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Bank Credit, Liquidity Shocks and Firm Performance: Evidence from the Financial Crisis of 2007-2009*

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Abstract

This paper provides evidence about the transmission of banking sector problems to the real sector, and examines the impact of bank credit supply frictions on firm performance. I exploit differences in the composition of banks' liabilities structure during the financial crisis of 2007-2009 as a source of exogenous variation in the availability of bank credit to nonfinancial firms, in order to identify the causal relationship between bank credit supply and firm performance, measured by firms' stock returns. My evidence indicates that banking relationships are important for firms. Firms whose banks relied more on core deposit financing had a lower decline in bank credit during the crisis than those whose banks were mainly financed by noncore sources of funding. I document a positive relationship between changes in bank credit and firms' stock returns during the crisis: a one standard deviation decline in bank credit to a firm causes a stock return reduction of 3.5 percentage points, while firms that had lending relationships with healthier banks had a lower decline in bank credit and thereby lower reductions in their stock returns during the crisis.

Key words: Bank credit, bank liquidity shock, financial crisis, relationship lending, firm financial constraints, firm performance

JEL Classification: E44, G21, G32, L25

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1 Introduction

How important are banks as liquidity providers for the real sector? Banks serve as a source of external finance for businesses, especially for small ones that would likely have difficulties obtaining liquidity from nonbank sources of financing. Problems with the financial health of banks trigger a decline in credit supply and cause distress to business activity.[2] Therefore, when banks experience funding troubles, central banks worldwide try to suppress tensions by offering different programs to provide liquidity and to restore solvency in the banking sector. But are all these interventions always necessary? The problem with bank distress and economic downturn is that they usually occur at the same time. Therefore, it is hard to disentangle the direction of causality. It is not always clear whether it is a decline in lending due to banks' financial health problems that causes a slowdown of economic activity, or that the economic slowdown and reduction in bank credit occur due to a decline in loan demand. In periods of bank distress, loan supply and economic activity can decline even without the feedback effect on bank lending from the deterioration of their financial health. However, the decline in lending itself may have little effect on economic activity if firms can access nonbank sources of funding.

The existing empirical literature that studies linkages between deterioration of banks' health and decline in bank lending and business activity provides inconclusive results. Early empirical literature documents the correlation between aggregate changes in liquidity, lending and output (Bernanke, 1983; Bernanke and Blinder, 1992). Moreover, it shows that shocks to banks' financial health can have a significant effect on the magnitude of an economic recession. However, these inferences can be misleading because the correlation between shocks to banks' financial health and changes in lending can be driven by overall deterioration of economic conditions, which reflect a decline in loan demand. Such a decline can occur because firms might postpone investment projects due to increased uncertainty, or because their creditworthiness deteriorates due to the economic downturn. The use of aggregate data does not allow to control for possible demand effects. To overcome this issue, more recent studies use cross-sectional variation (state, bank and firm level) (Altunbas, Gambacorta, and Marques-Ibanez, 2009; Ashcraft, 2006; Driscoll, 2004; Gambacorta, 2005; Gozzi and Goetz, 2010; Iyer, Lopes, Peydro, and Schoar, 2014) or natural experiments (Chava and Purnanandam, 2011; Gan, 2007; Khwaja and Mian, 2008; Peek and Rosengren, 2000). However, while it has been documented that banks cut back on lending in response to adverse liquidity shock, the evidence that a change in bank lending affects real economic activity is not conclusive (Driscoll, 2004; Ashcraft, 2006; Chodorow-Reich, 2014).

This paper, therefore, examines the relationship between disruptions in bank credit supply and firm performance. The implicit assumption of my methodological approach that allows the identification of this relationship relies on the fact that differences in banks' willingness to grant credit during the crisis were unrelated to the pre-crisis characteristics of banks' corporate borrowers. As has been widely discussed in the literature[3], the financial crisis of

[2]The importance of proper financial intermediation for business activity has been documented in empirical studies for instance by Rousseau and Wachtel (1998), Dell'Arricia, Detragiache and Rajan (2008) or Bena and Jurajda (2011).

[3]See the discusion of the crisis events in Acharya and Richardson (2009), Adrian and Shin (2010), Brunnermeier (2009), Diamond and Rajan (2009), and Gorton (2009).

2007-2009 originated in the sub-prime mortgage market, resulting in adverse liquidity shock to banks' short-term wholesale funding, which triggered severe liquidity problems for banks and contraction in their lending. Those banks that financed their assets mainly with short-term wholesale or noncore funding such as commercial paper, interbank loans, repurchase agreements and large denomination deposits, were highly exposed to the liquidity shock. In contrast, banks that mainly relied on retail or core deposits, which proved to be a more stable source of funding during the recent financial crisis, experienced lower liquidity shock (Cornett, McNutt, Strahan, and Tehranian, 2011; Ivashina and Scharfstein, 2010). Therefore, I employ heterogeneity in banks' liability structure and explore their pre-crisis reliance on core deposits to measure their exposure to the liquidity shock, to study whether firms that had lending relationships with more exposed banks had a relatively higher decline in bank credit, and if these firms also incurred any changes in their performance.

In order to establish the impact of contraction in bank credit on firm performance, I rely on another assumption, that there is relationship lending, meaning that bank-borrower ties are strong and valuable. Because switching banks is costly, this implies that firms with outstanding loans from banks that sustained a higher decline in lending during the crisis become more constrained in terms of obtaining bank credit than borrowers from healthier banks. In my study, I show that lending relationships matter in the loan syndication market. In the process of loan syndication, the originating bank (or "lead" bank) prepares the loan contract with the borrowing firm, retains the larger share of the loan and finds other lenders (or "participant" banks) willing to grant the rest of the loan amount. In my sample, there is a 63% higher likelihood for the lead bank of the firm's previous syndicated loan to become lead lender again, if the borrowing firm accesses the loan syndication market for new credit.

In this paper, I first analyze whether U.S. banks reduced lending to nonfinancial U.S. firms in response to adverse liquidity shock. One of the most harmful consequences of the financial crisis of 2007-2009 was the contraction in bank lending. New loans to businesses fell substantially from the third quarter of 2007. Ivashina and Scharfstein (2010) document a 79% drop in new loan originations to large businesses in the U.S. in the fourth quarter of 2008 relative to the second quarter of 2007. My findings tend to confirm that banks decrease lending due to negative funding shocks. I document a positive correlation between loan issuance and reliance on core deposit financing during the crisis in a cross-section of banks. My results show that banks that relied more on core deposit financing than wholesale funding reduced lending to a smaller extent.

I next turn to the examination of how banks' financial health affects provision of bank credit at the firm level and whether changes in bank credit affect firm performance. I document that the positive correlation between banks' reliance on core deposit financing and changes in bank lending during the crisis is also present in a cross-section of firms: firms whose banks relied more on core deposits had a lower decline in bank credit during the crisis, while switching to healthier banks during the crisis was very difficult for firms. My results for the cross-section of firms provide evidence that bank credit matters for a firm's valuation. There is a statistically significant positive relationship between bank credit growth and a firm's total return during the crisis: a one standard deviation decline in bank credit to a firm causes a stock return reduction

of 3.5 percentage points, which is almost three times larger in magnitude than the average firm-level total return of 1.2% during the sample period.

The results of this study are important for policy implications in two ways. First, my findings emphasize the need to carefully assess risk and liquidity of banks' funding sources. My results show that banks' higher reliance on core deposits helped them to sustain a lower reduction in lending during the crisis, with the latter adversely impacting business activity. Therefore risk and liquidity of funding sources should be taken into account in regulatory policies, thereby supporting the implementation of the stable funding ratios within the Basel III frameworks. Second, my research suggests the favorability of government policies aimed at providing liquidity support to banks and restoring the stability of the banking sector during the crisis, because due to the stickiness of bank-firm relationships, this leads to higher stock returns for firms, thereby propagating boosting in the real sector.

2 Literature Review

2.1 Bank liquidity, monetary shocks and financial crisis

Analysis of the real consequences of shocks to bank's liquidity has attracted significant attention among researchers over the last two decades. This stream of the literature starts with the examination of the impact of monetary policy driven liquidity shocks on bank lending and economic activity. Bernanke (1983) first showed that shocks to banks' financial health can have a significant effect on the magnitude of an economic recession. Bernanke and Blinder (1992) document that capital shocks, induced by monetary policy proxied by changes in the Federal funds rate correlate with aggregate macroeconomic variables, such as aggregate bank loan supply, bank deposits and aggregate output. The authors find that monetary policy tightening induces a decline in aggregate lending and output. However, these two studies do not account for a decline in loan demand in times of economic slowdown, which might cause a decline in loan supply as well as monetary tightening. In an attempt to resolve this identification problem, Kashyap and Stein (1995) use disaggregated data on bank balance sheets and repeat the analysis of Bernanke and Blinder (1992). Using cross-sectional differences in banks' responses to monetary tightening, Kashyap and Stein find that the decline in lending is more pronounced for small banks. Despite the authors advocating that there was a decline in lending due to monetary tightening, they do not analyze the effect of credit reduction on real activity. There are also other more recent studies that focus their analysis only on the effect of a deterioration in banks' health on lending (Gambacorta, 2005; Altunbas, Gambacorta, & Marques-Ibanez, 2009). Gambacorta (2005) and Altunbas et al. (2009) study consequences of liquidity shocks induced by monetary policy contractions. The authors find that an increase in the interest rate causes a decrease in bank lending. However, the effect of monetary policy is different across banks. For instance, it is higher for small, less liquid and poorly capitalized banks.

Apart from the monetary policy induced shocks to banks' health, there is a stream of works that examines causes and consequences of the financial crises that occurred around

the world over the last two decades. Peek and Rosengren (2000) and Gan (2007) study the collapse of the Japanese real estate market in the early 1990s. Peek and Rosengren (2000) find that adverse shock to parent banks in Japan was transmitted to their subsidiaries in the U.S., because these subsidiaries reduced lending in the U.S. Moreover, it had an adverse impact on the construction activity in the U.S. states that have higher penetration rates by Japanese banks. Gan (2007), using loan level data of matched pairs of firms and banks in Japan, is able to control for changes in firms' loan demand and risk. She finds that the same firm, with two lending relationships, obtains less funding from a bank that was ex ante more exposed to the real estate market. Gan also documents that reduction of bank lending, proxied by the top lender's exposure to the real estate market, causes a decline in a firm's investment and stock returns. Khwaja and Mian (2008) exploit unexpected nuclear tests in Pakistan as the exogenous shock which resulted in massive withdrawals of dollar denominated deposits in the country. Similarly to Gan (2007), Khwaja and Mian (2008) use loan level data and document that firms' loans from a bank that had a 1% larger decline in liquidity drop by 0.6%. In contrast to other studies, they examine the effect of a decline in bank financing among firms. They find that while the adverse effect of the liquidity shock on lending is large for all firms, the effect of the liquidity shock on firms' borrowing is large only for small firms. Large firms can completely compensate for a drop in bank lending through public credit markets, while small firms cannot do so. Therefore, small firms face large declines in their total borrowing and experience significant losses. Chava and Purnanandam (2009) use the Russian default of 1998 as an exogenous shock to the U.S. financial system, to examine whether adverse shocks to banks' financial health affected stock returns of bank-dependent firms in the U.S. The authors find that U.S. firms with access to the public debt market (rated firms) performed better than bank-dependent firms after the Russian default, i.e., rated firms reduced capital expenditure less than bank-dependent firms, and their operating profit decreased less than the profit of bank-dependent firms. Moreover in the post crisis period, banks with high exposure to the Russian crisis decreased the number of loans and increased their interest rates significantly more than banks with little exposure.

