Yiyi Bai, Tri Vi Dang, Qing He and Liping Lu

Does lending relationship help or alleviate the transmission of liquidity shocks? Evidence from a liquidity crunch in China

Abstract

We examine China's June 2013 liquidity crunch as a negative shock to banks and analyze the wealth effects on exchange-listed firms. Our findings suggest that liquidity shocks to financial institutions negatively impact borrower performance, particularly borrowers reporting outstanding loans at the end of 2012. Stock valuations of firms with long-term bank relationships, however, outperform the market and experience smaller subsequent declines in investment than peers lacking solid banking relationships. This effect is the strongest for firms that enjoy good relations with China's large state-owned banks or foreign banks, and weakest for firms whose connections are solely with local banks. We document a positive correlation between the stock performances of firms and the stock performances of lender banks and the likelihood of lender banks operating as net lenders in the interbank market. These results suggest that banks transmit liquidity shocks to their borrowing firms and that a long-term bank-firm relationship may mitigate the negative effects of a liquidity shock.

Key words: lending relationship, interbank liquidity crunch, local banks.
JEL classification: G30, G140, G210.

Yiyi Bai, orcid.org/0000-0002-7228-1732. Zhongnan University of Economics and Law. Email: yiyi.bai@zuel.edu.cn

Tri Vi Dang, orcid.org/0000-0002-8848-4163. Columbia University. Email: td2332@columbia.edu

Qing He, orcid.org/0000-0002-6782-099X. Corresponding author. Renmin University of China. Email: qinghe@ruc.edu.cn

Liping Lu, orcid.org/0000-0002-2625-5795. VU University Amsterdam. Email: l.lu@vu.nl

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1 Introduction

The global financial crisis of 2008 highlighted the role of the interbank market in liquidity management of financial institutions. The drying-up of liquidity in the interbank market, which initially spread to credit markets, eventually led to a collapse of the real economy that required massive intervention by financial authorities. Given the social and economic costs of financial crises (Ongena et al., 2003; Gan, 2007; Iyer and Peydro, 2011), it is hard to deny the importance of understanding the channels through which interbank market liquidity shocks affect the real economy. Our following discussion addresses the role of financial institution lending as a transmission channel linking credit markets to stock markets.

A failure of the interbank lending market makes it difficult for financial institutions to cover liquidity shortfalls. Affected banks can transmit the shock to their borrowing firms (Schnabl, 2012), but may attempt to cushion liquidity-shock effects in the case of their most trusted clientele. This is because banks benefit from long-term relationships that reduce information asymmetry (Petersen and Rajan, 1994; Berger and Udell, 1995; He et al., 2017). Long-term relationships put them in a better position to monitor borrowers and avoid risk-shifting during a liquidity shortfall. Such favorable treatment is rarely granted to arm's-length borrowers. Thus, the transmission of bank liquidity shocks to a borrowing firm depends to some extent on the closeness and longevity of the bank-firm relationship.

The literature has not properly addressed this nexus of bank-firm lending relationships and liquidity shock transmission. Liquidity shocks typically affect both financial institutions and borrowing firms, making it difficult to disentangle liquidity effects (Chava and Purnanandam, 2011; Schnabl, 2012). We address this challenge with an examination of China's June 2013 interbank liquidity crunch. This well-contoured negative liquidity shock allows us to tease out the role of lending-relationship in liquidity shock transmission.

China offers excellent conditions for conducting a natural experiment on liquidity shock transmission.

First, the June 2013 interbank liquidity shock occurred after China's new leadership had been installed the previous March. To drive home the point that a new era had arrived, the shock was used to put interbank participants on notice that they needed to recalibrate their expectations regarding interventions from the People's Bank of China (PBOC) and improve their liquidity management.

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Second, the liquidity crunch was a well-defined exogenous event lasting only a few days. It started with the PBOC showing reluctance to provide liquidity to financial institutions, and ended with the PBOC offering funds to the interbank market.

Third, the annual reports of listed firms allow us to compile a novel dataset that covers borrower and lender information on the five largest long-term loans held by listed firms in 2012. Relationship lending alleviates information asymmetry and facilitates long-term contracting (Boot, 2000). We thereby use long-term loans to identify a relationship between the lending financial institution and the borrowing firm.

Fourth, the liquidity crunch achieved its policy purpose. Banks subsequently tightened their lending standards. This behavior shift suggests that banks became worried about future access to the interbank market and thus allows us to estimate the impact of the bank-firm relationship on the real economy through lending channels.

Our analysis of the role of institution lending in the transmission of interbank liquidity crunch starts with an examination of stock market reactions to this shock. We find that all firms experienced sharp drops in their share prices during this period. The declines are more pronounced for firms with outstanding loans at the end of 2012, allowing us to infer that the liquidity shock was transmitted from institutional lenders to their borrowers. Among firms that have access to institutional credit, we distinguish between firms with a "relationship bank" (i.e. a bank providing the bulk of their long-term credit) and firms without that. We find that firms with a relationship bank experienced a lower valuation loss than other banks during the liquidity crunch. This suggests that a bank-firm relationship can mitigate the negative effect transmitted from an interbank liquidity shock.

