance with data collection.

A large theoretical literature suggests that credit supply is an important factor in explaining the evolution of the business cycle (e.g., Bernanke and Gertler, 1989; Holmström and Tirole, 1997; Kiyotaki and Moore, 1997; Diamond and Rajan, 2005). Consistent with these theories, bank credit growth is highly pro-cyclical. However, the cyclicality of bank debt can reflect banks' willingness to lend (the "loan supply" effect) or firms' demand for loans (the "loan demand" effect). The two effects differ in terms of welfare costs of financial frictions and the channel through which monetary policy operates, and therefore it is crucial to tell them apart. In this paper, we rely on firm-level data to do so.

To isolate the loan-supply effect, we examine firms' substitution between bank credit and public debt *conditional* on firms' raising new debt financing. By revealed preferences, if a firm gets debt financing, then the firm must demand debt. Thus, by conditioning on new debt issuance, we are able to rule out the demand explanation. In contrast, if we include a firm that did not receive new financing, we could not be sure if this is because the firm did not need new financing or because it was not able to raise new financing. Controlling for the relative cost of debt, we interpret the substitution from bank debt to public debt as evidence of a shift in bank credit supply. In other words, if there is a contraction in bank credit supply, ceteris paribus, some firms who would otherwise receive a loan instead issue bonds.

The idea of using changes in the composition of external finance over the business cycle to identify shifts in bank-loan supply is also central to Kashyap, Stein and Wilcox (1993). They interpret a rise in aggregate commercial paper issuance relative to bank loans as evidence of a contraction in bank loan supply. The advantage of examining substitution between bank credit and public debt *at the firm level* is that it addresses the concern about compositional changes in the set of firms raising debt.[1]

For our tests we focus on U.S. firms raising new debt financing between 1990 and 2009. Bond issuance data is from Thomson One Banker and loan issuance data is from DealScan which primarily covers large syndicated loans.[2] To assure that firms in our sample have access

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[1] Kashyap and Stein (2000) point out that "perhaps in recession there is a compositional shift, with large firms fairing better than small ones, and actually demanding more credit. Since most commercial paper is issued by large firms, this could explain Kashyap et al. (1993) results."

[2] For benchmark results, we constrain the sample to term loans (i.e., installment loans) and bonds; however, we find similar result for short-term debt (revolving credit lines and commercial paper), and for a sample including both types of debt.

to the bond market, we condition on firms having issued bonds in the last five years. We find that the incidence of bank loans, as compared to bonds, is very cyclical. Of firms receiving a bank loan but not issuing a bond in 1993, 16% received a loan but did not issue bonds in 1994, 3% issued bonds but did not get a syndicated loan, and 4% did both (77% did neither). Conditioning on individual firms reveals that firms getting a bank loan are likely to stay with that form of debt in the near future. The pattern is similar in most years of the study. For example, of firms receiving a loan but not issuing a bond in 2003, 27% only received a loan in 2004, 6% only issued bonds, and 5% did both (52% did neither). However, when banks are in distress, this pattern changes. For example, of firms receiving a bank loan in 2007, only 6% received a loan in 2008, whereas 17% issued a bond and 2% did both.

Our main set of results models a firm's choice between bank and public debt as a function of availability of bank credit. Given that any single measure of availability of bank credit is imperfect, we use four different variables to proxy for it: (i) tightening of lending standards based on the Federal Reserve Senior Loan Officer Opinion Survey, (ii) average non-performing loan losses relative to equity for a sample of large banks, (iii) a market-adjusted stock price index for banks, and (iv) a measure of monetary policy shocks based on the federal funds rate deviation from the Taylor-rule. These variables are correlated with aggregate lending volumes, but this may reflect time series variation in either demand or supply for bank credit. By only including firms either issuing bonds or receiving a bank loan in our sample, we isolate the effect of bank credit supply. We purposefully examine the choice of debt (dummy) as opposed to debt amount, because even conditional on positive debt issuance, the amount of debt is likely to be influenced by changes in firm's investment opportunities.

All four time-series variables indicate a strong pro-cyclical pattern in the debt financing mix for the firms in our sample. A one standard deviation increase in the net fraction of loan officers reporting tightening in lending standards (24.6 percentage points) implies a 1.8% decrease in probability of debt financing being a loan. For the other time-series variables, one standard deviation change in the direction of loan supply tightening (higher non-performing loans to equity, lower bank stock prices, or tighter monetary policy) predicts a decrease in probability of external credit being a bank loan by 2.6% to 4.9%. This is large compared to the unconditional average probability of external debt being a loan (13.3% for the full sample). The

results are robust to an extended set of controls, to exclusion of the 2007-2009 financial crisis and to sub-periods fixed effects.

The substitution between bank loans and public bonds can only be measured for firms with access to both markets. Thus, by design, our analysis relies on the least financially constrained firms, whose investment may be insensitive to the supply of bank credit. The argument is that these firms are still affected by variation in the loan supply in the form of financing they raise, so changes in debt-issuance behavior of these firms inform us about aggregate credit supply. It is important that our measure applies to firms that are not in our sample; after all, it is the firms that cannot substitute that are most likely to be affected by a contraction in bank credit. Indeed, we find that fraction of rated firms receiving a loan in a given quarter is a strong predictor of a likelihood of raising bank debt for unrated firms, and it also predicts investments for the set of unrated firms that are likely to be most dependent on bank lending (firms with high leverage and low market valuation).[3] Also, notice that credit to firms outside of our sample might differ from the types of credit that rated firms get; e.g., loans to large firms are likely to be syndicated whereas loans to small firms are not. However, the necessary condition for generalization of our measure is that the different types of bank credit are correlated. We elaborate further on the out-of-sample implications of our measure in the final section of the paper.

To interpret increase in bond issuance relative to bank debt issuance as contraction in bank credit supply, we need to address two main alternative explanations. First, the observed substitution from loans into bonds could be a result of an expansion in bond supply. To rule out this hypothesis, we look at the relative cost of the two forms of debt financing. Controlling for credit rating, we find that bonds are relatively more expensive in periods when the substitution from loans to bonds is highest. This is inconsistent with increase in bond supply.

The second concern is that observed substitution from loans into bonds is a result of expansion in demand for bonds. The theoretical literature predicts just the opposite. For example, in Diamond (1991), Rajan (1992), Chemmanur and Fulghieri (1994), and Bolton and Freixas

[3] This out-of-sample evidence reinforces the argument that our findings are not driven by an unexplained change in preferences for bonds versus loans at the firm level.

(2000), the advantage of bank debt is a result of banks' ability to monitor.[4] These theories stipulate that the preference for public debt over bank debt is more likely for projects of a higher quality, with larger collateral and lower uncertainty about cash flows, so we would expect higher demand for bank debt in periods of low credit supply. A more contrived alternative is that the nature of investments (at the firm level) changes over time in such a way that bond financing is more attractive in recessions. We specifically focus on potential shift from durables to non-durables goods in addition to verifying robustness of our findings in a sample of single-segment firms.

Notice that similar to Kashyap, Stein and Wilcox (1993), our research design does not require perfect substitutability between public debt and syndicated bank loans. If substitutability is low, our tests will lack power. In fact, there are several reasons to believe that these two forms of debt are fairly close substitutes for firms that have access to the bond market. (As mentioned above, firms in our sample often switch between the two sources of debt.) In particular, both bonds and syndicated loans have similar bankruptcy and corporate tax treatment; they share many contractual features including covenants protection and collateralization, and are comparable in range of maturities and repayment characteristics.[5] Also, Kashyap, Lamont and Stein (1994) compare inventory investment of firms with and without access to public bond market during economic recessions and attribute lower contraction in inventories of firms with access to public bonds to their ability to substitute between bank credit and public debt. Close substitutability of the two forms of debt for firms with credit rating is also consistent with findings by Faulkender and Petersen (2005).

The contribution of our paper is advancing the measurement of bank credit supply in a business-cycle context. Several recent studies on this topic use cross-bank variation in access to funding to identify the effect of loan supply on lending volume (e.g., Kashyap and Stein, 2000

[4] Although most of the literature argues that the advantage of bank financing should be strongest for small and more opaque firms, Ivashina (2009) finds evidence of information asymmetry about borrower credit quality for the sample of firms analyzed in this paper.

[5] We do not examine substitution to non-debt forms of external finance. There is a large literature addressing differences between debt and equity financing, going back to Jensen and Meckling (1976) and Myers (1977). Firms raise equity much less frequently than debt. For example, Erel, Julio, Kim and Weisbach (2010) report that US non-financial firms issued ten times as much in public bonds as in seasoned equity offerings over the 1971-2007 period, and even more in private debt (loans). For this and other reasons, external equity is likely not a close substitute for bank loans. We abstain from analyzing specific reasons why a firm might choose debt over equity financing.

and Ivashina and Scharfstein, 2010). A key identifying assumption in these studies is that clients' demand for credit is uncorrelated with banks' access to funding. However, unobservable matching between types of firms and banks makes it a potentially strong assumption. Our methodology relies on within-firm variation in debt issuance, so is less sensitive to this concern.

There is a literature that focuses on exogenous shocks to the bank credit supply in order to establish causal effect between availability of bank credit and firms' activity. Notably, Peek and Rosengren (2000) look at the contraction in the U.S. credit supply caused by Japanese banks in the context of the Japanese crisis in the early 1990s. More recently, Leary (2010) examines expansion in bank credit in the first half of 1960s following the introduction of the certificates of deposits and fall in credit during the 1966 Credit Crunch. Chava and Purnanandam (2010) examine the effects of exogenous disruptions in credit supply in the context of the Russian crisis in the fall of 1998.[6] The evidence in these papers is consistent with the importance of bank credit supply on firms' activity. However, these clear but isolated examples of variation in bank credit supply have limited implications about variation in loan supply over the business cycle.

The rest of the paper is organized in five sections. Section 1 describes the data. Sections 2 and 3 present results. The first set of result is the cyclicality of bank finance relative to bond finance at the aggregate. The second set of results examines cyclicality of the substitution between bank and bond financing at the firm level. Section 4 evaluates predictive power of the substitution between bonds and loans for the small firms. Section 5 concludes.