The financial crisis of 2007-2009 has reopened the question of whether bank performance can have a significant impact on business activity. Several papers examine the banks' behavior during the recent turmoil (Iyer, Lopes, Peydro, and Schoar, 2014; Ivashina and Scharfstein, 2010; Gozzi and Goetz, 2010; Cornett, McNutt, Strahan, and Tehranian, 2011; Wardlaw, 2010; Chodorow-Reich, 2014). Using loan level data for Portugal, Iyer et al. (2014) show that adverse liquidity shocks measured by banks' ex ante reliance on interbank loans triggered a decline in bank lending. Employing the within-firm estimator of Khwaja and Mian (2008), they document that, for the same firm, its borrowing from banks with a higher ratio of interbank loans to total assets declines more. They also show that this effect differs among firms. It is absent for large firms but more pronounced for small firms. Moreover, small firms cannot compensate for the credit drop from more affected banks by getting credit from other less affected banks or from nonbank sources of funding. However, the authors do not examine the effect of a drop in credit supply on firm performance.

Ivashina and Scharfstein (2010) use data on syndicated lending in the U.S. and show that provision of new credit to large businesses dropped during the crisis. However, this decline

in lending was diverse among banks. Banks funded with deposits managed to have a lower decline in lending while those that were more exposed to unused credit lines experienced a greater decline in provision of new credit. Cornett, McNutt, Strahan, and Tehranian (2011) extend the work of Ivashina and Scharfstein (2010). They study how commercial banks in the U.S. adjust their holdings of liquid and illiquid assets during a period of macroeconomic illiquidity, and they also show that it is retail or core deposits rather than total deposits that acted as a stable source of funding during the financial crisis of 2007 - 2009. Cornett et al. (2011) find that banks with higher holdings of illiquid assets and a lower share of core deposits accumulated liquid assets on their books during the turmoil, while at the same time they decreased provision of new credit. While Ivashina and Scharfstein (2010) and Cornett et al. (2011) document that banks reduce lending in response to adverse liquidity shocks, they do not analyze whether these shocks affected business activity during the recent turmoil. Research conducted by Gozzi and Goetz (2010) made an attempt to fill this gap. Gozzi and Goetz (2010) exploit data on U.S. commercial banks and find that banks that relied heavily on wholesale funding suffered a greater decline in lending than those that used core deposits to finance their assets. Moreover, they documented that the liquidity shock had an adverse effect on economic activity, because employment declined more in metropolitan areas, where banks had higher shares of wholesale funding to total assets. My research contributes to this literature by analyzing how the financial crisis of 2007-2009 affected business activity on the firm level rather than on the level of metropolitan areas.

More recent empirical studies by Wardlaw (2010) and Chodorow-Reich (2014) examine the consequences of deterioration of bank financial health respectively on investment and employment of U.S. firms. Both studies find that bank health matters, though in the case of Chodorow-Reich (2014) it matters only for small and medium firms. However, those studies consider the impact only on firms' balance-sheet characteristics, which can be measured with a time delay, or cannot be immediately and costlessly adjusted in response to shocks. In my paper I examine the impact of bank financial health on firm performance measured by stock returns, which should more accurately measure firms' responses to a changing banking environment.

Although there is consensus in the literature that bank health affects the credit supply, there is no consensus about the effect of bank lending on output. Despite studies which advocate that a change in bank lending affects real economic activity, there is evidence that this link is very limited. For instance, Driscoll (2004) and Ashcraft (2006) document the insignificant effect of aggregate loan supply shocks on the real output in the U.S. states. This study re-examines the link between shocks to loan supply and performance of U.S. firms. To the best of my knowledge, this is the first study that directly examines the impact of bank loan supply on firms' stock returns during the financial crisis of 2007-2009.

2.2 Relationship lending

In this study I examine whether credit supply frictions affect firm performance. Here I assume that lending relationships are valuable and important for firms in order to obtain access to bank credit. Otherwise, firms can almost costlessly switch to new banks to compensate a shortfall in credit supply of their troubled relationship banks during the crisis. In such a situation, I would

find no differential effect among clients of different banks and no effect of credit supply frictions on firm performance. Below I provide a brief overview of the existing literature advocating that lending relationships matter for borrowers.

The large strand of literature on financial intermediation emphasizes the importance of banks and the significant role of strong lending relationships in mitigating information frictions (Diamond, 1984; Ramakrishnan and Thakor, 1984; Boot, 2000). Strong lending relationships are beneficial for borrowers because, as has been shown in prior studies, closer ties to banks increase the availability of credit (Petersen and Rajan, 1994; Cole, 1998), reduce cost of funds (Berlin and Mester, 1998; Bharath et al., 2011) and help to relax collateral requirements (Berger and Udell, 1995). However, there are also costs of strong lending relationships due to a lender's ability to exercise monopoly power over private borrower-specific information acquired, thereby making it costly for a borrower to switch to another lender who is less informed (Sharpe, 1990; Rajan, 1992). Nevertheless there is evidence that borrowers switch to new lenders if their relationship lenders cannot satisfy their growing credit needs (Gopalan et al, 2011). Gopalan et al (2011) examined why borrowers switch lenders in the context of the U.S. loan syndication market.

In this paper, I use the loan syndication market to link borrowers and lenders. This market expanded tremendously over the last 30 years, starting from around $137 million in the late 1980s to $940 billion in 2014 (Sufi, 2007; Adler, 2015). Syndicated lending became one of the most important ways for U.S. corporate borrowers to receive funding from banks and institutional investors, accounting for almost half of the commercial and industrial loans originated, according to the Federal Reserve Survey of Terms of Business Lending.

Syndicated loans are originated by two or more lenders that jointly grant funds to a single borrower. The originating bank (or "lead bank") conducts due diligence, negotiates the preliminary terms of the loan contract with the borrower and then arranges commitments from other participant lenders willing to finance part of the loan. The originating banks retain a larger portion of the loan on their balance sheets than participant banks. The originating banks play the most significant role in the syndicate, as they directly communicate with the borrower about preliminary terms of the loan. Later they service the loan and govern its terms, and monitor the borrower. Thereby the lead bank forms a lending relationship with the borrower while participant banks maintain an arm's-length relationship with the borrower through the lead lender.

The determinants of loan syndicate structure have mainly been examined in empirical literature to study the impact of information frictions among multiple lenders. Sufi (2007) tests the model built by Holmstrom and Tirole (1997), which shows that in the case of multiple lenders, one monitoring lender faces a moral hazard problem. Sufi (2007) shows that in the loan syndication market, syndicates are established in such a way as to mitigate the moral hazard problem. For less transparent borrowers, lead banks keep a larger loan share in the syndicate, to guarantee their willingness to conduct the optimal level of monitoring. They also establish small and more concentrated syndicates and turn to participant banks that have stronger lending relationships with borrowers in the case of opaque borrowers. Dennis and Mullineaux (2000) also document the availability of public information about the borrowers as

an important factor that influences the decision to syndicate loans and determines the syndicate structure. In addition, Bharath et al. (2011) show that repeated borrowing helps borrowers to get lower loan spreads and that lending relationships are more valuable for less transparent borrowers.

3 Liquidity and the Financial Crisis of 2007-2009

The turmoil in financial markets in 2007-2009 has become the most dramatic event since the Great Depression. During the years before the financial crisis, banks had been gradually stepping out from the traditional sources of funding to newly formed practices in which they could finance new credit provision by selling and securitizing preexisting loans or by using short-term wholesale funding[4] (Acharya and Richardson, 2009; Brunnermeier, 2009; Diamond and Rajan, 2009; Gorton, 2009). The use of wholesale funding became very popular among financial institutions because of decreased regulation, innovation and rivalry from nonbank financial institutions. Reliance on the wholesale funding helped banks to increase their liabilities, which were previously restricted to the local depositors' base. However, when the market for these funds dried up during the crisis, banks faced severe liquidity problems in rolling over their debt, and according to Shin (2009) and Raddatz (2010), dependence on wholesale funding was one of the main causes of the taking down of some financial institutions, as well as of a dramatically expanded depth and transmission of the crisis.

The financial crisis started in mid 2007 with increased delinquencies and foreclosures on sub-prime mortgages, which created panic in the secondary market for securitized assets (Brunnermeier, 2009). All types of securitized assets fell in value and became very difficult to price and to borrow against. These tensions mounted into the meltdown of the market for asset-backed commercial paper in August 2007, as a result of increased uncertainty about banks' exposure to securitized assets and the inability of some lenders to provide funding to their off-balance sheets structured investment vehicles. The collapse of the market for asset-backed commercial paper increased uncertainty about the value of banks' own books, and concerns about off-balance sheet liquidity exposures of banks to their conduits structures brought into question banks' liquidity and solvency. These concerns prevented banks from lending to each other resulting in the collapse of the interbank market and a huge rise in borrowing interest rates. The costs of borrowed funds are well described by the Treasury-Eurodollar (TED)[5] spread or by the LIBOR-OIS[6] spread[7], which spiked more than twice in their value in August 2007 and stayed highly volatile for over a year.

In early 2008 the financial situation improved after the bailout of Bear Stearns and

[4]Wholesale funds include commercial paper, repurchase agreements, interbank loans and wholesale deposits.

[5]The TED spread is the difference between the risky 3-month LIBOR rate and the risk-free 3-month Treasury Bill rate. The LIBOR rate is the interest rate at which banks lend to each other in the interbank market and T-bill rate is the rate on riskless U.S. government debt.

[6]The LIBOR-OIS spread is the difference between the LIBOR rate and corresponding overnight indexed swap rate. OIS rate is considered less risky than the LIBOR and is used as a proxy for risk-free rate.