We next conduct several tests on firms with access to institutional credit to clarify the role of relationship banking. We find that firms with relationship banks experience a lower valuation loss than peers borrowing from non-bank institutions. The effect is strongest for state-owned banks and foreign banks, and the weakest for local banks.[1] This finding reflects financial deregulation in China over the past few decades. foreign banks have gradually come to play significant roles in the

[1] Although local governments are main owners of local banks in some cases, only state-owned banks are fully controlled by the central government. State-owned banks are very different from local banks in many aspects such as size and market share, so it makes sense to separate them into two groups. China Banking Regulatory Commission (CBRC) categorizes banks into 11 groups: policy banks, state-owned banks, joint-stock banks, foreign banks, city commercial banks, rural commercial banks, rural cooperative banks, rural credit unions, village banks, private banks and Postal saving bank. (see http://www.cbrc.gov.cn/chinese/jrjg/index.html). Following CBRC, we simplify it into 4 groups: state-owned banks (including also policy banks), joint-stock banks (including Postal Saving banks as well), local banks (including city commercial banks, rural commercial banks, rural cooperative banks, rural credit unions and village banks), and foreign banks.

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credit market. We also document a positive correlation between the stock performances of firms and the stock performances of their lender banks, as well as the lender banks' positions in the interbank market.

The study finishes with an investigation the long-run impact of the liquidity crunch on firm investment in subsequent years. The June 2013 liquidity crunch acted as a signal to banks about appropriate lending strategies. Aware that the PBOC might withhold short-term liquidity in the future, banks responded by adjusting their loan terms (e.g. amount, interest rate, maturity). Modified lending conditions, in turn, may have influenced corporate investment strategies. Consistent with other studies, we find that firms with outstanding loans reduced their investment ratios over the two-year post-event period. Firms that had long-running and close relationships with banks were less shy about investing than their peers in the post-event period. This evidence supports our view of how the lending channel works.

This paper makes three contributions to the literature. First, the June 2013 liquidity crunch provides a tight frame for studying transmission of a liquidity shock from the interbank market to the stock market. The liquidity crunch and bank-firm lending relationships are then used in our identification strategy. Michaud and Upper (2008) show that risk premiums are mainly driven by factors related with funding liquidity in the short-term, i.e. the ability to convert assets into cash by individual banks. The lending relationship among banks is also an important factor in a bank's ability to access liquidity in the interbank market (Cocco et al., 2009).

Second, we contribute to the literature on relationship banking. James (1987) and Lummer and McConnell (1989) find positive market reactions of bank loan announcements from the borrowing-firm perspective, while Megginson et al. (1995) find heterogeneous market reactions from the lending-bank perspective. Slovin et al. (1992) find that small, less prestigious firms benefit more than their larger counterparts from screening and monitoring services associated with bank loans. Moreover, the quality, organizational structure, and origin of the lender also matter for market reactions (Slovin et al., 1988; Billet et al., 1995; Ongena and Roscovan, 2013). There is also evidence on the trivial roles of relationship banking. Maskara and Mullineaux (2011) find that self-selection bias affects the positive announcement effect in the existing research (see also Ongena and Smith, 2000; Boot, 2000; Ongena, Smith, and Michalsen, 2003). Fields et al. (2006) find that the general advantages of bank-firm relationships have disappeared since the 1980s, although relationship banking may still be beneficial for small and poorly performing firms or during the period with high credit spreads. The role of banks in certifying corporate borrowers has been revitalized since the 2008 global financial crisis (Li and Ongena, 2015).

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Recent literature emphasizes the impact of the shocks to liquidity providers on their borrowers (Chava and Purnanandam, 2011; Schnabl, 2012). This literature tends to focus on whether financial institutions transmit liquidity shocks to their borrowers and subsequent impacts on firm investment opportunities and performances. However, the economic factors that trigger the liquidity shocks may directly affect firm profitability and growth opportunities, which are key challenges for empirical identification. In other words, reliable evidence that a bank-firm relationship on balance helps or hurts firm performance is scarce in the literature. Our goal is to provide novel empirical evidence for the value of bank-firm relationship after addressing the identification limitations mentioned in the existing literature.

Third, we provide evidence on the consequences of central bank interventions. We document the market reactions to an unexpected change of central bank policy in the interbank market that may help explicate the effectiveness of financial authorities' policies. Our study adds to the literature on channels to mitigate negative liquidity shocks. We find that strong bank-firm relationships may alleviate the impacts of liquidity shocks, thereby clarifying the mechanisms that precipitate financial crisis.

The remainder of the paper is organized as follows. Section 2 describes the institutional background and the testable hypothesis. Section 3 discusses the empirical model and research design. Section 4 shows the summary statistics. Section 5 provides empirical results. Section 6 concludes with a summary of the findings and to word to policymakers.