1. Data

Loan data for this study come from Reuters' DealScan database. These data primarily cover large syndicated loans at the loan origination. We only look at the U.S. firms. The mean size of the loans between 1990 and 2009 was $272 million; the median was $199 million, and 95% were larger than $10 million. Bond data come from Thomson One Banker data base. For our base line results, we compare term loans to bonds. In robustness tests, we examine short term credit, i.e. revolvers and commercial paper (CP), and all type of debt at once. We infer CP issuance from Standard & Poor's instrument level rating data (commercial paper is not issued

[6] Other examples include Ashcraft (2005) who uses the closure of healthy branches of impaired bank holding companies, and Becker (2007) who uses a demographics-based instrument.

without a rating). Throughout the analysis, we condition on firms having issued bond in the last five years, so that we avoid firms without access to the bond market.

Firm financial data comes from Compustat. The identification will be driven by firms that issue both, bank and public debt. Approximately 59% of the Compustat firms with bond issue data also issue loans as reported in DealScan. The mean size of the bond issue between 1990 and 2009 was $390 million; the median was $125 million, and 95% were larger than $60 million. Borrowers had mean and median log assets equivalent to $1.1 billion. We exclude the financial sector from the sample (SIC codes 6000 to 6999); this is important because—at least in the last recession—many of the bond issues by financial firms were backed by government guaranties leading to an unusually large bonds volume issue by banks. For example, according to Standard and Poor's, in the first half of 2009, about 30% of all new bond issues had some sort of guarantee.[7]

The data used in the analysis is organized as a panel of firm-quarter observations from 1990:Q1 to 2009:Q4. There are 22,869 firm-quarter observations (10.6% of Compustat firm-quarters) with new debt issuance by the broadest definition (including revolving lines and commercial paper), and 12,782 firm-quarters (6.0%) by the narrower definition (term loans and bonds only) that we use as baseline. In a third of all firm-quarters with debt issuance, debt issues are new loans by the narrower definition, and, by the broader definition, in two thirds (the difference is due to the fact that many more firms have credit lines than issue commercial paper). We focus on the 5.7% of Compustat firm-quarters with one but not both kinds of new debt (baseline).[8] As Figure 1 illustrates, in the most recent financial crisis, there was considerable shift from bank loans to bonds, starting in late 2007. It became particularly pronounced in the fourth quarter of 2008 and continued through the first half of 2009. For publically rated firms, average loan issuance (dollar volume) as a fraction of total debt issuance for the four quarters between 2008:Q4 and 2009:Q3 dropped by 70% as compared to its average quarterly level in the first half of 2008 (46% including CP and revolving lines).

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[7] "Corporate bond issuance sets record," *Wall Street Journal*, 24 July 2009.

[8] We exclude quarters with issuance of both types of debt for methodological reasons. However, simultaneous issuance of both types of debt is typically associated with large corporate transactions such as takeovers and recapitalizations. We are interested in the real economic activity and, in that sense, exclusion of these transaction is consistent with the focus on general purpose corporate financings.

We want to highlight a clear negative correlation between the share of bank debt as a percentage of total debt financing and the net percentage of banks tightening credit standard collected as part of the Senior Loan Officer Opinion Survey on Bank Lending Practices (Figure 1). This relation renders additional support for the measure proposed in this paper. According to the Federal Reserve Board, the information obtained from the survey is one of the key macroeconomic indicators about the credit market conditions, and it is reported regularly to the Board of Governors and to the Federal Open Market Committee as part of the internal briefing materials that are used in formulation of monetary policy.[9] But although the survey information provides valuable insight about credit conditions, as any survey data, it might be a reflection of beliefs as opposed to actions. The interpretation of the survey data becomes particularly sensitive when one tries to understand whether the observable credit conditions are driven by supply or demand.[10]

[FIGURE 1]

Table 1 summarizes the composition of the sample and firm level characteristics. Throughout the analysis, we include firm-fixed effects in addition to other firm-level control variables. In particular, for each firm-quarter, we calculate the log of the previous quarter's assets and the log of the previous quarter's property, plant and equipment. We also compute the return on assets as operating income before depreciation divided by previous quarter's assets and the one year lagged return to the end of the previous quarter (i.e., the log of the previous quarter's closing stock price minus the closing stock price five quarters ago). We define an indicator variable for firms paying a dividend in the current quarter.

[TABLE 1]

We use four time-series variables to track variation in banks' willingness to lend over time (all the time-series variables are quarterly):

- Tightening of lending standards: The data comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices. The series corresponds to the net percentage of domestic respondents tightening standard for commercial and industrial

[9] For further information see http://www.federalreserve.gov/boarddocs/snloansurvey/about.htm.
[10] Although there are specific questions in the survey asking about "demand" for credit, answers given to these questions may not be independent of changes in credit standards. Lenders might observe fewer loan applications as a result of tightening lending standards, thus the causal relation between supply and demand of credit is unclear.

(C&I) loans to large and medium-sized firms. A higher value indicates that more banks report tighter credit standards (contraction in bank credit). The measure ranges from -24.1% (in quarter 2, 2005) to 83.6% (in quarter 4, 2008).

- Non-performing loans as a fraction of equity: The ratio was compiled from Consolidated Report of Condition and Income (known as Call Reports) and correspond to market capitalization value-weighted averages for Bank of America, JPMorgan Chase, Citibank, Wells Fargo, Bank of New York, US Bancorp, Fifth Third Bancorp, Wachovia, Toronto-Dominion Bank, SunTrust, KeyCorp, Regions Financial, Comerica, PNC and National City Corporation. A higher value is likely to be associated with a contraction in bank credit.
- Bank index: The logarithm of the level of the market-adjusted price for banks (industry number 11) using industry return data originally introduced by Fama and French (1997) and available from Kenneth French's on-line data library. A higher value is likely to be associated with an expansion of bank credit.
- Monetary policy: A measure of the unexpected monetary policy constructed as deviation of the federal funds rate from the target level. The target level is computed using Taylor-rule (Taylor, 1993.)[11] A lower value indicates tighter monetary policy, which is likely to be associated with a contraction in bank credit. The idea is to identify instances where monetary policy is likely to have an exogenous effect on the credit supply. For example, a reduction in the federal fund rate could be a response to a fall in consumers' demand; an expansionary monetary policy would still likely have an effect on credit supply, however the net (observable) effect on credit is less clear.

2. Results: Cyclicality of bank and public debt at the aggregate level

Before turning to firm level data, we examine the cyclicality of the aggregate stock of bank credit. This step is important for understanding the potential magnitude of bank debt for macro-economic volatility and business cycles. We construct the time series of aggregate U.S. corporate debt from Flow of Funds data, reported by the Federal Reserve. For bank debt, we

[11] For potential GDP, we rely on Congressional Budget Office numbers.

combine data on Other Loans and Advances and Bank Loans Not Elsewhere Classified. For public debt, we add up Commercial Paper and Corporate Bonds. Data on economic recessions is from the National Bureau of Economics Research (NBER). The data is quarterly; so, any quarter containing at least one month classified as a recession month by NBER is categorized as a recession.

As can be seen from Figure 2, the growth of total credit outstanding for U.S. non-financial firms is highly pro-cyclical. Several patterns are striking. Of the two types of credit, bank debt is both more volatile and more cyclical than public debt. Second, bank debt often shrinks rapidly, whereas the outstanding stock of market debt never falls year-to-year. Third, several recessions—notably, the three most recent NBER recessions—exhibit rapidly shrinking bank debt at some point during the recession. Public debt is more stable and less affected by recessions. These facts appear consistent with a business cycle role for the supply of bank credit similar to that proposed by Holmström and Tirole (1997).

[FIGURE 2]

Figure 2 also illustrates that our argument—substitution from (to) bank debt into public debt as a measure of bank-credit supply contraction (expansion)—is consistent with the exogenous shifts in bank credit supply documented in the previous literature. Leary (2010) points out a gradual expansion in bank credit between 1961 and 1966 following the emergence of the market for certificate deposits. Indeed, in the first half of 1960s one can see a rise in relative share of bank debt as the growth rate of bank credit accelerates while the growth of public debt slows down. This is sharply reversed in the 1966 Credit Crunch (Leary, 2010). Similarly, the shift in relative composition of corporate debt is clear following the burst of the Japanese real estate bubble (Peek and Rosengren, 2000) and the 1998 Russian debt crisis followed by the LTCM collapse (Chava and Purnanandam, 2010). These shocks to the supply of bank loans are visible in Figure 2, in that they coincide with or precede changes in the relative growth in corporate debt stocks.

The aggregate statistics for the growth in the total value of bank and public debt outstanding are presented in Table 2, Panel A. The growth of two forms of debt finance for non-farm, non-financial, corporate business in the U.S. has been remarkably similar for the last half-century: 6.81% average real four quarter growth for market debt and 6.23% for bank debt (the difference is statistically insignificant). The stock outstanding at the end of quarter 2009:Q3 was

1.93 trillion dollars of bank debt and 4.15 trillion dollars of market debt, 13% and 29% of GDP, respectively. Bank debt was more important in relative terms in the middle of the sample, and actually exceeded the value of market debt in 1982 and 1983 (the fluctuation over time in the shares of bank and market debt are shown in Figure 2).

[TABLE 2]

While the average growth rates have been very similar, the volatility of bank debt has been much higher than that of market debt. The standard deviation of the real quarterly growth in the stock of bank debt is 7.5%, more than twice as high as the 3.6% standard deviation for market debt. This difference is highly statistically significant.[12] During the sample period, there have been thirty eight quarters where bank debt was lower in real terms than it had been four quarters earlier, but not a single quarter where bond finance was lower than four quarters earlier (Table 2, Panel A also shows various moments of the two distributions of growth rates).