[7]The TED spread and the LIBOR-OIS spread measure perceived credit risk in the banking sector and reflect the strain in the interbank market. The narrowing of spreads represents confidence in the interbank market as the risk of default on interbank loans is decreasing while the widening of spreads reflects liquidity problems in the interbank market.

the Federal Reserve's actions to provide liquidity support to the banking sector. However, the situation worsened sharply on September 15, 2008 when the investment bank Lehman Brothers filed for bankruptcy after unsuccessful attempts to find liquidity support. The collapse of Lehman Brothers immediately provoked a dramatic shock in the financial markets, because of the undermined confidence and increased uncertainty among financial institutions. The panic led to funds drying up in the market for commercial paper and in the interbank market, with the borrowing interest rates rising to beat the historic records of summer 2007. The subsequent events were marked by the federal government's efforts to calm down the situation by pumping liquidity into financial markets and institutions through different programs, and bailouts of the Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac) and the insurer American International Group (AIG). These measures helped to mitigate the panic, but the situation eased only in the midle of 2009 and the costs of interbank lending returned to their pre-crisis levels later in the second half of 2009. By the end of 2009, the Federal Reserve closed many of their liquidity provision programs as conditions in the interbank and credits markets have improved.

According to this overview and to the works of Acharya and Merrouche (2013), and Brunetti et al. (2011), one of the main features of the financial crisis of 2007-2009 was the dramatic collapse of liquidity provision in the short-term wholesale markets. Brunnermeier (2009) even refers to the recent financial crisis as a "liquidity crunch". So the crisis was not triggered by the deterioration of the financial stand of banks' clients. Problems in the banking sector are attributed to the adverse shocks to their short-term funding and are orthogonal to their clients' financial position, which provides a good setting to analyze the impact of bank credit on firms' perfomance. The meltdown of the commercial paper market and freeze of the interbank market was an exogenous and unexpected shock for banks, which provoked severe liquidity problems. Those banks that financed their assets mostly with short-term wholesale or noncore funding such as commercial paper, interbank loans, repurchase agreements and large denomination deposits were highly exposed to the liquidity shock (Shin, 2009; Gozzi and Goetz, 2010; Raddatz, 2010). In contrast, as Cornett et al. (2011) and Ivashina and Scharfstein (2010) show, banks that mostly relied on retail or core deposits, which proved to be a more stable source of funding during the recent financial crisis, experienced lower liquidity shock.

4 Methodology

4.1 Banks' financial health and lending

When banks' financial health deteriorates due to adverse liquidity shock, it is hard for them to raise funding to compensate for the liquidity shortage in periods of macroeconomic illiquidity. Therefore, banks become liquidity constrained. I examine whether banks that are less exposed to the liquidity shortfall in the wholesale market are less liquidity constrained and thereby reduce lending to a lesser extent during the crisis.

To identify how a change in banks' financial health affects lending, an exogenous measure of their financial health is needed that would be different across banks and would not

reflect differences in their performance. The financial crisis of 2007-2009 triggered a substantial liquidity shortfall in markets for wholesale funds, which in turn created huge financing problems for banks. This liquidity shock was unexpected, and it was unrelated to the performance of banks' clients. Banks that relied more on short-term wholesale funds were more exposed to the liquidity shock. These sources of funding are short-term and are less informationally insensitive than retail deposits (Gorton, 2009). In contrast, reliance on retail or core deposits cushions banks from the liquidity dry up in wholesale funds. When the wholesale deposits experienced a decline in autumn 2008, retail deposits continued to rise (Cornett et al., 2011). This is not a new phenomenon; empirical works by Gatev, Schuermann, and Strahan (2006) and Gatev and Strahan (2006) document that banks experience an increase in deposit inflows during periods of tight liquidity. This happens because, during the time of market turbulence, investors transfer their funds from markets to banks, which they consider a safer place for holding their money.

The availability of deposit financing during turbulent times increases the capacity of banks to provide credit. Ivashina and Scharfstein (2010) and Cornett et al. (2011) show that deposits proved to be a more stable source of funding during the recent financial crisis and banks that relied more on deposit financing cut their lending to a lesser extent. This study explores banks' pre-crisis reliance on core deposits as a measure of their exposure to the liquidity shock.

To examine whether banks cut back on lending when they face adverse liquidity shocks, I estimate the following specification:

$$\begin{aligned} \triangle Bank\,Lending_{it} = \alpha + \beta_1 Bank\,Liquidity\,Exposure_{it-1} + \\ + \beta_2 Bank\,Liquidity\,Exposure_{it-1} * Crisis + \\ + \gamma Bank\,Controls_{it-1} + \mu_i + \varphi_t + \mathrm{u}_{ij}. \end{aligned} \tag{1}$$

This is a bank-level regression, where $\triangle Bank\,Lending_{it}$ is the change in the number of newly issued term loans and credit lines[8] made by bank i to non-financial firms during the quarter t.

Bank Liquidity Exposure is exposure to the liquidity shock measured by the lagged share of core deposits to the bank's total assets. $Crisis$ is a dummy variable that equals one for the period from 2007 Q3 till 2009 Q4. The main coefficient of interest is β_2. The higher the level of core deposits maintained by a bank, the greater is its liquidity buffer, and the lesser is its liquidity exposure. Therefore, β_2 measures to which extent banks that relied more on more stable short-term core deposit financing changed their provision of credit during the crisis. β_2 is expected to be positive.

Bank Controls include bank size, liquid assets, total capital ratio, non-performing loans and return on assets[9]. μ_i and φ_t are bank fixed effects and quarterly dummies, respectively. I include bank fixed effects because changes in provision of credit might be influenced by individual banks' characteristics such as available lending opportunities, clients' base and managerial skills. Bank fixed effects absorb all time invariant bank heterogeneity. Given the sample period is relatively short, I assume that banks haven't changed their client base and managerial skills

[8] I use the number of loans instead of the dollar amount, as due to the fact that lender shares in the loan syndicate are usually not available in the Dealscan database, using the dollar amount might lead to a measurement error.

[9] See variable definitions in Table 1.

significantly, so their heterogeneity is fixed over time. Quarterly dummies absorb all other macroeconomic shocks such as massive liquidity provision by the Federal Reserve during the crisis. Total liquidity supply by the Federal Reserve was exogenous for banks, while internal allocation of liquidity across banks was maintained by their demand for liquidity.

4.2 Existence of relationship lending

My analysis of the impact of credit supply frictions on firm performance relies on the assumption that firms form relationships with banks which help them to obtain bank credit in the future. To examine the existence of relationship lending in the loan syndication market, I use the following econometric model that tests the likelihood of the borrower to access the same lender it has borrowed from in the past for a new syndicated loan, depending on the lender's role in the syndicate (Chodorow-Reich, 2014):

$$Lead_{bi} = \alpha + \beta_1 Previous\, lead_{bi} + \beta_2 Previous\, participant_{bi} + \theta_b + \epsilon_{bi}, \tag{2}$$

$$Participant_{bi} = \alpha + \beta_1 Previous\, lead_{bi} + \beta_2 Previous\, participant_{bi} + \theta_b + \nu_{bi}. \tag{3}$$

The sample covers borrowers that used the loan syndication market from 2003 to 2013, and existing and potential lenders active in that market during the year. The dependent variable *Lead* (or *Participant*) is an indicator variable that equals 1 if bank b served as lead (or participant) lender for borrower i and equals 0 otherwise, as well as if borrower i has no loans from bank b in the current year. The independent variables *Previous lead* and *Previous participant* are indicator variables that equal 1 if bank b served as lead or participant lender for a borrower's previous loan and account for the existence of repeated borrowing from the same bank.

4.3 Firm-level outcomes

In this subsection I examine whether banks can transmit adverse liquidity shocks to their borrowers by providing less credit. A decline in bank lending can pose financial constraints on firms and results in the abandoning of profitable investment projects, and in poor performance. At the firm level it is important to examine whether a drop in lending by a particular bank can impose financial constraints on firms, because firms can compensate this fall in financing by borrowing from other less-troubled banks.

I begin my examination of whether banks can transmit liquidity shocks to firms by exploring differences in firms' access to bank credit induced by the deterioration of the banks' financial health. First, I measure the firm's access to bank credit or its financial constraints by the average exposure of all the firm's lenders, and examine its impact on the changes in the firm's total credit from banks. Second, I examine the impact of changes in a firm's total bank credit on changes in its valuation, where the deterioration of the banks' financial health is used as an exogenous source of variation in bank credit. The following two-stage econometric model is used to estimate the effect of changes in banks' credit on firms' stock returns:

$$\triangle log\, Bank\, Credit_{jt} = \alpha + \beta_1 Banks' Liquidity\, Exposure_{jt-1} + \beta_2 Banks' Liquidity\, Exposure_{jt-1} * \\ * Crisis + \gamma Firm\, Controls_{jt-1} + \theta_j + \varphi_t + \epsilon_{jt}, \tag{4}$$

$$r_{jt} = \alpha + \beta_1 \triangle log\, \hat{Bank}\, Credit_{jt} + \beta_2 \triangle log\, \hat{Bank}\, Credit_{jt} * Crisis + \\ + \gamma Firm\, Controls_{jt-1} + \theta_j + \varphi_t + \nu_{jt}. \tag{5}$$

$\Delta log\, Bank\, Credit$ is the change in the logarithm of a firm's total borrowing from banks, measured by the number of outstanding loans.

r_{jt} measures changes in the firm's stock market valuation, such as stock returns. I focus here on the firm's stock return rather than an other firm's balance-sheet characteristics because a firm's balance-sheet characteristic may react slowly to bank liquidity shocks. Moreover, there might be a delay in measurement of the balance-sheet characteristics at a firm, and it might be costly for a firm to quickly adjust its books in response to the shock, while stock prices react immediately to shocks and are measured more frequently than balance-sheet characteristics.

$Banks' Liquidity\, Exposure$ of a firm j in a quarter t is calculated as follows:

$$\begin{matrix} Banks' Liquidity \\ Exposure \end{matrix}_{jt} = \sum_i \frac{Loan\, Amount_{ijt}}{Total\, Loan\, Amount_{jt}} * \begin{matrix} Bank\, Liquidity \\ Exposure \end{matrix}_{it} \tag{6}$$

It is the weighted average of liquidity exposures of banks that have outstanding loans with the firm j in a quarter t. Weights correspond to the size of loan from each bank. Banks' exposure to the financial crisis is measured by the ratio of core deposits to total assets. This measure takes into account all banks from which a firm has outstanding loans. The next measure takes into account only banks that act as lead lenders in the loan syndicate, i.e., it excludes participant lenders.

$$\begin{matrix} Banks' Liquidity \\ Exposure\, Lead \end{matrix}_{jt} = \sum_i \frac{Lead\, Loan\, Amount_{ijt}}{Total\, Loan\, Amount_{jt}} * \begin{matrix} Lead\, Bank \\ Liquidity\, Exposure \end{matrix}_{it} \tag{7}$$

$Crisis$ is a dummy variable that equals one for the period from 2007 Q3 till 2009 Q4.

Firm controls include profitability, Tobin's Q, Z-score, cash holdings, cash flow, tangible assets, leverage, and firm's size[10]. θ_j and φ_t are firm fixed effects and quarterly dummies, respectively. Firm fixed effects absorb all time invariant firm heterogeneity. Quarterly dummies absorb all other macroeconomic shocks that had an impact on all firms during the sample period.