2 Institutional background and testable hypothesis

2.1 Institutional background

China's bank-centered financial system and relatively small capital markets make it challenging for firms to raise external financing from bond or equity markets (Allen et al., 2005; He, Lu and Ongena, 2015). According to China's National Bureau of Statistics, bank-credit-to-GDP ratio in China was about 112 % in 2013, with banks providing about half of total financing for Chinese firms. The Chinese banking system has been dominated by the "Big Four" state-owned banks and three major

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policy banks.[2] There are twelve joint stock banks, hundreds of local banks,[3] as well as hundreds of branches and representative offices of foreign banks that conduct limited business activities in China (He et al., 2017).

The Chinese banking sector operated in an uncompetitive environment before the early 1990s (He et al., 2017). Commercial banks, especially the "Big Four" state-owned banks, accounted for a substantial proportion of credit granted for political reasons rather than profit maximization (Bailey et al., 2011). The government maintained strict control on the allocation of bank credit. The Peoples' Bank of China (PBOC) set the base interest rate along with upper and lower bounds for both the deposit and lending market.[4] As a result, banks had incentive to monitor borrowers actively or curtail default risk. Most of the bank credit extended by state-owned banks to state-owned enterprises (SOEs) suffered from poor lending practices (Berger et al, 2009). This inefficient lending led to a huge amount of non-performing loans in the banking sector that increased the fragility of the country's financial system. Since the late 1990s, the Chinese government has adopted a series of reforms to enhance bank efficiency and lower the non-performing loan ratio. Clean-up measures have ranged from straight-out bailouts to fund injection into financial institutions.

Following China's entry into the WTO in 2001, the government has sought to deregulate the financial system in anticipation of an intensive competition from foreign financial institutions. Most Chinese banks nowadays have been restructured from wholly state-owned banks. Foreign investors are now permitted to take minority ownership in these banks. Western-style corporate governance mechanisms such as shareholder meetings, boards of directors and auditing systems were adopted to monitor daily bank operations. Many commercial banks, including the "Big Four", have become publicly listed firms with strategic foreign institutional investors.

Despite substantial improvement of operational efficiency (Jia, 2009), many problems with the Chinese banking sector remain. The Chinese government often tightly regulates the banking system to manage its economic growth. Bankruptcy law is poorly enforced; government agencies often try to prevent defaults and bankruptcies for the sake of social stability and employment. Thus,

[2] China's "Big Four" state-owned banks are Agricultural Bank of China, Bank of China, China Construction Bank, and Industrial and Commercial Bank of China. The three policy banks are China Development Bank, Agricultural Development Bank of China, and Export-Import Bank of China. "Big Four" were formed to replace the mono-bank system and separate commercial lending from central banking functions. Joint-equity banks were incorporated as limited companies and typically featured a state-dominated shareholding structure (Bailey et al, 2011).
[3] Local banks include city and rural commercial banks, urban and rural credit cooperatives, rural cooperative banks, and village and town banks.
[4] This policy has been lifted gradually since 2013, leaving only a small part of it, such as credit card interest rates, which are still under regulation.

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with an expectation of government bailout ex ante, banks often adopt an aggressive strategy in making lending decisions.

To alleviate the shocks from the global financial crisis, the Chinese government launched an RMB 4 trillion (around USD 650 billion) stimulus plan on Nov 9, 2008. With abundant liquidity and a gloomy economy, banks that were mostly engaged in short-term funding activities (e.g. short-term credit and high-yielding wealth management products) channeled their new funds to long-term projects with potentially higher returns. When redemptions on their short-term funding came due, they turned to the interbank market to cover their cash needs, thus making the interbank market a critical part of their liquidity management.

2.2 Liquidity crunch

The drying up of interbank market liquidity became a seasonal phenomenon in China after 2010. Cash demand peaks in late June as banks turn to the interbank market to meet their semi-annual regulatory requirements (e.g. loan-to-deposit ratios, reserve requirement ratios, and other repayment obligations). The PBOC typically injects funding into the inter-bank market during this period of liquidity tightness to smooth market function.

At the beginning of June 2013, banks followed the established pattern of extending credit aggressively to meet their semi-annual performance goals. The stock of new lending increased to RMB 863 billion in June 2013, a 28.89 % increase from May 2013. Banks assumed the PBOC, as usual, would accommodate their liquidity needs by injecting extra funding into the interbank market. This time around, however, the PBOC altered its policy stance and provided no additional liquidity to the market.

In the weeks leading up to the June 20 panic, the interbank market witnessed several adverse news events (see Appendix 1 for a timeline of major events). A bond offering from the Agriculture Development Bank of China on June 5, 2013 was undersubscribed, raising the prospect on an impending liquidity squeeze in the interbank market. The overnight interbank interest rate was 4.62 % that day. During June 6-8, a rumor flew that that China Everbright Bank (a joint stock bank) had defaulted on a repayment obligation of RMB 100 billion in interbank loans to Industrial and Commercial Bank of China. While both banks claimed the rumor was groundless, interbank market participants were shaken. The interbank market delayed its closing time due to potential defaults on interbank loans, and the interbank rate spiked to 9.58 % on June 8. After falling back to normal levels on subsequent days, the unexpected June 14 non-issuance of treasury bonds again stoked

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fears in the interbank market. The markets continued to believe that the PBOC would step in with extra funding to alleviate the heightened systemic risk caused by low liquidity conditions.