Not only is the stock of bank debt outstanding more volatile than the stock of public debt, it is also much more cyclical. Whereas the real growth in public debt is uncorrelated with GDP growth, the growth in bank debt is significantly positively correlated with the GDP growth. In Panel B of Table 2, the real growth of the debt stock is regressed on growth the preceding quarter, a dummy for whether any month in the quarter was classified as belonging to a recession by NBER and real, four quarter GDP growth. This is done separately for the two kinds of debt. The growth of market debt is highly autocorrelated, with an estimated coefficient of 0.943 on lagged growth.[13] However, its relation to GDP growth and to the recession indicator is statistically and economically insignificant. Bank debt growth is similarly autocorrelated, but also strongly related to GDP growth (but not the recession indicator). The coefficient on real GDP growth is 1.16, indicating that a 1.2% drop in growth (corresponding to standard deviation of four quarter real GDP growth) predicts a 1.3% drop in the real growth rate of bank debt. This illustrates how pro-cyclical bank debt is, especially in comparison with market debt. This point is also clear from Figure 2.

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[12] Even allowing for the overlapping nature, the *p*-value of the difference for the standard deviations is below 0.1%. The difference in means is insignificant (*t*-stat 0.28).

[13] To some extent, this autocorrelation is induced by using overlapping four quarter growth rates as observations, but it is apparent also in non-overlapping data. We make no inferences based on the coefficient on lagged growth. Rolling four quarter growth rates have the advantage of removing any seasonality from the time series.

The average maturity of bonds exceeds that of loans. Could this mechanically increase the cyclicality of the stock of bank debt (as compared to the stock of bond debt)? The shorter the maturity, the larger the volume due-for-refinancing is. If both loan and bond markets shut down, the total amount of loans outstanding would fall faster, but this is unlikely to be an explanation for our findings. We never see the hypothetical scenario of no bond issuance; as one can see in Figure 2, the growth rate of bonds is always strictly positive. Moreover, in firm level data, we control for the maturity of issued debt as well as a firm's preferred debt type.

The cyclicality of bank debt can reflect cyclical variation in the relative demand for bank debt, shifts in the relative supply of bank debt, or both. If we knew for sure that the demand for intermediated credit rises in bad times, aggregate evidence that the stock is counter-cyclical would be enough to establish that bank supply is highly variable and counter-cyclical. As pointed out above, theories of intermediated debt and market debt suggest that bank debt is more attractive in bad times, because it is more flexible and it bring superior monitoring. These theories support a counter-cyclical relative demand for bank debt. However, market debt tends to be available for larger firms, and large firms may have a pro-cyclical share in aggregate investment. More generally, if the set of firms that tend to issue bonds differ from those that borrow from banks, the cyclicality of these groups of firms might affect the evolution of aggregate debt stock even if supply never moved at all. Aggregated data cannot address whether compositional changes in the type of firms raising debt finance can explain the observed cyclicality. We therefore turn to firm level data.

3. Results: Cyclicality of bank and public debt at the firm-level

A. Benchmark results

In this section, we present results for a firm-quarter panel of new debt financing. We model how aggregate time-series variables that are likely to be related to bank lending supply explain the mix of new debt issuance. We rely on the revealed preference argument that any firm raising outside debt has non- zero demand for credit. This allows us to interpret significant coefficient estimates on the time-series variables as evidence of how supply varies over time.

The sample of firm-quarters excludes any firm-quarter where no debt was raised or where both bond and bank debt were raised. Because firms raise new debt financing only occasionally, the panel is unbalanced. On average, there are five observations per firm. We construct a

quarterly indicator of the debt choice (D_{it}) equal to 1 if a firm receives bank loan and 0 if a firm issues a bond.[14] Our baseline results only considers term loans (no revolving credit lines) and bonds (no commercial paper), but we vary these definitions in robustness tests (see Table 8). Multiple loan issues in the same quarter are counted as one, similarly for bond issues. The estimated equation is of the following form:

$$D_{it} = \alpha_i + \beta b_t + \gamma X_{it} \quad (1)$$

where $D_{it}$is the indicator variable for receiving bank loan for firm *i* in quarter *t*, b_t is a time series measure meant to capture banks' willingness to lend, and X_{it} is a set of controls, specific to the firm i. X_{it} includes the log of assets (lagged), the log of property, plant and equipment (lagged), the return on assets (operating income before depreciation divided by previous quarter's assets), one year lagged return to the end of the previous quarter, leverage (long term debt over assets), and a dummy indicating whether a firm pays a dividend in the current quarter. The benchmark specification does not include the amounts, maturity, and many other features of the debt.[15] Overall, we have slightly more than ten thousand observations with data on all controls. Equation (1) is estimated using ordinary least squares (OLS), with errors clustered by period since this is the dimension on which the variable of interest varies.[16]

Throughout the analysis we use quarterly data (except for one robustness test) because this corresponds to the highest frequency of data available for both accounting data and three of the time-series variables. DealScan data on loan originations is available back to 1990, so firm level tests are limited to this time period (whereas Flow of Funds data goes back to the 1950s).[17]

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[14] There is no strong argument against using the relative amount of bank and bond finance instead of the dummies, but since most firms get only one kind of finance, not much information is lost by focusing on the binary cases. We get similar results using a continuous left hand side variable. Firms raising both types may be involved with mergers.

[15] We would like to control for the borrower's desired maturity and amount, but realizations are not good controls. Conditioning on such contract features may bias our results. This can happen if maturity and amount partially reflect supply (i.e. are not completely driven by borrower preferences), in which case realized values of these variables will be correlated with the dependent variable, introducing reverse causality between dependent variable and a control. Therefore, it is not clear if including realized values as controls improves estimates. We include these and other variables as additional controls in robustness tests.

[16] Equation (1) could be estimated with logit or probit, but these require additional assumptions, e.g. about functional forms (which OLS does not require to be unbiased) without offering any obvious compensating advantage in our setting (Angrist and Pischke, 2009).

[17] DealScan coverage goes back to late 1980s, however the coverage is uneven and primarily concentrated on large LBO deals.

However, because this period contains two recessions, large fluctuations in bank stock prices, significant changes in monetary policy, and the LTCM crisis in the late 1990s, it promises to allow identification of the cyclicality of firm level choices of bank and market debt.

Table 3 presents the main set of results. In Table 3 column one, the cyclical variable is the net fraction of loan officers reporting tightening credit standards, predicted to be negatively correlated with banks' willingness to lend. Indeed, the coefficient is negative and significant. The coefficient point estimate, -0.075, implies that a one standard deviation increase in lending standards is predicted to decrease the probability that a firm gets a loan, conditional receiving debt financing, by 1.8% (or, equivalently, that the fraction of external debt financing that is bank loans will be lower by 1.8%). In other words, firms appear to substitute bonds for bank loans at times when lending standards are tight. This is unlikely to reflect a drop in demand, since all the firms in the sample receive external credit in some form. Therefore, we interpret this as evidence for cyclical lending supply from banks. The firm level control variables show some predictive power, notably leverage (high values of the variable predict loans), and the dividend payer dummy (payers tend to issue bonds). The regression in column one has a fairly high *R*-squared, 40%, mostly due to the effect of the approximately four thousand firm fixed effects. The *R*-squared could be driven by cross-sectional predictability, but, in fact, the pure time-series *R*-squared of the firm fixed effects is also high (41% for the full sample). This suggests that compositional effects are indeed important in explain the use of bank vs. bond loans, and validates the use of fixed effect specifications.

[TABLE 3]

We next repeat the regression with our second time-series measure, the ratio of non-performing loans to equity for large banks. It is less subjective than the survey based measure, but it is backward looking. Like lending standards, it is highly correlated with aggregate lending volumes. This variable is likely to drive lending only if bank capital is costly or difficult to raise, so that non-performing loans (which will reduce bank capital) makes lending more difficult. The coefficient estimate in column two is negative and significantly different from zero, implying a 4.9% increase in the probability of a bank loan for a one standard deviation decrease in non-performing loans.

In column three, we use the bank stock price index. This is a more forward looking measure of banks' performance. The coefficient implies that a one standard deviation increase in

the stock price of banks relative to the market increases the likelihood that a firm gets a loan (conditional on getting external credit) increased by 3.9%.

Finally, in column four, we use our measure of unexpected monetary policy shocks. This traces a parallel with Kashyap, Stein and Wilcox (1993); in their work, periods of tightening monetary policy are used as instances where one should expect a shift in credit supply. Again, the result is highly significant. The implied increase in the fraction of bank loans for a one standard deviation increase in the policy variable is 2.6%.

Using four predictors of bank willingness to lend constructed from different data sources and with different time series properties, we find that the fraction of new credit that is sourced from banks falls rapidly with bank financial health and economic environment. The expected change in the bank fraction of new credit for a change from the 10^{th} to the 90^{th} percentile of the distributions ranges from 5% (lending standards) to 11% (non-performing loans). Our use of bond credit as the alternative to bank loans has dealt with demand and firm fixed effects with compositional changes in the population of firms raising credit. In other words, it appears bank loan supply is highly cyclical. Two key caveats that remain are the potential cyclicality of bond supply and the nature of firm investment. We consider these in the next section.

B. Alternative explanations

By design, our results rule out the demand-driven explanation in the contraction of bank credit. However, we need to address other alternative explanations. In particular, a switch from bank debt to bonds in times of low growth and poor bank health could be caused by counter-cyclical bond supply (instead of cyclical loan supply). We can assess this empirically by examining relative yields of bonds and bank debt. If the relative decrease in bank loans in bad economic times were driven by increases in bond supply, we would expect to see bond yields fall relative to bank loan interest rates.

We compare loans of similar credit risk by grouping bonds and loans based on credit ratings. We do not rely on the secondary market prices, but instead use yields at issuance. We include bonds with maturity between 3 and 10 years, which are consistent with maturities of term loans. We use the groups BBB, BB, and B (the groups for which there is sufficient frequency of issuance for both types), and calculate the ratio of the average loan yield to the average bond yield each quarter. The time-series are plotted in Figure 3 together with the share of bank debt as a percentage of total corporate debt financing. The relative prices for all three categories tend to

follow the economic cycle; loans tend to be relatively cheaper in recessions (including the 2007-2010 recession). If shift in bond supply could explain our findings, we should observe a negative correlation between the relative cost of loans and the share of loans in the overall debt financing. However, this is inconsistent with the aggregate evidence.[18]

[FIGURE 3]

A similar pattern emerges from the correlation between the relative cost of loans (as compared to bonds) and the four time-series that we use to track variation in banks' willingness to lend over time (reported in Table 4). All of the twelve correlations are of the same sign as the coefficients in the relative issuance regressions estimated in the preceding section (Table 3), i.e., they suggest that bank loans are cheaper in bad economic times. Only two out of twelve correlations are not statistically significant. Thus, the results in Table 4 strongly reject the bond supply explanation of the quantity findings. It appears that firms issue bonds when banks are reluctant to lend, and that they do it despite bonds being relatively expensive.