To control for endogeneity of a firm's total bank credit, I estimate this model using an instrumental variables (IV) estimation technique, where $Liquidity\, Exposure$ is used as an instrument for changes in a firm's total bank credit. The IV estimation provides consistent results only if the chosen instruments are relevant and valid. Instruments are assumed to be relevant if they are correlated with an endogenous regressor, such as a change in a firm's total bank credit, while the instruments' validity assumes that chosen instruments are not correlated with the error term from the second stage regression (Wooldridge, 2010).

The identification assumption of this model is that, conditional on the observable char-

[10]See variable definitions in Table 1.

acteristics of firms, and firm and time dummies, instrumental variables are not correlated with unobserved components of the stock return equation, meaning that banks' liquidity exposure influences a firm's stock returns only through changes in its total bank credit. I employ two tests to examine the validity and relevance of instruments: a weak identification test and an overidentification test. The weak identification test (the Cragg-Donald test) examines instruments' relevance. Its null hypothesis is that instruments are weak. If instruments are weak then the IV estimator becomes less efficient, because it generates larger standard errors than those generated by the OLS estimator. To test the null hypothesis, I use F statistics from the Cragg-Donald Wald test, which I compare with the weak ID test critical values provided by Stock and Yogo (2005). The validity of instruments is tested by an overidentifying restrictions test with the null hypothesis that the model is correctly specified and instruments are exogenous.

5 Data

I use data on outstanding bank loans made to U.S. firms by U.S. banks during the period from 2006 till the end of 2013, along with balance sheet information on firms and banks. Loan data comes from Thomson Reuters Dealscan database which provides detailed information on loan transactions. The Dealscan database reports flow data on new loan originations and covers a large share of commercial lending to medium and large borrowers in the U.S. (Ivashina and Scharfstein, 2010). It contains information on the identity of lenders and borrowers, lender type (bank vs. nonbank), lender role in the syndicate (lead[11] vs. participant), some borrower characteristics such as sales, industry, credit rating if applicable, firm type (private vs. public), contract terms such as maturity, amount and interest rate, loan type and purpose. Most of these loan transactions are syndicated. Syndicated loans are originated jointly by several banks that later service and monitor the loan. The originating banks retain a significant portion of the loan on their balance sheets while selling the remaining shares to participant banks. The originating banks play the most significant role in the syndicate and are referred to as lead banks. In this study, I focus on all lenders (lead and participant) and additionally check the results for lead lenders only. I split each loan between these banks according to bank shares in the syndicate. But the data on the lender shares in the syndicate is missing for 75% of observations. If there is no information about lender shares, then I split the loan amount equally between banks.

Dealscan does not provide balance sheet information[12] for companies that are engaged in loan contracts. To obtain more detailed information about banks, I manually match lender companies from Dealscan,[13] based on the lender's ultimate parent information, with the data on U.S. bank holding companies and individual commercial banks. Financial data on the bank holding companies is taken from the Federal Reserve FR Y-9C Consolidated Financial Statements for Bank Holding Companies. Financial data on individual banks is taken from Reports of Condition and Income (Call Reports) provided by the Federal Deposit Insurance

[11]Lead banks are defined as agents and arrangers but not participants in the Dealscan database.

[12]Dealscan provides data on sales which is missing for many companies.

[13]I manually matched banks using the following identifiers: lender name and name of parent bank, state and city. I referred to the FFIEC's National Information Center to identify financial institutions.

Corporation (FDIC).[14] Definition of variables is presented in Table 1. Table 2, Panel A reports banks' descriptive statistics. The average change in loan issuance for the whole sample is 0.05, indicating that on average there was an increase in bank lending during 2006-2013. Over the entire sample, the average bank has a core deposit ratio of 0.232, a total capital ratio of 0.142, a liquid assets ratio of 0.253, a return on assets (ROA) of 0.001 and a non-performing loan ratio (NPL) of 0.014.

Firm-level data is obtained from Compustat North America[15] which provides detailed information on balance sheet, cash flow and income statements of public firms in the U.S. on a monthly, quarterly and annual basis. I use quarterly data, and my sample contains only nonfinancial U.S. firms. I exclude from the analysis financial firms according to the industry code (SIC 6000 - 6999). See Table 1 for details on variables construction. Table 2, Panel B reports firms' descriptive statistics. Market data is taken from the Center for Research in Security Prices (CRSP). To account for outliers I winsorize all variables at 1% in the 1st and 99th percentiles of the distribution. Table 3 reports descriptive statistics for the sample of the stock returns of nonfinancial U.S. firms. I report descriptive statistics of variables for the whole time period of 2006-2013 and for the pre-crisis, crisis and post-crisis periods. For the entire period of 2006-2013 borrowing firms have, on average, total bank credit of -0.003, a total return of 0.012, profitability of 0.035, a market-to-book ratio of 1.32, a Z-score of 0.767, cash holdings of 0.098, a cash flow of 0.022, tangible assets of 0.331, and leverage of 0.285. When comparing the pre-crisis and crisis periods, there was a decline in firms' total bank credit, total return, profitability, market-to-book ratio, Z-score and cash flow while there was an increase in cash holding and leverage during the crisis.

6 Results

6.1 Banks' financial health and lending

Table 4 shows the estimation results for the effect of the liquidity shock on changes in bank lending, where bank lending is measured by the number of newly issued loans during the quarter and liquidity shock is measured by the share of core deposits in total bank assets. The results in columns 1-3 show that in the cross-section of banks there is a positive correlation between changes in new loan issuance and reliance on core deposit financing during the crisis, controlling for bank and time fixed effects. The coefficient on the interaction variable $Core\,deposits{*}Crisis$ is positive and significant indicating that banks with higher reliance on core deposits issued more loans during the financial crisis of 2007-2009. More precisely, our fixed effect estimation in column 1 indicates that a one standard deviation increase in the fraction of a bank's core deposits to total assets increases loan provision to firms by almost 2 percent. In columns 2-3 I add bank-specific characteristics. Comparison of the estimates in columns 1-3 shows that the magnitude and statistical significance of the effect of a liquidity shock on banks' lending are unchanged by the addition of new control variables. These tests confirm my findings that

[14] FR Y-9C and Call Reports are publicly available from the website of Federal Reserve Bank of Chicago.

[15] Dealscan companies are matched to companies from Compustat using the link provided by Michael Roberts. See Chava and Roberts (2008) for details on the link construction.

banks with higher exposure to liquidity shock had lower loan issuance to nonfinancial borrowers during the crisis.

6.2 Existence of relationship lending

The estimation results in Table 5 confirm the existence of repeated borrowing. In column 1, the probability of the lead bank becoming the lead arranger in the new syndicate is 63%. The impact of *Previous participant* in column 1 is also positive and significant indicating that the participant bank has a higher probability to become the lead bank in the borrower's next attempt to get financing in the loan syndication market. In addition to lender fixed effects, the specification also accounts for borrowers' industry, state, year, public or private status and size in columns 2 and 4. The use of these additional fixed effects doesn't change the estimation results. These results for the existence of repeated borrowing confirm that borrowers form relationships with lenders in the loan syndication market.

6.3 Firm-level outcomes

6.3.1 The impact of banks' financial health on firms' total bank credit

I begin the analysis of bank credit dynamics at the firm level with a semi-parametric test. Figure 1 shows the growth of bank credit at the firm level relative to 2006 Q1 (the beginning of the period) for two groups of firms. I divided firms into high and low exposure groups based on their banks' exposure during the crisis (average for the crisis period). High exposure firms have banks' core deposits lower than the average, while low exposure firms have banks' core deposits higher than the average. Figure 1 shows that two groups of firms had similar trends in bank credit growth before the crisis, while there was a reversal of the lending trend for the high exposure firms in 2008 Q2. During the crisis, bank credit declined for all firms but it declined more for high exposure firms. Two groups of firms had differences in availability of credit during the crisis, which also persisted post crisis.

However, the semi-parametric test in this case doesn't account for firm-specific differences. Therefore I further focus on multivariate evidence based on estimation of panel regressions. Table 6 shows the estimation results from the first-stage of the instrumental variable (IV) model specified in equation (4). Bank credit is measured by the log difference of the number of outstanding loans from banks to a firm during the quarter. Changes in bank credit provided to the firm are instrumented by the weighted average liquidity exposure of firm's lenders, measured by the ratio of core deposits to total assets. Columns 1-2 of Table 6 show estimation results for banks' liquidity exposure, based on all lenders in the loan syndicate, while columns 3-4 report results for banks' liquidity exposure based only on lead lenders. The estimation results document a positive correlation between core deposits and changes in bank credit during the crisis. As bank credit declined for all firms during the crisis, those whose banks relied more on core deposits had a lower decline in bank credit, controlling for firms' observable characteristics, firm and time fixed effects. The point estimate in column 1 of Table 6 implies that a one standard deviation increase in a bank's reliance on core deposits increases bank credit for a firm by 1.6

percentage points. This is two times higher than the magnitude of the average firm-level bank credit growth rate of - 0.7% during the crisis.

Next I examine firms' ability to substitute a bank credit shortfall by borrowing more from existing banks or by forming lending relationships with new banks during the crisis. The important question here is whether firms had difficulties in establishing new lending relationships to obtain credit during the crisis. Column 1 of Table 7 shows estimation results for changes in firm's total borrowing from banks that were already lending to the firm before the crisis. There is again a positive and significant relationship between existing banks reliance on core deposits and changes in bank credit from existing banks, meaning that firms that were already borrowing from banks with a stronger liquidity position had a lower decline in bank credit during the crisis. Meanwhile firms which borrowed more from banks that relied more on non-core financing (wholesale funding) faced a greater reduction in credit during the crisis. The magnitude of this effect is almost the same as for the whole sample of existing and new banks in Column 3, indicating that firms borrowed more from existing banks and not from new banks during the crisis. Column 2 shows the estimation results for changes in a firm's total borrowing from new banks during the crisis, relative to a firm's total borrowing from existing banks. Bank liquidity exposure during the crisis doesn't have a significant effect on changes in a firm's total borrowing from new banks. Estimation results hold both for the whole sample of banks and for lead banks only. These findings again re-establish the importance of bank-firm ties in the loan syndication market, and confirm the stickiness of lending relationships, because it was not easy for firms tied to weaker banks to switch to healthier banks during the crisis.

6.3.2 The impact of bank credit on firm performance

Table 8 shows the estimation results from the second-stage of the instrumental variable (IV) model, specified in equation (5), for changes in a firm's total bank credit and stock return. Bank credit is measured by the log difference of the number of outstanding loans from banks to a firm during the quarter. Changes in bank credit provided to the firm are instrumented by the weighted average liquidity exposure of a firm's lenders, measured by the ratio of core deposits to a bank's total assets. Columns 1-2 of Table 8 shows estimation results for banks' liquidity exposure based on all lenders in the loan syndicate, while columns 3-4 report results for banks' liquidity exposure based only on lead lenders.