The climax of the episode began with a June 19 statement from the State Council by Premier Li Keqiang on economic and financial reform. He stated that China would maintain a prudent monetary policy stance and a reasonable level of money supply. The interbank rate rose to 7.66 % that day. Closing of the interbank market was again delayed by 30 minutes. Panic was rife by the opening of the interbank market the next day, yet the PBOC insisted on issuing treasury bills, further siphoning liquidity from the interbank market. A new rumor flew that Bank of China had defaulted in the interbank market. The overnight interest rate, already over 10 % at the opening of the interbank market, reached an historical high of 13.44 % at the end of the day.

A statement from the PBOC on June 23, 2013 reiterated the State Council's stance on "prudent monetary policy." The PBOC would fine-tune its monetary policy and rein in monetary aggregates. "Black Monday" hit the stock markets on June 24, with the Shanghai Stock Exchange Composite Index falling by about 5 %. Stock prices decreased by about 10 % for most commercial banks. Throughout the meltdown, the PBOC stayed neutral and announced that market liquidity was sufficient. Some financial institutions were forced to sell assets to meet their liquidity needs.

Concerned with a potential contagion, the PBOC issued a statement on June 25 that stated its commitment to ensuring sufficient market liquidity and providing temporary funding to accommodate banks' liquidity needs. There was great relief in markets as the PBOC suspended treasury-bill issues and granted liquidity support to some financial institutions. On June 26, the overnight interbank interest rate returned to 5.55 % and the panic abated.

Many researchers treat China's June 2013 liquidity crunch as an attempt by the government to rebalance economic growth while avoiding a debt-induced financial crisis. To push banks to curtail risky lending, the PBOC withheld its usual injection of extra liquidity. When this seemed to overshoot the desired response, it abandoned the experiment and began to provide extra liquidity to avoid a larger crisis. It is worth noting here that when we analyze the long-term interbank interest rate (one-year interest, see Figure 1), a proxy for financing activity in the real economy, we find no significant changes during the liquidity crunch period.

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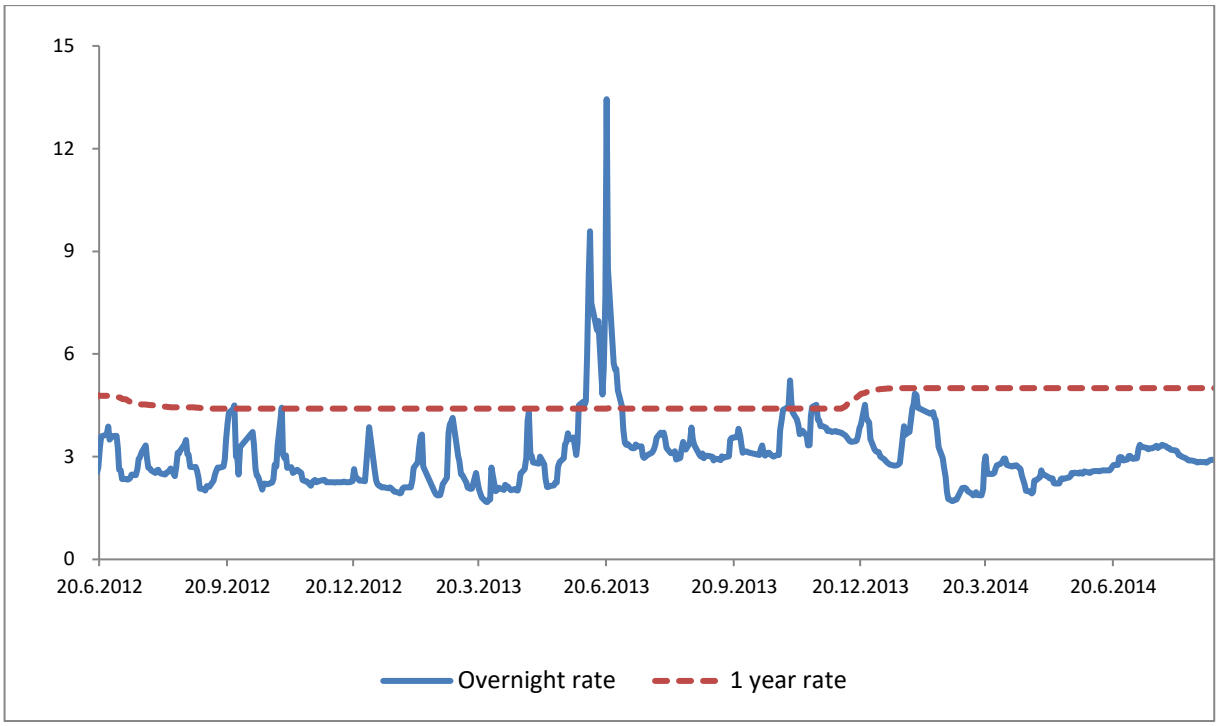
Figure 1 Interbank interest rate from one year before to one year after June 20, 2013 liquidity crunch



Source: CSMAR

The main feature of the liquidity crunch in June 2013, therefore, is the power of PBOC's messaging on its excessive risk-taking to banks. The financial institutions that relied heavily on the interbank market for short-term credit were exposed to severe liquidity constraints with a sudden tightening of the monetary stance.