In Table 5, we further verify this point by using relative cost of loans as compared to bonds as an additional control variable in the benchmark regression reported in Table 3. For brevity, we report only the coefficient on the time series variable and the significance of that coefficient estimate (i.e., each cell corresponds to one regression). The first row of the Table 5 reports the benchmark results from Table 3. The key estimates remain largely unaffected. In view of this result, we conclude that the share of bank loans varies over time due to variation in the willingness of banks to lend.

[TABLES 4 & 5]

The second potential caveat to the supply-based interpretation of our benchmark findings is that for a given firm, bond financing becomes more attractive in recessions.[19] As discussed in the introduction, theory predicts that in economic downturns, firms are likely to prefer bank debt because of its advantages in monitoring and renegotiation. Yet, there could be other distinctive features of public debt that could make it the preferred choice of financing in recessions. For

[18] This pattern is consistent with our premise as the cost of bonds is likely to increase due to the substitution from loan into bond market following contraction in bank-credit supply. Although the latter should also lead to an increase in loan cost, credit rationing can prevent interest rates on issued loans from rising.

[19] Let us reiterate that, because we use firm fixed effects in all regressions, the only investment shifts that might explain our results are those that occur *within firm*. Thus, we focus only on such explanations. It is very likely that there are compositional shifts in the pool of firms raising debt over the economic cycle, and that is precisely the motivation for using firm-level fixed effect specifications throughout the analysis.

example, if the choice of bank versus public debt is determined by the trade-off between liquidation cost in bankruptcy (which is higher for public debt) and the disciplining role of non-renegotiation (which is weak for bank debt), then a firm will switch to bonds if it perceives that the expected cost of liquidation is low (Bolton and Scharfstein, 1996). It is difficult to come up with a realistic explanation for why expected liquidation costs would be pro-cyclical.[20]

Alternatively, it is possible that in bad economic times, firms focus on manufacturing different products. If some types of investments are better financed by bonds, it might lead to a cyclical pattern relative to demand for bank loans. For example, if bond debt is more suitable for financing of non-durable goods, which tend to be less cyclical, a contraction in durable consumption in recessions could be the driver behind substitution from bank loans to bond debt. We address this specific explanation by verifying that non-durable industries do not use more bond debt than durable industries. More broadly, changes in the industry pattern of investment are much more plausible for firms that operate in different industries. Thus, we also reexamine our findings in a sample of single-segment firms. If our results are driven by firms changing the nature of their investment toward bond-friendly types in recessions, we would expect weaker results. However, results stay unaffected in this smaller sample (see Table 5).

A more direct way of ruling out changes in the nature of investment is to test our predictions in a sample of single-segment firms. The idea is that the single-segment firms must be less able to switch the nature of investment than multi-segment firms. We use segment data from the Compustat Segment Database and define a firm as multi-segment in a year it reports business segments in two distinct Fama-French industries, each with sales and assets above 5% of firm total.[21] A firm is classified as single-segment if it does not report such segments. This reduces the sample size by a quarter. The third row in Table 5 reports regressions results for single-segment firms only. Coefficients are very similar in magnitude and significantly different from zero in all cases. These results imply that change in the nature of investments over the business cycle is an unlikely explanation for our findings.

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[20] Notice that, at the firm level, we find an increase in bond issuance. Thus, it cannot be the case that firms are simply giving up projects that are best financed by bank debt and choosing projects that are best financed by bonds. But, even if they did—i.e., if there is projects substitution at the firm level,—it would still imply a contraction in bank credit supply.

[21] The 5% cutoff is not empirically important for our conclusions.

C. Subsamples based on firm characteristics

We next consider how the supply response we have identified in the full sample may vary across firms. Several papers have pointed to the likelihood that some firms suffer more than others when bank supply is weak (e.g., Kashyap and Stein, 2000). The cross-sectional incidence of supply can easily be assessed within our empirical framework by splitting the sample.[22] We consider two dimensions: leverage and credit ratings.

[TABLE 5]

We first group firms by book leverage. Leverage quintiles are defined using book debt divided by book assets ("book leverage"). The quintile cut-offs are 0.21, 0.30, 0.39 and 0.49.[23] Across variables, the low leverage groups have smaller and less significant coefficient estimates. As leverage rises, the effect of loan supply appears larger and more significant (the monetary policy variable is barely significant even in the high leverage groups, suggesting that this effect is less robust). The sample split by leverage provides evidence for a stronger effect among firms with high leverage.

We next group firms by their credit ratings (S&P firm credit opinions), into groups of investment grade (BBB- and higher) and non-investment grade (BB+ and lower) firms.[24] The estimated effect of loan supply is larger and more significant for speculative grade than for investment grade firms (firm quarters, to be exact). For two of the time series variables, the effect is insignificant for investment grade firms. The differences across groups are economically meaningful, as well as statistically significant. It appears that weaker firms suffer most when loan supply is tight.

D. Further robustness tests

[22] We could also allow the coefficient on the time series variable to vary by firm groups, but estimate the regression for the full sample. Splitting by subsample differs in that it allows the coefficient on control variables to vary across groups, but this is not material to our conclusions.

[23] We have also tried year-by-year cut-offs, which produces similar magnitudes but somewhat higher significance in general.

[24] This sample split leaves out unrated firms. Since the main rating agencies aim to rate all US corporate bond issues, there are virtually no bonds issued by unrated firms. Unrated firms do occasionally receive bank loans, but this leaves us without variation in the left hand side variable.

In this section, we present a number of additional robustness tests. We present these robustness tests in condensed form in Table 6 by presenting only the coefficient of interest.[25] First, we introduce additional controls capturing various features of new debt. We control for maturity of debt, and for amount of debt raised, and then for both as well as yield of the debt. Consistently, the results are similar after the introduction of these additional measures. As can be seen from the first two rows of Table 6, only in one case the coefficient loses statistical significance. Next, we change the conditioning to firms with a bond issued in the last two years or remove the conditioning on past issuance completely, to see whether our results are sensitive to this. This does not appear to change results notably. We also try no filtering, which is equivalent to keeping any bond issuer in the sample indefinitely. This reduces the magnitude and significance of the lending standards variable, but otherwise leaves estimates in the neighborhood of the baseline results. These two tests suggest that while the details of the conditioning on prior issuance (i.e. two vs. five years) is not critical, some conditioning is necessary, most likely to keep firms which had, but no longer have, access to the bond market from contaminating the results.

Our baseline regressions are estimated in the seventy eight quarters from 1990Q1 to 2009Q4, a fairly long time period. This raises two concerns. First, the effect of bank loan supply needs not be stable through time, and there is enough time to consider this possibility quantitatively. In particular, we might worry that the 2007-2009 financial crisis somehow differs from normal times. We therefore exclude the last sixteen quarters (2006:Q1-2009:Q4) from the sample. This does not have a large impact on the results (the non-performing loans variable has a larger coefficient, while lending standards and stock prices have smaller coefficients, but these are not significant differences). Second, the firm fixed effects are meant to absorb compositional changes in the pool of firms raising debt. If the time period is too long, firms may change through time, and the firms' fixed effects may not do their job properly. To address this concern, we vary the sample timing and the number of fixed effects.

[TABLE 6]

[25] Each line of Table 6 shows the coefficient estimate from a regression, which differs from the baseline regressions in Table 3 as described in the left column.

In the next regression, we allow each firm to have a separate fixed effect for each decade (i.e., 1990:Q1-1999:Q4 and 2000:Q1-2009:Q4). This larger set of fixed effects absorbs more of the variation in the dependent variable, but does not change the coefficients on the time series variables much. Two coefficients are larger in absolute terms, two are smaller, all are significantly different from zero, and none are significantly different from the baseline results (in a statistical sense). We can push this further, of course, by letting the fixed effects apply for even shorter periods. The control for compositional changes becomes even better, but eventually we will run into the limits of identification. The following two lines of Table 6 show results for five and then four year periods. Results remain comparable to the baseline, and generally larger with five year periods, while the bank index has an insignificant coefficient for the four year periods (if we use even shorter periods, not reported, eventually all variables lose significance). The regressions with four year periods contain approximately 4,000 fixed effects and identify only from firms raising both bond and bank debt in the same four-year period, so some loss of significance is perhaps to be expected.

Finally, we divide the sample into months, using quarterly accounting data from the preceding quarter, and the finest time series variation available for the bank supply variables. Coefficient variables are very similar to the quarterly regressions.

All the tests reported so far have been restricted to term loans and corporate bonds with maturity exceeding one year. However, much bank credit is given in the form of revolving lines, on which firms can draw as needed. Because the amount of outstanding credit is normally much less than the maximum amount available under the revolver, it makes sense to treat credit lines differently. However, excluding credit lines may affect our results if the reduced quantity of bank lending we observe is actually a shift from term loans to credit lines. To test this, we add credit lines and short term market financing, in the form of corporate commercial paper, to the sample. Results are reported in Table 7.

The first line of Table 7 reports base line results from Table 3. The next line uses only commercial papers and credit lines, and the last line combines bonds with commercial paper, and credit lines with term loans. Extending the sample to short term credit leads to coefficient estimates that are similar in sign, larger in magnitude, and in two cases, lower in significance. This lower significance likely reflects the lower power in the test that uses only short term debt. This lower power stems from the fact that only very few large firms have access to the

commercial paper market. This explains the low number of observations in the second row (less than three thousand) and the high mean of the dependent variable (see also the two panels of Figure 1 where the same pattern is visible). Despite the low power, three of the four coefficient estimates are significantly different from zero in the short term credit sample. In the full sample, which includes both short and long term credit, the effects estimated earlier are significant, and all the magnitudes are larger than what we estimated for long term credit only. This confirms that the restriction to long term credit is econometrically conservative and does not bias our results toward finding effects of the time-series variables we use to proxy for banks' willingness to lend.