Columns 2, 4, 6 and 8 of Table 8 report the results of the second-stage of the instrumental variable approach. According to the Cragg-Donald Wald test F statistics for the weak identification test and statistically significant estimates of instrumental variables reported in the firt-stage regression in Table 6, the instruments are not weak. Hansen J statistics at the bottom of Table 8 indicate that we cannot reject the null hypothesis of instruments' validity. The estimation results show that there is a statistically significant positive relationship between a firm's total bank credit growth and total return during the crisis: a one standard deviation decline in bank credit to a firm causes a stock return reduction of 3.5 percentage points, which is almost three times larger than the average firm-level total return during the sample period of 1.2%. The bank credit matters for a firm's valuation, controlling for firm observable characteristics, firm fixed effects and time dummies. The magnitude and statistical significance of

the effect are unchanged when I cluster standard errors at firm and state levels[16]. I also add additional instruments in the first-stage regression that account for a bank's financial health: bank total risk-based capital ratio and bank size. The estimation results reported in columns 2 and 4 show that my main findings are robust to the inclusion of these instruments.

Further, I examine whether firms that are financially constrained are more responsive to changes in bank credit. I employ several identification strategies, which have been widely used in prior studies, to sort firms into two groups: financially constrained and financially unconstrained. I divide my sample based on firms' age, size and access to the public debt market.

A firm's age can be associated with its quality. The longer the firm operates, the more established and mature it is. Old, or mature firms are usually considered less dependent on external finance (Mueller, 1972; Oliner and Rudebusch, 1992). Beck et al. (2003) and Hadlock and Pierce (2010) also document firm age as a useful predictor of financing constraints. I assign firms to the financially constrained (unconstrained) category if they are in the bottom (top) median of the quarterly age distribution.

A firm's size is another commonly used criteria to identify firms that are financially constrained (Oliner and Rudebusch, 1992; Beck et al., 2003; Almeida et al., 2004). Large firms are usually believed to have fewer difficulties in accessing external finance because they are usually older, better established and well-known companies. Large firms are also more likely to have larger collateral, which helps them to be less sensitive to credit frictions. Gilchrist and Himmelberg (1995), Fama and French (2002) and Frank and Goyal (2003) also advocate that firm size is a good proxy for financing constraints. I rank firms on the basis of their quarterly sales revenue and assign them to the financially constrained (unconstrained) category if they have net sales lower (higher) than $1 billion referring to those firms as small (large).

A firm's access to the public debt market is a good direct measure of financing constraints because it shows its ability to access external finance. Firms with no access to the public debt market are considered financially constrained (Gilchrist and Himmelberg, 1995; Almeida et al., 2004). I assign firms to the financially unconstrained category if they issued bonds during the quarter.

The estimation results in Table 9 indicate that both young and old firms' stock returns are affected by changes in bank credit[17]. However, if I consider small and large firms and firms with and without access to the bond market, the change in bank credit only has a significant effect on the stock returns of small firms and those that had no bond issuance, but it has no significant effect on stock returns of large firms and those that issued bonds. This is consistent with the view that large firms and firms with access to the bond market can switch towards external financing when credit supply by banks is limited.

Robustness checks

I conduct several checks to evaluate the robustness of my main findings. First, my main result that firms' stock returns are highly sensitive to changes in bank credit during the crisis relies on

[16]Estimation results are identical to the previous estimates and are not reported.

[17]In column 3 the effect is marginally significant with p-value of 0.137.

the assumption that sorting of firms to banks is as good as random. However, a possible concern is that it is not. This may happen if high-quality firms borrow from financially healthier banks, while low-quality firms deal with financially unhealthy banks because they might have lower chances of borrowing from financially healthier banks. In this case my main finding captures non-random sorting of firms into banks based on their financial health. If sorting was indeed the issue, then the exclusion of low-quality firms from the analysis should significantly change the estimated results.

I measure firm quality by its net worth and assign firms to the low-quality category if they are in the bottom quartile of the quarterly pre-crisis net worth distribution. The results in Table 10 show that changes in bank credit have a positive effect on firms' stock returns during the crisis. The estimates in columns 1 and 2 are statistically significant, while the magnitude is slightly lower. I conclude that even after exclusion of low-quality firms, stock returns of medium and high-quality firms were negatively affected by the bank credit crunch during the crisis.

Second, I examine how robust my findings are with respect to selected samples of firms. Estimation results in Table 11 show that excluding firms with negative profitability and cash flow from the analysis doesn't qualitatively change the results.

7 Conclusions

This paper provides evidence about the transmission of banking sector problems to the real sector and examines the impact of bank credit supply frictions on firm performance. To address these questions I examine the financial crisis of 2007-2009, which provides a setting where problems in the banking sector can be attributed to adverse shocks to banks' short-term funding, rather than to problems in the real sector. In particular, I examine whether banks relying more on core deposit financing decrease lending to a lesser extent than those banks financed mainly by unstable sources of funding. My findings tend to confirm that banks decrease lending due to negative funding shocks. I document a positive correlation between loan issuance and reliance on core deposit financing during the crisis in the cross-section of banks. My results show that banks that relied more on core deposit financing rather than wholesale funding reduced lending to a smaller extent. The effect implies that a one standard deviation increase in the fraction of a bank's core deposits to total assets increases loan provision to firms by almost 2 percent.

I exploit differences in the composition of banks' liabilities structure during the financial crisis of 2007-2009, as a source of exogenous variation in the availability of bank credit to nonfinancial firms in order to identify the causal relationship between bank credit supply and firm performance. I first show that the positive correlation between a bank's reliance on core deposit financing and a change in bank lending during the crisis is present in a cross-section of firms: firms whose banks relied more on core deposits had a lower decline in bank credit during the crisis, while switching to healthier banks during the crisis was very difficult for firms. Further, I examine whether a decline in bank lending imposes financial constraints on firms and thereby affects their performance, as measured by firms' stock returns. My results provide evidence that bank credit matters for a firm's valuation. I document a positive statistically significant relationship between a firm's total bank credit growth and total return during the

crisis: a one standard deviation decline in bank credit to a firm causes a stock return reduction of 3.5 percentage points, which is almost three times larger than the average firm-level total return of 1.2% during the sample period, while firms that had lending relationships with healthier banks had a lower decline in bank credit and thereby lower reductions in their stock returns during the crisis.

From the policy perspective, the results of this study support the introduction of the stable funding ratio within Basel III, as this research provides evidence of the importance of banks' stable sources of funding, such as core deposits. They also stand in favor of government policies aimed at providing liquidity support to banks and restoring the stability of the banking sector during the crisis, because due to the stickiness of bank-firm relationships, this leads to higher stock returns for firms, thereby propagating a boost in the real sector.

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Table 1: Description of Variables

Variable	Description	Source
Bank level		
Core deposits	(Time deposits under $100,000 + total transaction deposits)/Total assets	FDIC Call Reports
Total Capital Ratio	Total risk-based capital/Risk-weighted assets	FDIC Call Reports
Bank size	Log of total assets	FDIC Call Reports
Liquid Assets	(Cash + Securities + Fed Funds)/Total assets	FDIC Call Reports
ROA	Net Income/Total assets	FDIC Call Reports
NPL	(Loans past due 30 days or more + non-accruing loans)/Total assets	FDIC Call Reports
Firm level		
Total Return	Change of the firm's average stock price	Compustat-CRSP
Profitability	(Operating income before depreciation)/Total assets	Compustat
Market-to-Book	Market value of assets/Total assets	Compustat
Z-score	(3.3*EBITDA[18]+ Sales + 1.4*Retained earnings + 1.2*Working capital)/Total assets	Compustat
Cash	Cash and short - term investments/Total assets	Compustat
Cash Flow	Operating income before depreciation/Non-cash total assets	Compustat
Tangibility	Net PPE[19]/Non-cash total assets	Compustat
Leverage	(Debt in current liabilities + long-term debt)/Total assets	Compustat
Size	Log of total assets	Compustat

Table 2: Bank and Firm Level Descriptive Statistics

	N	Mean	St. Dev.	Min	p10	p50	p90	Max
Panel A: Bank level								
ΔBank Lending	3678	0.0525	18.82	-211	-6	0	5	227
Core Deposits$_{t-1}$	3678	0.2324	0.116	0.003	0.093	0.222	0.395	0.584
Core Deposits$_{t-1}$*Crisis	3678	0.0754	0.125	0.000	0.000	0.000	0.286	0.584
Total CAP$_{t-1}$	3678	0.1420	0.042	-0.027	0.110	0.135	0.177	0.615
Size$_{t-1}$	3678	16.234	1.911	12.827	14.014	15.951	18.970	21.625
Liquid Assets$_{t-1}$	3678	0.2527	0.127	0.024	0.130	0.221	0.427	0.926
ROA$_{t-1}$	3678	0.0015	0.005	-0.094	-0.001	0.002	0.004	0.053
NPL$_{t-1}$	3678	0.0141	0.015	0.000	0.002	0.009	0.033	0.168
Total Assets (USD bln)	3678	103.83	344.66	0.376	1.242	8.559	174.17	2463.3
Panel B: Firm level								
Total Return	46723	0.0128	0.121	-0.338	-0.125	0.011	0.149	0.417
Δlog Bank Credit	45830	-0.0022	0.173	-0.693	-0.154	0.000	0.134	0.693
Banks' Liquidity Exp$_{t-1}$	45853	0.1069	0.074	0.000	0.029	0.094	0.200	0.472
Banks' Liquidity Exp$_{t-1}$*Crisis	45853	0.0281	0.061	0.000	0.000	0.000	0.114	0.472
Banks' Total CAP$_{t-1}$	45830	0.0880	0.039	0.000	0.040	0.088	0.139	0.180
Banks' Size$_{t-1}$	45830	12.532	5.147	0.000	6.159	12.643	19.420	21.485
Lead Banks' Liquidity Exp$_{t-1}$	45853	0.0926	0.077	0.000	0.017	0.077	0.183	0.497
Lead Banks' Liquidity Exp$_{t-1}$*Crisis	45853	0.0248	0.059	0.000	0.000	0.000	0.096	0.497
Lead Banks' Total CAP$_{t-1}$	45830	0.0838	0.042	0.000	0.030	0.083	0.143	0.176
Lead Banks' Size$_{t-1}$	45830	12.236	5.804	0.000	4.491	12.379	20.250	21.537
Profitability$_{t-1}$	45916	0.0354	0.025	-0.066	0.011	0.034	0.064	0.120
Market-to-Book$_{t-1}$	39456	1.3533	0.844	0.281	0.617	1.115	2.351	5.616
Z-score$_{t-1}$	42536	0.7724	0.905	-4.240	-0.107	0.885	1.681	2.500
Cash$_{t-1}$	47135	0.0979	0.111	0.000	0.007	0.059	0.239	0.595
Cash Flow$_{t-1}$	44705	0.0226	0.030	-0.167	0.002	0.024	0.049	0.112
Tangibility$_{t-1}$	47021	0.3337	0.253	0.016	0.061	0.260	0.758	0.932
Leverage$_{t-1}$	45573	0.2821	0.203	0.000	0.050	0.251	0.546	1.242
Size$_{t-1}$	45853	7.3352	1.593	2.928	5.340	7.291	9.458	11.220
Total Assets (USD mln)	47137	7165	30296	8.248	206.1	1471	12852	846988

[18]Property, plant and equipment.