The liquidity crunch substantially altered lending practices of Chinese banks. Figure 2 plots the growth rate of loan supply before and after the liquidity crunch. We also obtain data for all newly issued loans disclosed by listed firms during six months before and after the liquidity crunch, and estimate the growth rate in the number and amount of loans in the two periods. As shown in Figure 2, the amount of loans falls by 27 % and number of loans decreased by 17 % after the liquidity crunch. In contrast, the amount of loans increases by 38 % and the number of loans by 12 % in the pre-crisis period.

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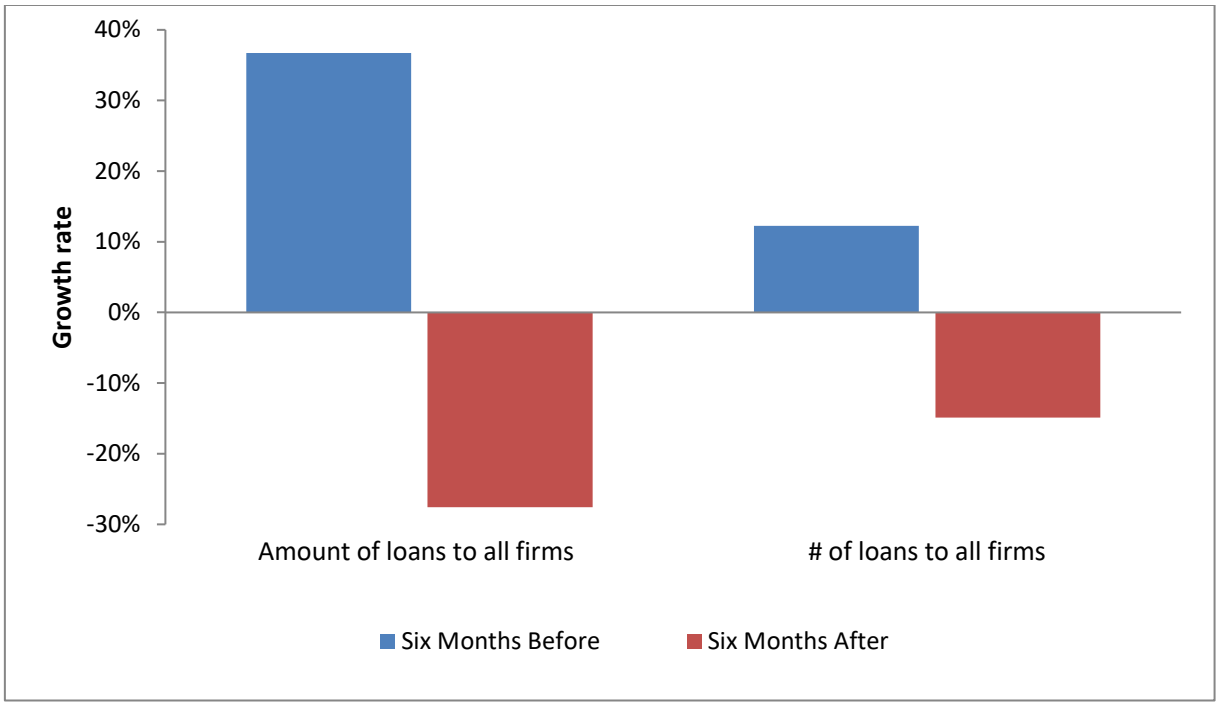
Figure 2 Growth of newly issued bank loans (quarterly, Jan. 2013 – Dec. 2013)



Source: CSMAR

We also obtain data on the total volume of long-term loans[5] newly issued by Chinese financial institutions six months before and after the liquidity crunch. From this, we calculate the monthly percentage of long-term loans over total loans in 2013. We then plot the term structure of newly issued loans in Figure 3, and find a descending trend in the percentage of long-term loans. This result indicates that banks moved to a more cautious lending strategy and changed their liquidity management approach after the liquidity crunch. It is broadly in line with the significant drop in the growth of loans shown in Figure 2. Thus, the June 2013 liquidity crunch event presents a unique setting in which financial institutions face an induced temporary liquidity shortage and respond by adopting conservative lending strategies that substantially reduce their liquidity supply over the long run. We exploit this unique event to investigate whether these changes in bank behavior caused by the liquidity shock are transmitted to borrowers.

[5] Long-term loans are typically loans that have a maturity longer than a year.