[TABLE 7]

The robustness results show that our baseline findings are representative of patterns across time periods and credit types, are not particularly sensitive to the number of fixed effects included, and are robust to variations in sample definition and the controls included.

4. The effect of bank loan supply for firms unable to substitute with bonds

Our results so far are identified from firms that are able to raise credit in bad times. Yet, many firms, for example those that have never issued bonds, will find it hard to substitute to public debt if the supply of bank loan contracts. If the substitution between private and public debt captures aggregate bank-credit supply, it should predict credit for *small* firms. This is consistent with the evidence that emerges from Figure 1. In-sample correlation between share of bank debt as a percentage of total corporate debt and net percentage of banks tightening lending standard for small firms is -0.42 and -0.39 for medium and large firms. (The correlation is -0.57 for small firms and -0.52 for medium and large firms if we include commercial paper and revolving lines.)

We can further test the relevance of loan and bond substitution as a measure of aggregate loan supply by focusing on the incidence of new bank debt for firms with no access to bond markets. We implement this by estimating regression (1) in the sample of Compustat firms that never issue a bond. Results are presented in Table 8. The dependent variable's mean is low, only 0.013, so coefficients should be smaller than in the base line regression presented in Table 3. Of the four time-series variables used in the earlier test, three predict probability that the firm will get bank loans in this sample (Table 8, columns 1 through 4). The coefficients are also economically large compared to the mean of the dependent variable. Notice that the measure of

tightening in lending standards—as discussed earlier, the measure most frequently used as an indicator of credit supply—is statistically insignificant.[26] Although overall results are consistent with the loan supply interpretation —e.g., increase in non-performing loans is associated with a lower likelihood of a firm getting a loan—this is not a stringent test because some of the correlation might be driven by variation in the demand for credit.

The focus of Table 8 is on columns five and six where we include the fraction of bank loans in external credit as an explanatory variable. (If there are 100 firms issuing debt in a given quarter and 5 of them issue loans, *Loan-bond substitution* is 0.05.) By construction, variation in this measure picks up variation in credit supply. As expected, the coefficient is positive and significant. The coefficient estimate implies that a one standard deviation increase in the ratio (8.9 percentage points) predicts an increase in the probability of an unrated firm receiving a bank loan in a given quarter by 0.25%, i.e., a 7% increase over the mean probability. The variable even holds up remarkably well in a horse race with the other time-series variables. The bank price index remain significant, whereas the tightening in loan standards variable becomes significant but with a positive coefficient. This shows the strong out-of-sample predictive power of the *Loan-bond substitution* variable, suggesting that the choice between bond and loan financing for the set of unconstrained firms is indeed an indicator of aggregate banks' willingness to lend.

[TABLE 8]

In Table 9 we present a reduced form of the effect of bank credit supply on firms' investments. The focus is on the variable measuring loan to bond substitution. The economic signs are as expected; a lower share of loans as a fraction of total debt (contraction in credit supply) is associated with lower investments. The results are statistically insignificant for the set of firms with access to both bond and loan markets. This result is consistent with the earlier argument that bonds and loans are close substitutes for the firms with access to both forms of debt financing. We next examine firms which have not previously issued bonds. For these firms, which lack access to the bond market, the coefficient estimate is again positive but insignificant.

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[26] The survey from which this measure is taken asks separate questions for borrowers of different sizes. We continue to use the survey data on tightening in lending standards for medium and large firms because our sample only includes firms with Compustat data (i.e., these firms are relatively large). However, the time-series correlation between the tightening of lending standards to small and that to medium and large firms is 0.97 so this choice is unlikely to matter.

This may be because we constrain our sample to firms with valid accounting information in Compustat. These firms may not be small (financially constrained) enough to show effect of loan supply, for example, because they can access the equity market.

One way to assess this is to focus on the sub-sample of financially constrained firms. In the last two columns in Table 9, we report a regression conditioning on above industry-median leverage (high leverage) and below industry-median stock-market valuation (low valuation) as proxies for financial constraints in general and specifically limited access to the equity market in combination with proven appetite for debt. This set of Compustat firms likely resembles non-Compustat firms better than the overall sample, and in that sense, this result may be suggestive of the business cycle effect of loan supply on investment for small firms generally. For this set of more constrained firms, the fraction of firms issuing loans in the overall flow of corporate debt is a significant predictor of investment activity. Thus, consistent with theory, these findings indicate that bank-credit supply is an important determinant of the real activity for bank-dependent firms.

[TABLE 9]

In generalizing the substitution between bank and bond debt as a measure of loan supply, we must be careful in interpreting the magnitudes. In recessions, the shift in bank credit supply for smaller firms is likely to be larger than for the firms that can freely substitute between bonds and loans (and in that sense we pick the lower bound of the loan supply shift). While this is a limitation, the substitution variable (based on firms that can substitute) constitutes a substantial improvement over existing measures of bank loan supply in a time-series context.

5. Conclusions

Theory predicts that credit supply should be an important factor in explaining the evolution of the business cycle. The existing empirical literature has uncovered several examples consistent with the economic role of the credit supply, but largely in cross-sectional settings or using isolated events. Tests using natural experiments or instruments to identify effects of the credit supply have limited out-of-sample applicability, and may not capture how credit supply moves in business downturns. The fact that there was a contraction in credit supply following the burst of the Japanese bubble in the early 1990-ies and after the 1998 Russian debt crisis can tell us that firms suffer when their lenders are troubled, but provides little guidance about how bank

lending aggravates the business cycles such as the 2008 downturn, or if banks' reluctance to lend delayed the recovery in 2010. On the other hand, work that uses bank-level cross-sectional variation to identify the credit-supply effect in a time series admits other interpretations. In this paper we bring new evidence to bear on the question of bank lending in the business cycle. This evidence provides a sharper test of whether credit supply matters in a time series setting.

Rather than bank-level variation in loan issuance, we study firms' choice between bank and public debt. Our focus is on large, rated firms for which these two forms of financing can be considered close substitutes. There are time-series measures of bank lending, but they may confound demand and supply. For example, tighter lending standards based on the Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices could be correlated with firms' demand for credit. Thus, we need to control for demand, and that is the principal contribution of this paper. The intuition for our methodology is simple: by restricting the sample to firms that receive new debt financing in a given quarter, we identify a setting in which we are able to isolate the demand effect. Because these firms receive some kind of credit, we know that their demand for external financing is not zero. Conditional on getting financing, and conditional on having a loan at some point, if a firm issues bonds when credit standards are tightening, we interpret it as a contraction in bank credit supply. Using firm-level data we can control for firm-level effects, which rules out any explanation based on shifts in the composition of demand at the aggregate level.

By design, we focus on the least financially constrained firms in the economy. However, we validate the loan-to-bond substitution effect for large firms as a predictor variable in the out-of-sample context for overall contraction in credit for small and non-rated firms. As expected, our results are a strong predictor of overall contraction in credit for firms that cannot substitute into bonds. We use the measure to whom that investment of constrained firms is affected by the contraction in bank credit identified from large firms' substitution patterns.

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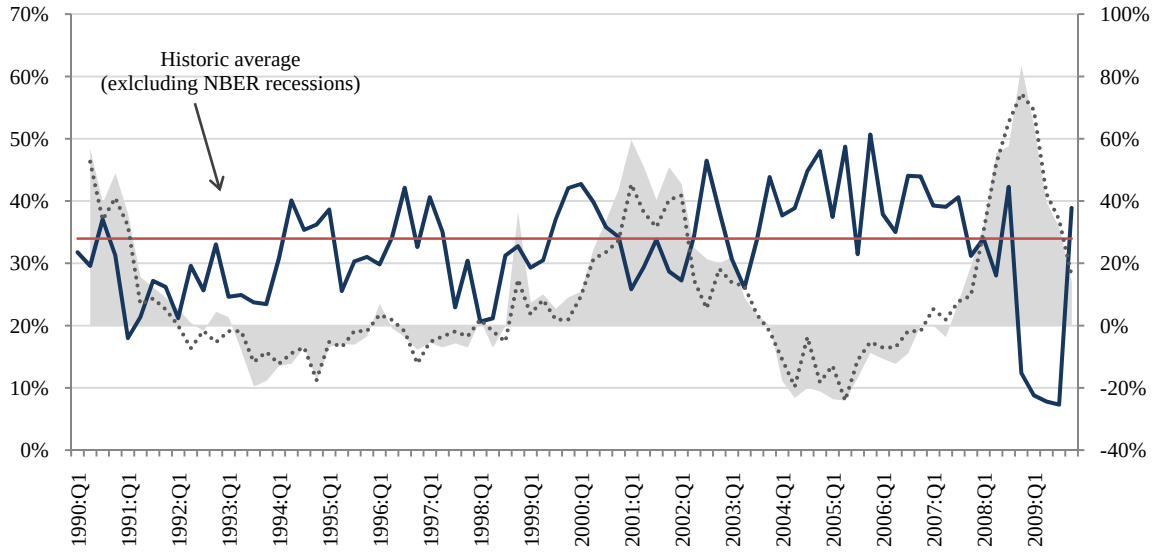
Figure 1
Share of bank debt as a percentage of total corporate debt financing

The graph plots number and volume of bank loan issues as a fraction of total debt issues for the firms with credit ratings. This graph measures the substitution effect between bank and bond financing, condition on the firms that have access to both types of financing. Data on tightening of lending standards comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices and correspond to the net percentage of medium and large lenders tightening credit standard for commercial and industrial loans. The horizontal line corresponds to the historic average of bank debt as a percentage of total corporate debt calculation over 1990-2009 period excluding NBER recessions.