[19]Earnings before interest, taxes, depreciation, and amortization.

Table 3: Descriptive Statistics

	N	Mean	St. Dev.	Min	p10	p50	p90	Max
Full Sample:								
Δlog Bank Credit	118338	-0.0028	0.169	-0.693	-0.154	0.000	0.061	0.693
Banks' Liquidity Exp_{t-1}	118388	0.1062	0.073	0.000	0.028	0.094	0.198	0.472
Banks' Liquidity Exp_{t-1}*Crisis	118388	0.0331	0.065	0.000	0.000	0.000	0.124	0.472
Banks' Total CAP_{t-1}	118338	0.0894	0.039	0.000	0.041	0.089	0.142	0.180
Banks' $Size_{t-1}$	118338	12.5339	5.157	0.000	6.217	12.635	19.478	21.485
Lead Banks' Liquidity Exp_{t-1}	118388	0.0921	0.075	0.000	0.017	0.077	0.182	0.497
Lead Banks' Liquidity Exp_{t-1}*Crisis	118388	0.0292	0.063	0.000	0.000	0.000	0.107	0.497
Lead Banks' Total CAP_{t-1}	118338	0.0856	0.043	0.000	0.031	0.085	0.145	0.176
Lead Banks' $Size_{t-1}$	118338	12.3327	5.836	0.000	4.524	12.505	20.450	21.537
Total Return	118372	0.0116	0.124	-0.338	-0.132	0.011	0.151	0.417
$Profitability_{t-1}$	116594	0.0348	0.025	-0.066	0.010	0.033	0.063	0.120
$Market\text{-}to\text{-}Book_{t-1}$	101915	1.3215	0.829	0.281	0.600	1.088	2.298	5.616
$Z\text{-}score_{t-1}$	108131	0.7667	0.907	-4.240	-0.121	0.878	1.679	2.500
$Cash_{t-1}$	119054	0.0981	0.110	0.000	0.007	0.060	0.237	0.595
$Cash\ Flow_{t-1}$	115932	0.0220	0.030	-0.167	0.001	0.023	0.048	0.112
$Tangibility_{t-1}$	118727	0.3311	0.255	0.016	0.058	0.254	0.761	0.932
$Leverage_{t-1}$	117667	0.2851	0.203	0.000	0.052	0.255	0.550	1.242
$Size_{t-1}$	118388	7.4040	1.572	2.928	5.445	7.361	9.514	11.220
Pre-Crisis Period:								
Δlog Bank Credit	20111	0.0036	0.169	-0.693	-0.134	0.000	0.182	0.693
Banks' Liquidity Exp_{t-1}	20132	0.0953	0.073	0.000	0.021	0.082	0.183	0.472
Banks' Total CAP_{t-1}	20111	0.0736	0.034	0.000	0.030	0.074	0.117	0.180
Banks' $Size_{t-1}$	20111	11.8719	5.388	0.000	5.103	11.951	19.138	21.427
Lead Banks' Liquidity Exp_{t-1}	20132	0.0818	0.075	0.000	0.012	0.064	0.159	0.497
Lead Banks' Total CAP_{t-1}	20111	0.0696	0.036	0.000	0.023	0.069	0.117	0.176
Lead Banks' $Size_{t-1}$	20111	11.4667	5.768	0.000	3.847	11.369	19.704	21.427
Total Return	20081	0.0183	0.093	-0.338	-0.086	0.015	0.125	0.417
$Profitability_{t-1}$	19566	0.0380	0.025	-0.066	0.014	0.036	0.068	0.120
$Market\text{-}to\text{-}Book_{t-1}$	17399	1.5397	0.877	0.281	0.734	1.306	2.577	5.616
$Z\text{-}score_{t-1}$	18056	0.8483	0.825	-4.240	0.062	0.947	1.715	2.500
$Cash_{t-1}$	20298	0.0912	0.111	0.000	0.007	0.048	0.233	0.595
$Cash\ Flow_{t-1}$	19410	0.0264	0.027	-0.167	0.006	0.026	0.052	0.112
$Tangibility_{t-1}$	20217	0.3278	0.245	0.016	0.066	0.259	0.730	0.932
$Leverage_{t-1}$	20018	0.2639	0.196	0.000	0.044	0.232	0.524	1.242
$Size_{t-1}$	20132	7.2045	1.629	2.928	5.116	7.165	9.419	11.220
Crisis Period:								
Δlog Bank Credit	37173	-0.0071	0.144	-0.693	-0.105	0.000	0.000	0.693
Banks' Liquidity Exp_{t-1}	37189	0.1055	0.075	0.000	0.026	0.093	0.200	0.472
Banks' Total CAP_{t-1}	37173	0.0806	0.037	0.000	0.035	0.080	0.126	0.180
Banks' $Size_{t-1}$	37173	12.2637	5.267	0.000	5.844	12.377	19.352	21.485
Lead Banks' Liquidity Exp_{t-1}	37189	0.0930	0.081	0.000	0.015	0.074	0.185	0.497
Lead Banks' Total CAP_{t-1}	37173	0.0782	0.040	0.000	0.028	0.077	0.127	0.176
Lead Banks' $Size_{t-1}$	37173	12.1984	5.833	0.000	4.551	12.325	20.227	21.537
Total Return	37256	-0.0013	0.155	-0.338	-0.197	-0.003	0.185	0.417
$Profitability_{t-1}$	36566	0.0328	0.027	-0.066	0.006	0.032	0.063	0.120
$Market\text{-}to\text{-}Book_{t-1}$	32082	1.2543	0.797	0.281	0.551	1.027	2.234	5.616
$Z\text{-}score_{t-1}$	33871	0.7587	0.919	-4.240	-0.123	0.873	1.665	2.500
$Cash_{t-1}$	37471	0.0921	0.108	0.000	0.007	0.052	0.231	0.595
$Cash\ Flow_{t-1}$	36275	0.0177	0.037	-0.167	-0.008	0.022	0.047	0.112
$Tangibility_{t-1}$	37360	0.3303	0.251	0.016	0.059	0.257	0.749	0.932
$Leverage_{t-1}$	36982	0.2876	0.207	0.000	0.047	0.260	0.557	1.242
$Size_{t-1}$	37189	7.3086	1.578	2.928	5.370	7.259	9.419	11.220
Post - Crisis Period:								
Δlog Bank Credit	61054	-0.0023	0.183	-0.693	-0.182	0.000	0.154	0.693
Banks' Liquidity Exp_{t-1}	61067	0.1103	0.072	0.000	0.034	0.099	0.201	0.472
Banks' Total CAP_{t-1}	61054	0.0999	0.039	0.000	0.053	0.100	0.150	0.180
Banks' $Size_{t-1}$	61054	12.9165	4.977	0.000	6.831	13.009	19.647	21.485
Lead Banks' Liquidity Exp_{t-1}	61067	0.0949	0.071	0.000	0.020	0.084	0.185	0.497
Lead Banks' Total CAP_{t-1}	61054	0.0954	0.044	0.000	0.036	0.097	0.152	0.176
Lead Banks' $Size_{t-1}$	61054	12.6998	5.826	0.000	4.867	12.923	20.850	21.537
Total Return	61035	0.0173	0.110	-0.338	-0.109	0.016	0.142	0.417
$Profitability_{t-1}$	60462	0.0349	0.024	-0.066	0.011	0.033	0.062	0.120
$Market\text{-}to\text{-}Book_{t-1}$	52434	1.2902	0.820	0.281	0.604	1.053	2.231	5.616
$Z\text{-}score_{t-1}$	56204	0.7452	0.924	-4.240	-0.177	0.861	1.676	2.500
$Cash_{t-1}$	61285	0.1041	0.110	0.000	0.008	0.069	0.242	0.595
$Cash\ Flow_{t-1}$	60247	0.0232	0.027	-0.167	0.003	0.023	0.048	0.112
$Tangibility_{t-1}$	61150	0.3326	0.261	0.016	0.055	0.250	0.776	0.932
$Leverage_{t-1}$	60667	0.2906	0.203	0.000	0.058	0.259	0.553	1.242
$Size_{t-1}$	61067	7.5279	1.538	2.928	5.594	7.469	9.594	11.220

Table 4: Bank Liquidity Exposure and Lending

	(1)	(2)	(3)
	△Bank Lending	△Bank Lending	△Bank Lending
Core Deposits$_{t-1}$	0.447	1.035	0.571
	(2.043)	(2.149)	(2.094)
Core Deposits$_{t-1}$* Crisis	15.532**	14.995**	14.874**
	(6.836)	(6.742)	(6.705)
Total CAP$_{t-1}$		23.109**	25.233**
		(9.985)	(11.960)
Size$_{t-1}$		2.248	2.404
		(1.956)	(2.084)
Liquid Assets$_{t-1}$			-3.375
			(4.907)
ROA$_{t-1}$			5.069
			(28.001)
NPL$_{t-1}$			29.452
			(22.611)
_cons	2.792*	-37.756	-39.889
	(1.540)	(32.807)	(34.558)
N	3698	3678	3678
N of banks	190	187	187
R^2	0.093	0.094	0.095

This table reports regression results for the sample of bank-quarter pairs. The dependent variable is the change in the number of new loans issued. The crisis period is from 2007 Q3 through 2009 Q4. All regressions include bank and time fixed effects. See Table 1 for variables definitions. Standard errors in parentheses are heteroskedasticity robust and clustered at the bank level. ***, ** and * are significance levels at 1%, 5%, and 10%, respectively.