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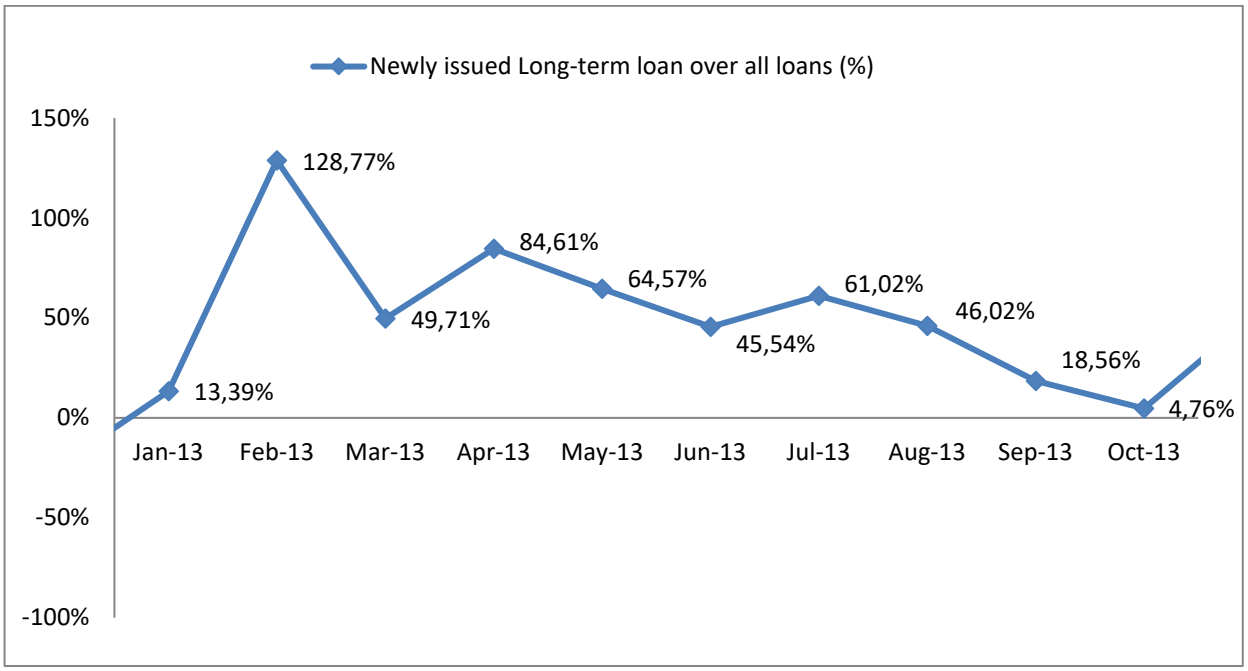
Figure 3 Term structure of new loans newly issued by financial institutions (monthly, Jan. 2013 – Dec. 2013).



Source: PBOC

2.3 Testable hypotheses

In a frictionless financial market, shocks to financial institutions should not affect firm borrowing as firms can easily access alternative external financing sources. However, market frictions (e.g. moral hazard and information asymmetry) can undermine the ability of the firm to access alternative financial channels (Holmstrom and Tirole, 1997).

In an economy where market frictions are present, shocks that affect the lending abilities of financial institutions can also impact their borrowers (Chava et al., 2011). Banks may reduce the amount of funds available to borrowers or reallocate their asset portfolios in favor of safer assets (Stein, 1988). China is no exception. In its bank-centered financial system, financial institutions mainly obtain funding from the interbank market. This exposes them to severe constraints during a liquidity crunch. It adversely affects their lending abilities, which then leads to a loss of value in firms borrowing from banks. Thus, we propose our first hypothesis:

> ***Hypothesis 1:*** *A firm that borrows from financial institutions experiences a larger value loss during a liquidity crunch than a firm that has no institutional borrowing.*

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The literature suggests that market frictions such as information asymmetry and agency costs may affect the flow of funds to firms with profitable investment opportunities (e.g. Stiglitz and Weiss, 1981). Lenders are uncertain about the creditworthiness of managers and investment opportunities. Financial institutions, and banks in particular, overcome these frictions by producing and analyzing information on their clients before making loan decisions (Petersen and Rajan, 1994).

One feature of the bank business is relationship lending. Banks benefit in reduced costs in information collection about borrowers and may gain access to otherwise useful proprietary information. Boot and Thakor (1994) show that the duration of bank-firm relationships is associated with loan contract terms. Firms with long-term banking relationships pay lower interest rates and are not required to pledge as much collateral. Empirical studies are generally consistent with the benefits of banking relationship. Hoshi et al. (1990, 1991) find that banks help their clients with long-term relationships alleviate credit constraints and survive liquidity shocks during the crisis. James (1987), Billett (1995), Maskara (2011) and Ongena (2013) document positive market reactions of bank loan announcements, suggesting that bank relationships are valuable from the perspective of outside investors.