Panel A: Excluding commercial paper and revolving lines



Panel B: Including commercial paper and revolving lines

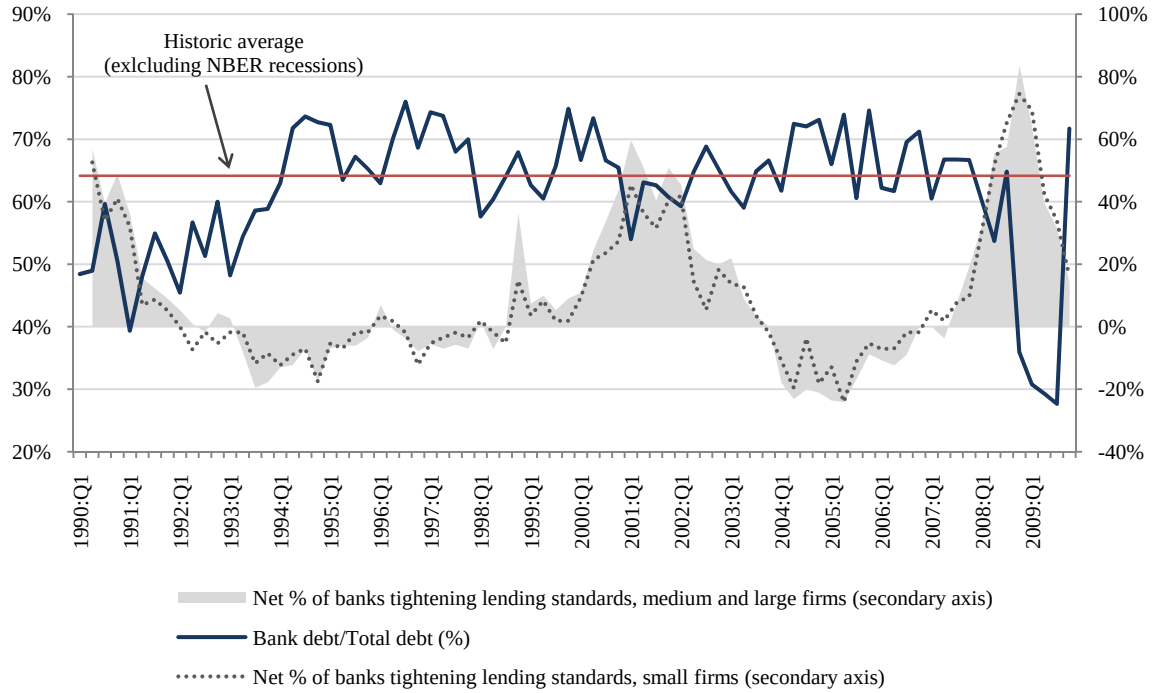


Figure 2
Volatility of corporate credit growth: Loans vs. Bonds

Figure 2 is compiled from quarterly United States Flow of Funds Accounts data (1953:Q1 -2010:Q2.) Each series corresponds to a four quarter rolling-window growth in nonfarm, nonfinancial corporate debt stock (Flow of Funds). *Bank and other loans* is the sum of Other Loans and Advances and Bank Loans Not Elsewhere Classified. *Commercial paper and corporate bonds* includes Commercial Paper and Corporate Bonds. Shaded areas indicate NBER recession periods. Dashed vertical lines indicate exogenous shifts in bank credit supply documented by the existing literature: (i) 1961 credit expansion following emergence of the market for certificate deposits (Leary, 2010); (ii) 1966 Credit Crunch (Leary, 2010); (iii) 1990 credit contraction following the burst of the Japanese real estate bubble (Peek and Rosengren, 2000); and (iv) 1998 credit contraction following the Russian debt crisis (Chava and Purnanandam, 2010).

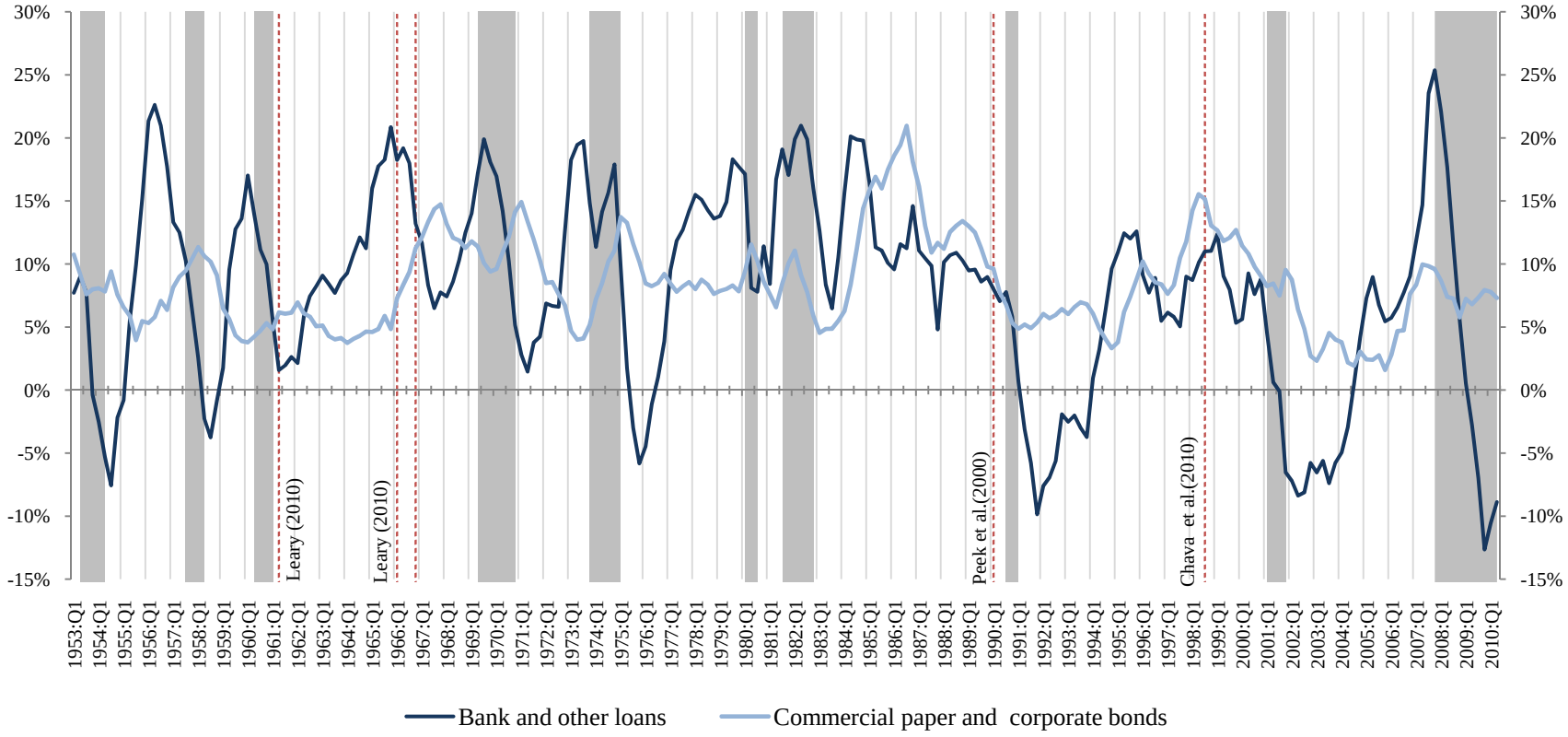


Figure 3
Relative cost of corporate loans vs. bonds

The graph plots loan-to-bond ratio of yields to maturity by credit rating. Yields are computed at issuance. BBB includes bonds and loans rated BBB+, BBB or BBB-; similarly for other categories. Loan data comes from DealScan database of loan originations and correspond to U.S. term loans with maturity between 3 and 10 years. Bond data comes from SDC Platinum and includes bonds and notes with maturity between 3 and 10 years issued by U.S. firms. The ratio of bank debt to total debt corresponds to the series plotted in the Figure 1 excluding commercial paper and revolving lines.