Table 5: Relationship Lending

	(1)	(2)	(3)	(4)
	Bank chosen as Lead lender		Bank chosen as Participant lender	
Previous Lead	0.629***	0.628***	0.057***	0.056***
	(0.005)	(0.005)	(0.003)	(0.003)
Previous Participant	0.091***	0.091***	0.404***	0.403***
	(0.003)	(0.003)	(0.006)	(0.006)
Bank FE	Yes	Yes	Yes	Yes
2-digit SIC	No	Yes	No	Yes
State and Year FE	No	Yes	No	Yes
Borrower Controls	No	Yes	No	Yes
N	1165662	1165662	1165662	1165662
N of borrowers	3547	3547	3547	3547
R^2	0.587	0.587	0.246	0.247

This table reports regression results for the sample of bank-borrower pairs. The dependent variable is the indicator corresponding to a bank participating in the loan syndicate in the indicated role. The bank can serve as a lead lender or participant lender in the loan syndicate. The sample period covers borrowers and lenders accessing the loan syndication market from 2003 to 2013 and, for each borrower, also includes all potential lenders that are active in loan syndication during the year. The independent variables *Previous lead* and *Previous participant* are indicator variables that equal 1 if a bank assumed a lead or participant role in the borrower's previous syndicated loan. Borrower controls include an indicator whether the borrower has public or private status and borrower's sales. All regressions include bank fixed effects. Standard errors in parentheses are heteroskedasticity robust and clustered at the borrower level. ***, ** and * are significance levels at 1%, 5%, and 10%, respectively.

Table 6: Change in firms' total bank credit and banks' financial health

	(1)	(2)	(3)	(4)
	Δlog Bank Credit			
	All Banks		Lead Banks	
Banks' Liquidity Exp_{t-1}	-0.832***	-0.517***	-0.746***	-0.502***
	(0.072)	(0.084)	(0.063)	(0.075)
Banks' Liquidity Exp_{t-1}* Crisis	0.212***	0.200***	0.181***	0.150**
	(0.078)	(0.076)	(0.069)	(0.069)
Banks' $TCAP_{t-1}$		-0.104		-0.195
		(0.123)		(0.151)
Banks' $Size_{t-1}$		-0.002**		-0.001
		(0.001)		(0.001)
Firm Controls:				
$Profitability_{t-1}$	0.083	0.075	0.075	0.074
	(0.077)	(0.078)	(0.077)	(0.078)
$Market\text{-}to\text{-}Book_{t-1}$	0.000	0.000	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
$Z\text{-}score_{t-1}$	0.007*	0.008*	0.008*	0.008*
	(0.004)	(0.004)	(0.004)	(0.004)
$Cash_{t-1}$	-0.005	-0.010	-0.006	-0.011
	(0.021)	(0.021)	(0.021)	(0.021)
Cash $Flow_{t-1}$	-0.040	-0.039	-0.036	-0.036
	(0.046)	(0.045)	(0.046)	(0.046)
$Tangibility_{t-1}$	0.006	0.006	0.006	0.008
	(0.022)	(0.022)	(0.021)	(0.022)
$Leverage_{t-1}$	-0.053***	-0.052***	-0.052***	-0.051***
	(0.013)	(0.014)	(0.013)	(0.014)
$Size_{t-1}$	-0.010**	-0.012***	-0.011***	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
N	92316	92316	92316	92316
N of firms	1495	1495	1495	1495
R^2	0.016	0.017	0.016	0.017

This table reports estimation results for the determinants of firm borrowing from banks for the sample of firm-quarter pairs. This is the first-stage regression from the specification (4) of the instrumental variable approach. $\Delta log\, Bank\, Credit$ is the change in the logarithm of firm's total borrowing from banks, measured by the number of outstanding loans. Banks' liquidity exposure is the liquidity shock experienced by a firm, measured as the weighted average of liquidity exposures of banks that have outstanding loans with the firm. Banks' exposure to the liquidity shock is proxied by banks' ratio of core deposits. For each firm, all other bank-level measures are also calculated as the weighted averages between all banks that have outstanding loans with the firm. The crisis period is from 2007 Q3 through 2009 Q4. See Table 1 for variables definitions. All regressions include firm and time fixed effects. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Table 7: Bank credit: existing and new lending relationships during the crisis

	(1)	(2)	(3)	(4)	(5)	(6)
	Δlog Bank Credit			Δlog Bank Credit		
	Existing Banks	New Banks	Existing and New Banks	Existing Banks	New Banks	Existing and New Banks
	All Banks			Lead Banks		
Banks' Liquidity Exp_{t-1}	-0.625***	-2.354***	-0.517***	-0.601***	-1.908***	-0.502***
	(0.095)	(0.356)	(0.084)	(0.086)	(0.341)	(0.075)
Banks' Liquidity Exp_{t-1}* Crisis	0.281***	0.388	0.200***	0.209**	0.017	0.150**
	(0.095)	(0.258)	(0.076)	(0.083)	(0.239)	(0.069)
Banks' $TCAP_{t-1}$	-0.143	0.006	-0.104	-0.262	0.453	-0.195
	(0.135)	(0.436)	(0.123)	(0.165)	(0.495)	(0.151)
Banks' $Size_{t-1}$	-0.003***	-0.018***	-0.002**	-0.001	-0.018***	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)
Firm Controls:	Yes	Yes	Yes	Yes	Yes	Yes
N	92316	92245	92316	92316	92245	92316
N of firms	1495	1495	1495	1495	1495	1495
R^2	0.019	0.139	0.017	0.017	0.131	0.016

This table reports estimation results for the decomposition of firm borrowing from existing and new banks during the crisis. I split firm's total borrowing during the crisis between banks the firm was borrowing before the crisis and banks the firm started to borrow from only with the start of the crisis. $\Delta log\, Bank\, Credit$ is the change in the logarithm of a firm's total borrowing from banks, measured by the number of outstanding loans. Banks' liquidity exposure is the liquidity shock experienced by a firm, measured as the weighted average of liquidity exposures of banks that have outstanding loans with the firm. Banks' exposure to the liquidity shock is proxied by banks' ratio of core deposits. For each firm, all other bank-level measures are also calculated as the weighted averages between all banks that have outstanding loans with the firm. The crisis period is from 2007 Q3 through 2009 Q4. Firm controls include profitability, market-to-book, Z-score, cash holdings, cash flow, tangible assets, leverage, and size. See Table 1 for variables definitions. All regressions include firm and time fixed effects. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Table 8: Bank credit and firm performance

	(1)	(2)	(3)	(4)
	Total Return			
	All Banks		Lead Banks	
Instrumented variables:				
$\Delta log\ \widehat{Bank\ Credit}$	-0.067*	-0.067*	-0.052	-0.047
	(0.039)	(0.040)	(0.036)	(0.036)
$\Delta log\ \widehat{Bank\ Credit}$* Crisis	0.271**	0.321**	0.201*	0.227**
	(0.138)	(0.136)	(0.109)	(0.105)
Firm Controls:				
Profitability$_{t-1}$	0.351***	0.352***	0.347***	0.348***
	(0.043)	(0.043)	(0.042)	(0.042)
Market-to-Book$_{t-1}$	-0.031***	-0.031***	-0.031***	-0.031***
	(0.002)	(0.002)	(0.002)	(0.002)
Z-score$_{t-1}$	-0.006**	-0.006**	-0.006***	-0.006***
	(0.002)	(0.003)	(0.002)	(0.002)
Cash$_{t-1}$	0.035***	0.035***	0.035***	0.035***
	(0.010)	(0.010)	(0.010)	(0.010)
Cash Flow$_{t-1}$	0.122***	0.124***	0.121***	0.122***
	(0.026)	(0.026)	(0.025)	(0.026)
Tangibility$_{t-1}$	0.005	0.006	0.005	0.005
	(0.011)	(0.012)	(0.011)	(0.011)
Leverage$_{t-1}$	0.030***	0.031***	0.029***	0.030***
	(0.006)	(0.006)	(0.006)	(0.006)
Size$_{t-1}$	-0.036***	-0.035***	-0.036***	-0.036***
	(0.002)	(0.002)	(0.002)	(0.002)
N	92316	92316	92316	92316
N of firms	1495	1495	1495	1495
R^2	0.100	0.091	0.110	0.107
Weak identification test:				
Cragg–Donald Wald F	43.668	30.434	59.590	41.321
Stock–Yogo critical value at 5%	11.04	15.72	11.04	15.72
Overidentification test:				
Hansen J-test	0.719	3.542	1.099	3.816
p-value	0.698	0.472	0.577	0.431
Firm & time FE	Yes	Yes	Yes	Yes
Additional instruments	No	Yes	No	Yes

This table reports estimation results of the impact of changes in bank credit on firms' stock returns. The reported results are for the second stage of the instrumental variable approach, results for the first-stage are shown in Table 6. The IV dependent variable is firm's total return. $\Delta log\ Bank\ Credit$ is the change in the logarithm of firm's total borrowing from banks, measured by the number of outstanding loans. $\Delta log\ \widehat{Bank\ Credit}$ is the predicted value of $\Delta log\ Bank\ Credit$ computed in the first-stage. Banks' liquidity exposure is the instrument. The set of instruments also includes squared banks' liquidity exposure, its interaction with the crisis dummy (not reported in the estimation results in Table 6). Banks' total capital and banks' size are used as additional instruments in columns 2 and 4. The crisis period is from 2007 Q3 through 2009 Q4. See Table 1 for variables definitions. All regressions include firm and time fixed effects. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Table 9: Bank credit, firm performance and firm financial constraints

	(1)	(2)	(3)	(4)	(5)	(6)
			Total Return			
	Young	Old	Small	Large	No Bond Issue	Bond Issue
Panel A: All Banks						
Instrumented variables:						
$\Delta log\, \widehat{Bank\, Credit}$	-0.023	-0.093***	-0.029	-0.107	-0.055	0.016
	(0.064)	(0.030)	(0.037)	(0.086)	(0.041)	(0.068)
$\Delta log\, \widehat{Bank\, Credit}$*Crisis	0.275*	0.273*	0.192*	-0.247	0.277**	0.520
	(0.157)	(0.153)	(0.109)	(0.243)	(0.128)	(0.483)
N	45079	47237	70682	21634	77719	14597
N of firms	882	851	1264	400	1331	254
R^2	0.097	0.099	0.111	0.030	0.098	0.007
Weak identification test:						
Cragg–Donald Wald F	17.249	20.991	43.801	7.011	32.693	3.496
Stock–Yogo critical value at 5%	15.72	15.72	15.72	15.72	15.72	15.72
Overidentification test:						
Hansen J-test	3.760	1.541	4.617	0.753	4.466	1.434
p-value	0.439	0.819	0.329	0.945	0.347	0.838
Panel B: Lead Banks						
Instrumented variables:						
$\Delta log\, \widehat{Bank\, Credit}$	-0.016	-0.072**	-0.025	-0.080	-0.063	0.027
	(0.063)	(0.033)	(0.034)	(0.082)	(0.039)	(0.076)
$\Delta log\, \widehat{Bank\, Credit}$*Crisis	0.248	0.171*	0.157*	-0.456	0.238**	0.446
	(0.167)	(0.093)	(0.092)	(0.546)	(0.108)	(0.338)
N	45079	47237	70682	21634	77719	14597
N of firms	882	851	1264	400	1331	254
R^2	0.101	0.113	0.115	-0.052	0.104	0.034
Weak identification test:						
Cragg–Donald Wald F	20.785	32.209	53.586	3.242	38.412	6.759
Stock–Yogo critical value at 5%	15.72	15.72	15.72	15.72	15.72	15.72
Overidentification test:						
Hansen J-test	2.627	3.361	4.767	0.732	4.061	3.581
p-value	0.622	0.499	0.312	0.947	0.398	0.466