We expect that banks can obtain sufficient information to monitor their borrowers through close and repeated interactions, and thus prevent risk-shifting in a liquidity shortfall. For firms borrowing from financial institutions, the transmission of liquidity shocks via relationship banks is weaker than via other non-bank financial institutions. Thus, we propose our second hypothesis:

> ***Hypothesis 2:*** *For firms borrowing from financial institutions, a firm with banking relationships is likely to experience less value loss during a liquidity crunch than a firm lacking banking relationships.*

A feature of the Chinese financial system is the dominance in credit allocation of state-owned banks, whose funding is implicitly guaranteed by the government. Relative to local banks and joint-equity banks, state-owned banks typically have more financing flexibility due to broader geographical presence and greater diversification of deposits and other funding sources. Their close ties with the government earn them frequent support from the regulatory authority, especially during crisis period.

At the other end of the government-involvement spectrum, we find foreign banks to be largely immune to an induced liquidity crunch used by political leaders as a tool to promote prudential behavior. The information generated from the lending relationship with foreign banks and state-

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owned banks has a larger valuation effect than those with joint-stock and local banks. Thus, the transmission of liquidity shocks by joint-stock banks and local banks is stronger than foreign and state-owned banks. We propose our third hypothesis:

> ***Hypothesis 3:*** *The value loss is lowest if a firm's relationship banks are state-owned or foreign banks, and highest if the relationship banks are local or joint-stock banks.*

The June 2013 liquidity crunch provided notice to banks on appropriate lending strategies and motivated banks to adjust their lending practices to cope with potential interbank liquidity shortfalls. After the liquidity crunch, we see that it took seven months for the volume of new loan issues to recover to a comparable level of June 2013. Therefore, the event provides an opportunity to investigate how bank lending behavior affects firm investment. When banks play a special role in mitigating frictions in an economy, it may be that long-term bank relationships help firms alleviate credit constraints. With a decreasing loan growth rate, we expect that firms with established banking relationships see smaller reductions in their investments. We propose our fourth hypothesis:

> ***Hypothesis 4:*** *Firms with bank relationships have smaller reductions in investments than other firms after a liquidity crunch.*

3 Research design, data and descriptive statistics

3.1 Research design

A standard market model (James, 1987) is used to estimate the benchmark returns and calculate abnormal returns (ARs). We run a daily market model over the estimation window of [-120, -21] to calculate abnormal returns and cumulative abnormal returns (CARs), with day 0 as the liquidity crunch date. We calculate the CARs over the event windows of [-5, +5] as our main dependent variable. We link the CARs to bank-firm relationship, firm and bank level characteristics in the regression equation:

$$CAR_i = \gamma_0 + \gamma_1 Bank_firm_i + \gamma_2 Firm_i + \gamma_3 Bank_i + \gamma_4 Industry_i + \epsilon_i \,, \qquad (1)$$

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where $Bank_firm_i$ equals 1 if the firm's largest lender of long-term loans is a bank, and 0 otherwise. We further categorize banks into *state-owned banks* (i.e. including the "Big Four" commercial banks and three main policy banks),[6] *joint stock banks, local banks,* and *foreign bank*s. Bank balance sheet data is retrieved from Bankscope. State-owned banks have dominated the Chinese banking sector since the 1980s. They are often considered the safest banks as they enjoy implicit government guarantees. Therefore, we propose that firms having relationships with state-owned banks may perform better in the stock market during the interbank liquidity crunch. We define *local banks* as urban or rural commercial banks, urban or rural credit cooperatives, rural cooperative banks, and village-town banks (i.e. small and medium-sized banks). Local banks may be quite different from national and regional banks in terms of geographical presence, organizational structure and business orientation. Local banks also enjoy a lower legal reserve requirement ratio, which is intended to incentivize them to finance small and medium-sized enterprises (SMEs). Since May 2012, the legal reserve requirement ratio has been 20 % for national and regional banks and 16.5 % for local banks.

$Firm_i$ denotes a set of firm characteristics, such as firm size, leverage, profitability, ownership, Tobin's Q, growth prospects, and stock market liquidity. We add firm ownership information from *CSMAR*, a widely-used database for the Chinese stock market, and create an SOE dummy variable that equals 1 if the firm's ultimate controller is a state-owned entity. We supplement the *CSMAR* stock data with firm balance sheet data at the end of 2012 from the *WIND* database. Detailed variable definitions are provided in Appendix 2.

3.2 Summary statistics

Our sample consists of all firms traded in the Shanghai and Shenzhen Stock Exchanges in 2013. We retrieve stock return data from *CSMAR*. We include all firms with information on stock returns within the [-5, 5] window around June 20, 2013. This leaves us with a sample of 42 financial firms and 2,335 non-financial firms.

We first search for the 2012 corporate annual reports on websites of record with the China Securities Regulatory Commission (CSRC). Disclosure rules at the time of the crisis required all listed firms to report information on their top five largest outstanding loans at the end of 2012 in their annual reports.[7] Thus, the firm's relationship bank can be identified by the major lender from

[6] As only a small number of listed firms borrow from policy banks, our results remain qualitatively unchanged by excluding the three banks.
[7] The China Securities Regulatory Commission (CSRC) requires all listed firms to disclose relevant information of their five largest outstanding loans in the annual reports, i.e. lender name, loan outstanding, maturity, etc.