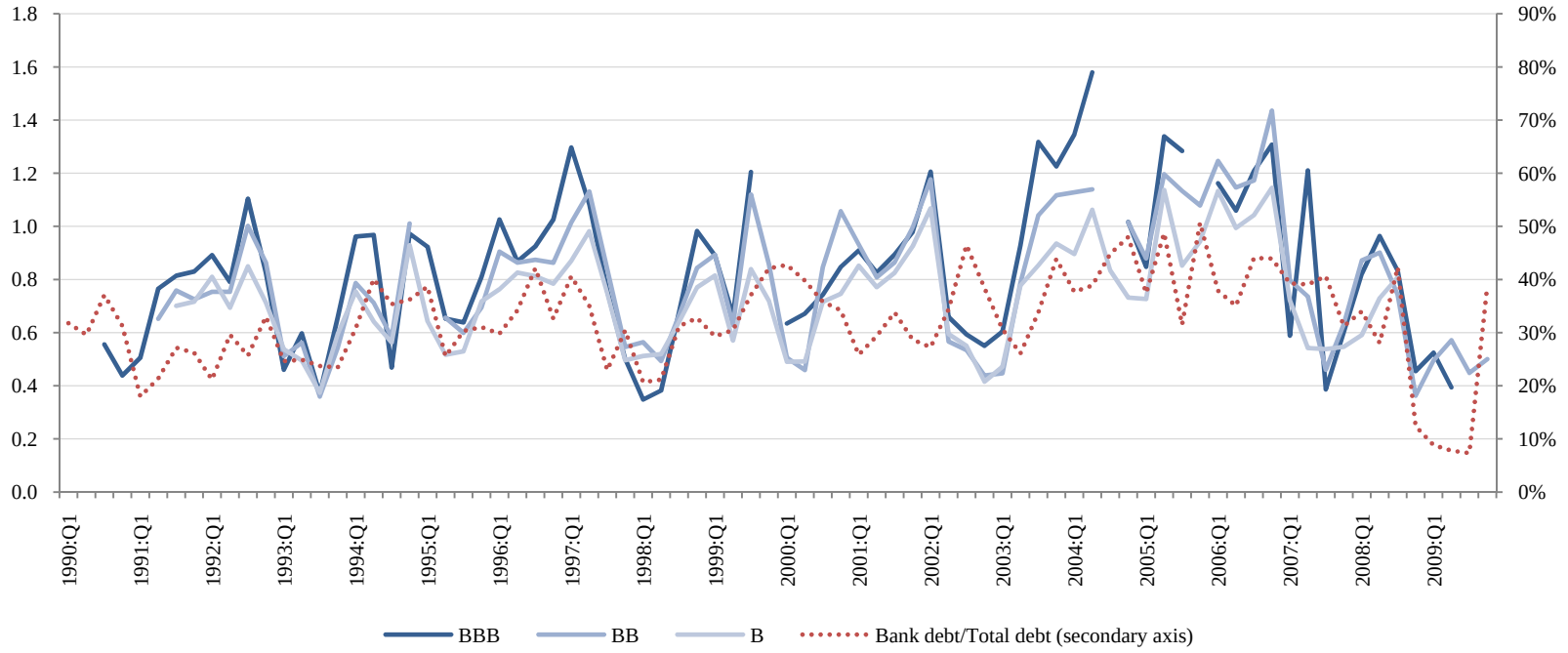


Table 1
Firm Level Variables

Statistics from the firm level quarterly panel, covering the 1990Q1 to 2009Q2 period. Debt financing data is tabulated for observations with data on control variables. Firm controls are the log of assets (lagged), the log of property, plant and equipment (lagged), the return on assets (operating income before depreciation divided by previous quarter's assets), one year lagged return to the end of the previous quarter, market-to-book ratio, and two dummies indicating whether a firm pays a dividend and repurchased shares (according to cash flow statement) in the current quarter, respectively. GDP growth is real per capita growth, seasonally adjusted. Data on tightening of lending standards comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices. The series corresponds to the net percentage of domestic respondents tightening standard for commercial and industrial (C&I) loans to large and medium-sized firms. Non-performing loans to equity ratio was compiled from Call Reports and correspond to market capitalization value-weighted averages. Sample includes large banks with available information (Bank of America, JPMorgan Chase, Citibank, Wells Fargo, Bank of New York, US Bancorp, Fifth Third Bancorp, Wachovia, Toronto-Dominion Bank , SunTrust, KeyCorp, Regions Financial, Comerica, PNC, National City Corporation.) Bank index is the logarithm of the level of the market-adjusted price for banks (industry #11) available from Kenneth French's data library. Monetary policy is based on the federal funds rate deviation from the target level as specified by Taylor-rule.

Panel A: Frequency of new debt finance

Observations (firm-quarter):		
Full sample	214,654	100.00%
With no new debt	201,872	94.05%
Excluding commercial paper and revolving credit lines:		
With new debt	12,782	5.95%
With new bank debt	4,089	1.90%
With new bond debt	9,217	4.29%
With only one kind of new debt	12,258	5.71%
Including commercial paper and revolving credit lines:		
With new debt	22,869	10.65%
With new bank debt	15,040	7.01%
With new bond debt	10,342	4.82%

Panel B: Firm level control variables (sample with only one kind of new debt)

Variable name	Observations	Mean	Std. Dev.	10^{th} %	Median	90^{th} %
Log (Assets)	12,257	7.395	1.939	4.734	7.474	9.887
Log (PP&E)	12,257	6.233	2.312	3.005	6.473	9.086
ROA	12,257	0.032	0.034	0.008	0.033	0.064
Market-to-book	12,257	1.483	0.652	0.942	1.29	2.25
Lagged 4y return	12,257	0.013	0.56	-0.556	0.032	0.511
Leverage	12,257	0.351	0.173	0.131	344	0.567
Dividend payer	12,257	0.524	500	0	1	1

Table 1-continued

Panel C: Time series variables (1990Q1-2009Q4)

Variable name	Mean	Std. Dev.	10^{th} %	Median	90^{th} %
Tightening in lending standards	10.2	24.6	-17.6	3.1	49.9
Non-performing loans (1999-2009Q2)	5.3%	2.4%	2.3%	5.4%	7.8%
Bank index	2.08	0.19	1.81	2.11	2.30
Monetary policy	1.44	1.74	-0.71	1.23	3.61

Panel D: Time series variables correlations

	Variable name	(1)	(2)	(3)
(1)	Tightening in lending standards	1		
(2)	Non-performing loans (1999-2009Q2)	0.697***	1	
(3)	Bank index	-0.103	-0.391**	1
(4)	Monetary policy	0.129	-0.161	0.432***

Table 2
Growth of Nonfarm, Nonfinancial Corporate Debt Stock

The data is compiled from the quarterly Flow of Funds data. Bank debt is the sum of Other Loans and Advances and Bank Loans Not Elsewhere Classified. Market debt is the sum of Credit Commercial Paper Issued by Nonfinancial Firms and Corporate Bonds. The data covers 231 quarters from 1952:Q4 to 2010:Q2. Growth rates are real four quarter log growth rates (net of the log change in the consumer price index). Panel A reports distribution of corporate credit Panel B, regressions of current credit growth on lagged credit growth and controls are presented. Any quarter containing a month classified as a recession month by NBER is classified as a recession. The quarters in 2009 are excluded from the regression, due to uncertainty about NBER recession dates. Errors are heteroskedasticity-robust. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Panel A: Summary statistics

Rolling 4Q growth rate, real	Public debt	Bank debt
Mean	6.81%	6.23%
Std. Dev.	3.60%	7.50%
Min	0.13%	-11.17%
10^{th} %	2.91%	-5.46%
Median	6.27%	7.43%
90^{th} %	11.49%	16.30%
Max	20.21%	23.29%
Quarters with negative growth (fraction)	0 (or 0%)	48 (or 20.8%)
Correlation with real GDP growth	0.034	0.221***

Panel B: Regression of real growth on lagged growth, real GDP and recessions

	Public debt	Bank debt
Lagged growth (previous quarter)	0.941***	0.928***
	(0.026)	(0.023)
NBER recession indicator	0.002	-0.005
	(0.002)	(0.006)
GDP growth (real, 4 quarter)	-0.075	1.161***
	(0.082)	(0.200)
R-squared	0.890	0.885
Observations	230	230

Table 3
Within-Firm Evidence on Loan vs. Bond Choice

Each observation in the sample corresponds to a new issue of bank or public debt. If in a given quarter a firm did not have a new loan or bond issue it will not be included in the sample. In this table, observations are excluded when a firm has not issued a bond in the last five years. The dependent variable is a dummy equal to 1 if the firm received a bank loan in that quarter and 0 otherwise. The table reports results of the linear regressions for the period 1990:Q1 to 2009:Q4. Data on tightening of lending standards comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices. The series corresponds to the net percentage of domestic respondents tightening standard for commercial and industrial (C&I) loans to large and medium-sized firms. Non-performing loans to equity ratio was compiled from Call Reports and correspond to market capitalization value-weighted averages. Sample includes large banks with available information (Bank of America, JPMorgan Chase, Citibank, Wells Fargo, Bank of New York, US Bancorp, Fifth Third Bancorp, Wachovia, Toronto-Dominion Bank , SunTrust, KeyCorp, Regions Financial, Comerica, PNC, National City Corporation.) Bank index is the logarithm of the level of the market-adjusted price for banks (industry #11) available from Kenneth French's data library. Monetary policy is based on the federal funds rate deviation from the target level as specified by Taylor-rule. Firm controls are the log of assets (lagged), the log of property, plant and equipment (lagged), the return on assets (operating income before depreciation divided by previous quarter's assets), one year lagged return to the end of the previous quarter, leverage (long term debt over assets) and two dummies indicating whether a firm pays a dividend and repurchased shares (according to cash flow statement) in the current quarter, respectively. Errors are heteroskedasticity-robust and clustered by quarter. *** , ** , * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable: Dummy equal 1 if the issue is a loan, 0 if the issue is a bond				
Dependent variable mean:	0.133	0.173	0.133	0.133
	(1)	(2)	(3)	(4)
Tightening in lending standards	-0.075***			
	(0.028)			
Non-performing loans /Equity		-2.032***		
		(0.361)		
Bank index			0.205***	
			0.0458	
Monetary policy				0.0147***
				(0.0047)
Log (Assets)	0.065***	0.047	0.022	0.042
	(0.025)	(0.035)	(0.016)	(0.027)
Log (PP&E)	-0.018	-0.028	0.007	-0.012
	(0.024)	(0.028)	(0.023)	(0.024)
ROA	-0.004	0.447	0.010	0.012
	(0.260)	(0.282)	(0.266)	(0.26)
Market-to-book	-0.033**	-0.050**	-0.044	-0.033**
	(0.015)	(0.022)	(0.016)	(0.015)
Lagged return	-0.024	-0.052**	-0.021	-0.021
	(0.014)	(0.017)	(0.014)	(0.014)
Leverage	0.198***	0.190**	0.172***	0.175***
	(0.053)	(0.091)	(0.052)	(0.052)
Dividend payer	-0.096***	-0.081**	-0.079***	-0.085***
	(0.026)	(0.033)	(0.028)	(0.027)
Firm fixed effects (Obs.)	Yes (2,101)	Yes (1,550)	Yes (2,101)	Yes(2,101)
Clusters (quarter)	79	42	79	79
R-squared	0.40	0.48	0.44	0.40
Observations	10,025	5,718	10,026	10,026

Table 4

Relative Cost of Corporate Loans vs. Bonds

This table presents correlations between loan-to-bond ratio of yields to maturity and macroeconomic variables. Data is quarterly and corresponds to the period between second quarter of 1990 and second quarter of 2009. Yields are computed at issuance. BBB includes bonds and loans rated BBB+, BBB or BBB-; similarly for other categories. Loan data comes from DealScan database of loan originations and correspond to U.S. term loans with maturity between 3 and 10 years. Bond data comes from SDC Platinum and includes bonds and notes with maturity between 3 and 10 years issued by U.S. firms. Data on tightening of lending standards comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices. The series corresponds to the net percentage of domestic respondents tightening standard for commercial and industrial (C&I) loans to large and medium-sized firms. Non-performing loans to equity ratio was compiled from Call Reports and correspond to market capitalization value-weighted averages. Sample includes large banks with available information (Bank of America, JPMorgan Chase, Citibank, Wells Fargo, Bank of New York, US Bancorp, Fifth Third Bancorp, Wachovia, Toronto-Dominion Bank , SunTrust, KeyCorp, Regions Financial, Comerica, PNC, National City Corporation.) Bank index is the logarithm of the level of the market-adjusted price for banks (industry #11) available from Kenneth French's data library. Monetary policy is based on the federal funds rate deviation from the target level as specified by Taylor-rule. *** , ** indicate statistical significance at 1% and 5% level, respectively.