This table reports estimation results of the impact of changes in bank credit on firms' stock returns. It is the second-stage of the instrumental variable approach. The IV dependent variable is firm's total return. $\Delta log\, Bank\, Credit$ is the change in the logarithm of a firm's total borrowing from banks, measured by the number of outstanding loans. $\Delta log\, \widehat{Bank\, Credit}$ is the predicted value of $\Delta log\, Bank\, Credit$ computed in the first-stage. Bank liquidity exposure is the instrument. The set of instruments also includes squared banks' liquidity exposure and its interaction with the crisis dummy, banks' total capital and banks' size. The crisis period is from 2007 Q3 through 2009 Q4. Firm controls include profitability, market-to-book, Z-score, cash holdings, cash flow, tangible assets, leverage, and size. See Table 1 for variables definitions. All regressions include firm and time fixed effects. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Table 10: Bank credit and firm performance: firm quality before the crisis

	(1)	(2)
	Total Return	
	Excluding Firms with Low Net Worth	
	All Banks	Lead Banks
Instrumented variables:		
$\Delta log\, \widehat{Bank\, Credit}$	-0.056**	-0.048*
	(0.029)	(0.026)
$\Delta log\, \widehat{Bank\, Credit}$* Crisis	0.219*	0.158*
	(0.116)	(0.085)
Firm Controls:		
Profitability$_{t-1}$	0.354***	0.350***
	(0.056)	(0.058)
Market-to-Book$_{t-1}$	-0.034***	-0.034***
	(0.002)	(0.002)
Z-score$_{t-1}$	-0.010***	-0.009***
	(0.003)	(0.003)
Cash$_{t-1}$	0.039***	0.040***
	(0.012)	(0.012)
Cash Flow$_{t-1}$	0.153***	0.152***
	(0.044)	(0.044)
Tangibility$_{t-1}$	-0.005	-0.006
	(0.015)	(0.015)
Leverage$_{t-1}$	0.040***	0.038***
	(0.007)	(0.007)
Size$_{t-1}$	-0.040***	-0.040***
	(0.003)	(0.003)
N	63120	63120
N of firms	1271	1271
R^2	0.104	0.111
Weak identification test:		
Cragg–Donald Wald F	36.452	43.819
Stock–Yogo critical value at 5%	15.72	15.72
Overidentification test:		
Hansen J-test	3.935	3.865
p-value	0.415	0.425

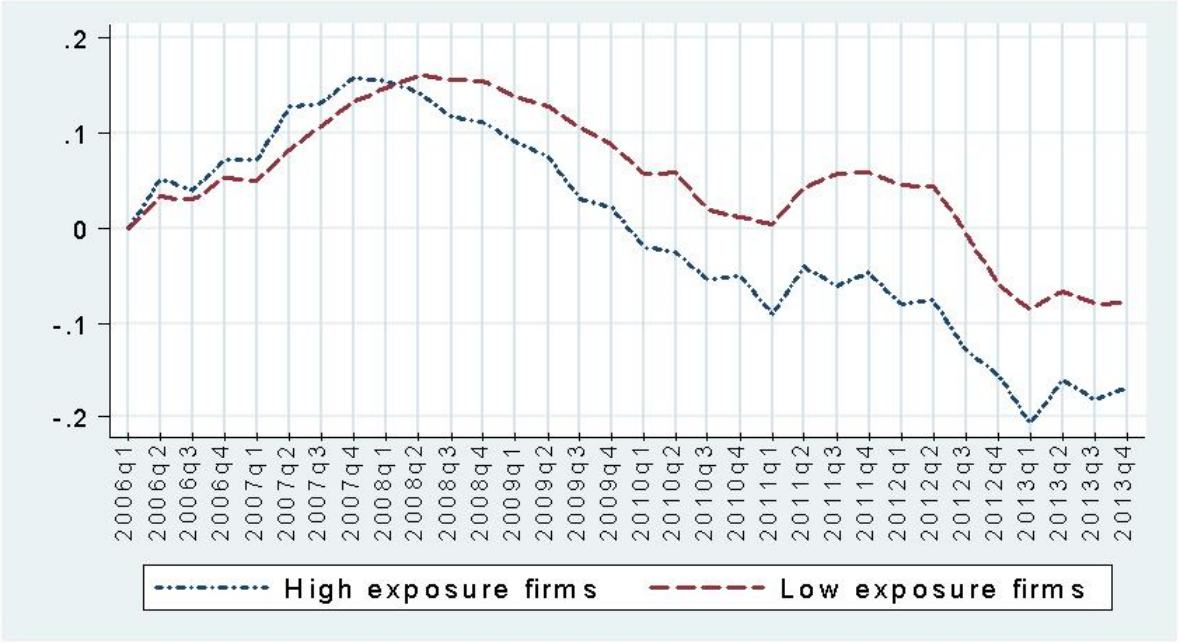
This table reports estimation results of the impact of changes in bank credit on firms' stock returns, excluding firms with low net worth. It is the second-stage of the instrumental variable approach. Firms with low net worth are in the bottom quartile of the quarterly pre-crisis net worth distribution. The IV dependent variable is firm's total return. $\Delta log\, Bank\, Credit$ is the change in the logarithm of a firm's total borrowing from banks, measured by the number of outstanding loans. $\Delta log\, \widehat{Bank\, Credit}$ is the predicted value of $\Delta log\, Bank\, Credit$ computed in the first-stage. Bank liquidity exposure is the instrument. The set of instruments also includes squared banks' liquidity exposure and its interaction with the crisis dummy, banks' total capital and banks' size. The crisis period is from 2007 Q3 through 2009 Q4. See Table 1 for variables definitions. All regressions include firm and time fixed effects. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Table 11: Bank credit and firm performance: selected samples of firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Return					
	Excluding Firms with Negative Profitability		*Excluding Firms with Negative Cash Flow*		*Excluding Firms with Negative Profitability and Cash Flow*	
Panel A: All Banks						
Instrumented variables:						
$\Delta log\, \widehat{Bank\, Credit}$	-0.082**	-0.077*	-0.089**	-0.082**	-0.085**	-0.078**
	(0.040)	(0.041)	(0.038)	(0.038)	(0.038)	(0.038)
$\Delta log\, \widehat{Bank\, Credit}$* Crisis	0.324**	0.359**	0.347**	0.365***	0.351**	0.370**
	(0.150)	(0.150)	(0.136)	(0.134)	(0.145)	(0.145)
N	87780	87780	83668	83668	83002	83002
N of firms	1471	1471	1469	1469	1465	1465
R^2	0.090	0.083	0.083	0.079	0.082	0.078
Weak identification test:						
Cragg–Donald Wald F	36.827	26.078	45.509	31.254	40.969	28.165
Stock–Yogo critical value at 5%	11.04	15.72	11.04	15.72	11.04	15.72
Overidentification test:						
Hansen J-test	0.781	2.083	1.089	1.987	1.177	2.245
p-value	0.677	0.720	0.580	0.738	0.555	0.691
Panel B: Lead Banks						
Instrumented variables:						
$\Delta log\, \widehat{Bank\, Credit}$	-0.060*	-0.059*	-0.062*	-0.059*	-0.058*	-0.054
	(0.035)	(0.035)	(0.034)	(0.034)	(0.034)	(0.034)
$\Delta log\, \widehat{Bank\, Credit}$* Crisis	0.207*	0.239**	0.182*	0.208**	0.186*	0.212**
	(0.112)	(0.110)	(0.105)	(0.102)	(0.108)	(0.106)
N	87780	87780	83668	83668	83002	83002
N of firms	1471	1471	1469	1469	1465	1465
R^2	0.110	0.106	0.111	0.109	0.111	0.108
Weak identification test:						
Cragg–Donald Wald F	53.684	37.396	57.624	39.589	55.194	37.904
Stock–Yogo critical value at 5%	11.04	15.72	11.04	15.72	11.04	15.72
Overidentification test:						
Hansen J-test	1.419	2.667	2.412	3.958	2.506	4.071
p-value	0.492	0.615	0.299	0.412	0.286	0.396
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional instruments	No	Yes	No	Yes	No	Yes

This table reports estimation results of the impact of changes in bank credit on firms' stock returns, excluding firms with negative profitability and cash flow. It is the second-stage of the instrumental variable approach. The IV dependent variable is firm's total return. $\Delta log\, Bank\, Credit$ is the change in the logarithm of a firm's total borrowing from banks, measured by the number of outstanding loans. $\Delta log\, \widehat{Bank\, Credit}$ is the predicted value of $\Delta log\, Bank\, Credit$ computed in the first-stage. Bank liquidity exposure is the instrument. The set of instruments also includes squared banks' liquidity exposure and its interaction with the crisis dummy, banks' total capital and banks' size. The crisis period is from 2007 Q3 through 2009 Q4. All regressions include firm controls, and firm and time fixed effects. Firms controls: profitability, market-to-book, Z-score, cash holdings, cash flow, tangible assets, leverage, and size. See Table 1 for variables definitions. Standard errors in parentheses are clustered at the firm level. ***, ** and * have significance levels at 1%, 5%, and 10%, respectively.

Figure 1: Firms' bank credit



This figure illustrates growth of bank credit at the firm level relative to 2006 Q1 for two groups of firms. High exposure firms have banks' core deposits lower than the average during the crisis, while low exposure firms have banks' core deposits higher than the average.

Abstrakt

V tomto článku zkoumám přenos problémů bankovního sektoru do reálné ekonomiky. Konkrétně se zabývám vlivem frikcí v nabídce bankovních úvěrů na výkonost firmy. Ke zjištění kauzálního vlivu nabídky bankovních úvěrů na výkonost firmy využívám rozdíly v pasivech různých bank v průběhu finanční krize mezi lety 2007 a 2009 jako zdroj exogenní proměnlivosti. Výkonnost firmy ve svém výzkumu měřím jako výnosy z akcií. Výsledky ukazují, že vztah s bankou je pro firmy důležitý. Firmy využívající služeb bank, které používaly jako zdroj financování běžné vklady, vykazovaly menší pokles výkonosti než firmy, které využívaly spíše banky, jež používaly jiné zdroje financování. Dále ukazuji pozitivní vztah mezi poklesem bankovního úvěru a výnosy z akcií firmy. Zjišťuji, že pokles o jednu směrodatnou odchylku v bankovním úvěru vede ke tří a půl procentnímu snížení výnosu z akcie firmy. Dále ukazuji, že během finanční krize se výnosy z akcií firem, jež si dlouhodobě půjčovaly od zdravějších bank, snížily podstatně méně než firmám, které si půjčovaly od bank užívající nekonvenční zdroje financování.

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