	Tightening in lending standards	Non-performing loans/Equity	Bank index	Monetary policy
Loan/Bond yield to maturity:				
BBB	-0.269**	-0.385**	0.373***	0.273**
BB	-0.208*	-0.482***	0.377***	0.226*
B	-0.074	-0.350**	0.332***	0.156

Table 5

Loan vs. Bond Choice: By Firms' Characteristics

This table re-examines results in Table 3 for different subsamples. The specifications are exactly the same as in Table 3, but for compactness of presentation we only report coefficients for the main explanatory variables—tightening of lending standards from Senior Loan Officer Opinion Survey, non-performing loans to equity ratio compiled from Call Reports, the logarithm of bank index and monetary policy shocks calculated using the federal funds rate deviation from the target level as specified by Taylor-rule. As in Table 3, regressions correspond to the choices of bank loan vs. bond finance over the period 1990Q1 to 2009Q2. Each observation is a firm-quarter where the firm issued bonds, received a new loan, or both. The dependent variable is a dummy equal to 1 if the firm received a bank loan in that quarter and 0 otherwise. Errors are heteroskedasticity-robust and clustered by quarter. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

	Dependent variable: Dummy equal 1 if the issue is a loan, 0 if the issue is a bond			
Explanatory variable:	Tightening in lending standards	Non-performing loans/Equity	Bank index	Monetary policy
Benchmark (Table 3)	-0.075***	-2.032***	0.205***	0.014***
Yield ratio (by rating category)	-0.087***	-1.935***	0.185***	0.008
Single-segment firms only	-0.071**	-1.883***	0.221***	0.013***
Book leverage:				
Bottom quintile	0.026	-0.232	0.038	0.012
Second quintile	-0.052	-1.044	0.071	0.007
Middle quintile	-0.043	-0.424	0.219**	0.007
Third quintile	-0.096*	-2.409***	0.306***	0.013*
Top quintile	-0.181**	-3.025***	0.428***	0.019
Credit rating:				
Investment grade	-0.255***	-0.753***	0.075**	0.014***
Non-investment grade	-0.004	-4.455***	0.523***	0.006

Table 6

Loan vs. Bond Choice: Further Controls

This table re-examines results in Table 3 for different time periods. The specifications are exactly the same as in Table 3, but for compactness of presentation we only report coefficients for the main explanatory variables— tightening of lending standards from Senior Loan Officer Opinion Survey, non-performing loans to equity ratio compiled from Call Reports, the logarithm of bank index and monetary policy shocks calculated using the federal funds rate deviation from the target level as specified by Taylor-rule. As in Table 3, regressions correspond to the choices of bank loan vs. bond finance. Each observation is a firm-quarter where the firm issued bonds, received a new loan, or both. The dependent variable is a dummy equal to 1 if the firm received a bank loan in that quarter and 0 otherwise. Errors are heteroskedasticity-robust and clustered by quarter. *** , ** , * indicate statistical significance at 1%, 5% and 10% level, respectively.

	Dependent variable: Dummy equal 1 if the issue is a loan, 0 if the issue is a bond			
Explanatory variable:	Tightening in lending standards	Non-performing loans/Equity	Bank index	Monetary policy
Benchmark (Table 3)	-0.075***	-2.032***	0.205***	0.014***
Further controls:				
Financing amount (log, real)	-0.077**	-2.270***	0.209***	0.014***
Time to maturity	-0.085***	-2.200***	0.204***	0.009*
Yield, amount, maturity	-0.110***	-2.215***	0.188***	0.006
Prior issuance filter:				
Bond issues in last 2 years	-0.091***	-1.615***	0.104***	0.010***
No filter	-0.037	-1.583***	0.244***	0.019***
Excluding crisis (2006-2009)	-0.058**	-2.621***	0.163***	0.015***
Fixed effects (Firm*Time window):				
10 years	-0.117***	-2.128***	0.159***	0.010*
5 yeas	-0.115***	-1.852***	0.277***	0.017***
4 years	-0.092***	-1.738***	0.146	0.012**
Monthly data	-0.127***	-2.228***	0.397***	--

Table 7
Including Short Term Financing: Commercial Paper and Revolving Credit Lines

In this table we relax our definition of bank credit and bond debt to include revolving credit and commercial paper issues. In each row, the regression only includes observations for firms which have accessed the market in the last five years (i.e. twenty quarters). This access refers to bonds in the first row, commercial paper in the second, and either type of security in the third. In each regression, firm-quarters where both types of financing occur are excluded. *** , ** , * indicate statistical significance at 1%, 5% and 10% level, respectively.

	Dependent variable: Dummy equal 1 if the issue is a loan, 0 if the issue is a bond					
Explanatory variable:	Mean	Obs.	Tightening in lending standards	Non-performing loans/Equity	Bank index	Monetary policy
Term loans vs. bonds (Table 3)	0.133	10,025	-0.075***	-2.032***	0.205***	0.014***
Revolvers vs. commercial paper	0.604	2,828	-0.101*	-0.785	0.709***	0.028**
Term loans/revolvers vs. bonds/ CP	0.418	13,449	-0.204***	-3.275***	0.597***	0.026***

Table 8

Out-of-sample Prediction Effect of the Loan-Bond Substitution Measure

This table uses sample of firms *not* used in the analysis in Table 3. Each observation in the sample corresponds to a firm-quarter. The dependent variable is a dummy equal to 1 if the firm received a bank loan in that quarter and 0 otherwise. Firms are included this sample as long as they have not issued bonds. The table reports results of the linear regressions for the period 1990:Q1 to 2009:Q4. The focus is on *Loan-bond substitution* defined as the fraction of firms which used bank credit among those firms that receive only one type of financing in a given quarter. As before, data on tightening of lending standards comes from Federal Reserve Senior Loan Officer Opinion Survey on Bank Lending Practices. The series corresponds to the net percentage of domestic respondents tightening standard for commercial and industrial (C&I) loans to large and medium-sized firms. Non-performing loans to equity ratio was compiled from Call Reports and correspond to market capitalization value-weighted averages for large banks with available information. Bank index is the logarithm of the level of the market-adjusted price for banks (industry #11) available from Kenneth French's data library. Monetary policy is based on the federal funds rate deviation from the target level as specified by Taylor-rule. Firm controls are the log of assets (lagged), the log of property, plant and equipment (lagged), the return on assets (operating income before depreciation divided by previous quarter's assets), one year lagged return to the end of the previous quarter, leverage (long term debt over assets) and two dummies indicating whether a firm pays a dividend and repurchased shares (according to cash flow statement) in the current quarter, respectively. Standard errors are heteroskedasticity-robust and clustered by quarter. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable: Dummy equal 1 if the firm receives a new loans in the quarter, 0 otherwise						
Dependent variable mean:	0.0134	0.0128	0.0134	0.0134	0.0134	0.0128
	(1)	(2)	(3)	(4)	(5)	(6)
Tightening in lending standards	-0.016					0.005**
	(0.020)					(0.002)
Non-performing loans /Equity		-0.050**				0.032
		(0.022)				(0.022)
Bank index			0.020***			0.017***
			(0.003)			(0.004)
Monetary policy				0.0007***		0.0002
				(0.0002)		(0.0002)
Loan-bond substitution					**0.028*** **	**0.035*** **
					(0.003)	(0.004)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects (Obs.)	Yes (6,461)	Yes (4,551)	Yes (6,462)	Yes (6,462)	Yes (4,551)	Yes (4,551)
Clusters	80	42	80	80	42	42
R-squared	0.09	0.10	0.09	0.09	0.10	0.10
Observations	146,680	83,590	146,679	146,677	83,220	83,267

Table 9
Real Effects of Loan Supply

Each observation in the sample corresponds to a firm in a given quarter. The dependent variable is investment in property, plant and equipment over lagged assets. The table reports results of the linear regressions for the period 1990:Q1 to 2009:Q4. The focus is on *Loan-bond substitution* defined as the fraction of firms which used bank credit among those firms that receive only one type of financing in a given quarter (conditional on the set of firms with access to bond markets). *High leverage* is a dummy variable equal to 1for firms with leverage above the industry median and 0 otherwise. *Low Q* is a dummy variable equal to 1for firms with market-to-book valuation below the industry median and 0 otherwise. Firm controls are the log of assets (lagged), the log of property, plant and equipment (lagged), the return on assets (operating income before depreciation divided by previous quarter's assets), one year lagged stock return to the end of the previous quarter, leverage (long term debt over assets) and two dummies indicating whether a firm pays a dividend and repurchased shares (according to cash flow statement) in the current quarter, respectively. Errors are heteroskedasticity-robust and clustered by quarter. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable: Quarterly change in Property Plant and Equipment as a % of lagged assets				
Dependent variable mean:	0.015	0.016	0.015	0.016
Firm sample:	Bond access	No bond access	No bond access/ High leverage/ Low Q	No bond access
	(1)	(2)	(3)	(4)
Loan-bond substitution	0.002	0.004	0.008**	0.010**
	(0.003)	(0.004)	(0.004)	(0.004)
Loan-bond substitution x Leverage				0.023**
				(0.010)
Loan-bond substitution x Market-to-book				-0.006***
				(0.002)
Log (Assets)	-0.003***	-0.003***	-0.009	-0.003***
	(0.001)	(0.000)	(0.015)	(0.001)
Log (PP&E)	-0.002***	0.001*	-0.006***	0.001*
	(0.001)	(0.000)	(0.001)	(0.000)
ROA	0.127***	0.072***	0.119***	0.072***
	(0.012)	(0.004)	(0.012)	(0.004)
Market-to-book	0.004***	0.004***	0.016***	0.005***
	(0.000)	(0.000)	(0.002)	(0.006)
Lagged return	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.000)	(0.001)	(0.000)
Leverage	-0.005**	-0.004*	0.004	-0.004
	(0.002)	(0.002)	(0.004)	(0.004)
Dividend payer	0.002***	0.002***	0.005***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Firm fixed effects (Obs.)	Yes (1,975)	Yes (4,980)	Yes (2,368)	Yes (4,980)
Clusters (quarter)	79	79	79	79
R-squared	0.26	0.25	0.25	0.25
Observations	45,835	85,797	24,129	85,797