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long-term loans disclosed in the firm's 2012 annual report. As the same lender may provide loans from more than one branch, we aggregate loan amounts at the headquarter-level of the lender.

We also include the following bank balance sheet data from Bankscope: bank total assets, bank liquidity ratio, and bank equity ratio. Bankscope balance sheet information is available for 46 of the 78 banks that serve as the listed firms' providers of long-term loans. This covers about 95 % of firms with banks long-term loans in our sample.

For the 2,335 non-financial firms with stock price information available in the event window, 1,830 firms had outstanding loans at the end of 2012 (including 767 firms whose largest lenders of long-term loans were non-bank institutions, 1,063 firms that had banks as their largest lenders of long-term loans), and 505 firms that did not report any loans.

Of the 1,063 firms whose largest lenders of long-term loans were banks in 2012, [8] 31 firms reported most of their loans came from foreign banks, 85 firms from 38 local banks, and 240 firms from 12 joint-stock banks. Most of the remaining 649 firms borrowed mainly from China's "Big Four" state-owned banks or three main policy banks.

4 Empirical results

4.1 Abnormal returns around the time of the liquidity crunch

Table 1 reports some descriptive statistics of CARs in eight event windows for 2,377 Chinese listed firms. For all reported windows, CARs are significantly negative at the 1% level. For example, CAR[-1, 1] equals -0.023 and is significant at the 1 % level. This means that the stock prices on average decreased abnormally by 2.3% for Chinese listed firms within the three trading days around the event day (i.e. the preceding Wednesday, the event day Thursday, and the following Friday). The result is economically significant as the average CARs of bank loan announcements before 2007 is around 0.5% (Li and Ongena, 2015). The negative market reactions to the liquidity crunches in China confirm that the liquidity shortage witnessed by financial institutions in the interbank market may have negatively impacted the access to financing, liquidity, and cash flow of borrowing firms as well.

[8] This includes 60 firms that did not disclose their five largest long-term loans in their 2012 annual reports, i.e. they simply reported that they had *some* long-term loans outstanding.

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Table 1 Descriptive statistics of CARs

	Mean	Std. Err.	Obs.	Min.	Max.
CAR[-1, 1]	-0.022***	0.001	2377	-0.28	0.218
CAR[0, 1]	-0.023***	0.001	2377	-0.148	0.171
CAR[-1, 0]	-0.017***	0.001	2377	-0.262	0.22
CAR[-2, 2]	-0.047***	0.001	2377	-0.318	0.289
CAR[-3, 3]	-0.044***	0.002	2377	-0.291	0.367
CAR[-5, 5]	-0.046***	0.002	2377	-0.397	0.497
CAR[-1, 2]	-0.050***	0.001	2377	-0.303	0.287
CAR[-1, 4]	-0.041***	0.001	2377	-0.286	0.367

The table reports descriptive statistics of the dependent variable cumulative abnormal return (CAR). Market index weighted by market value and daily stock returns at each trading day are used to calculate the CARs for eight event windows. Data source: *CSMAR*.

We categorize the listed firms by type of relationship bank to examine the role of lending relationships during the interbank liquidity crunch. Table 2 provides summary statistics on the CARs in three different event windows sorted by bank type.

Following previous studies, we choose the standard event window and focus on the CAR over a 3-days window [-1, 1]. We obtain similar results when checking other windows such as [0,1] and [-1,0] as a robustness.

Firms reporting outstanding loans at the end of 2012 underperformed their peers. We interpret this to mean that the negative liquidity shock for the interbank market had downstream impacts on firms seeking to meet their financing needs. Among all firms with financing needs, firms that borrowed from non-bank institutions had distinctly lower CARs than firms borrowing from banks. The differences are positive and significant in all three event windows. This finding indicates that investors perceive that banks are willing to keep supporting borrowers with established lending relationships during a liquidity crunch in the interbank market to such an extent that it confers a valuation premium on such firms.

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Table 2 Firm CARs sorted by firm type

	# of firms		*CAR[-1,1]*	*CAR[0,1]*	*CAR[-1,0]*
Non-financial firms					
Overall	2,335	Mean	-0.023***	-0.023***	-0.017***
		Std. Err.	(0.001)	(0.001)	(0.001)
No loans	505	Mean	-0.019***	-0.020***	-0.015***
		Std. Err.	(0.002)	(0.002)	(0.002)
Loans	1,830	Mean	-0.024***	-0.024***	-0.017***
		Std. Err.	(0.001)	(0.001)	(0.001)
		Dif No loans	***-0.004****	***-0.003****	***-0.002****
No relationship	767	Mean	-0.025***	-0.026***	-0.019***
		Std. Err.	(0.001)	(0.001)	(0.001)
Bank relationship	1,063	Mean	-0.022***	-0.022***	-0.017***
		Std. Err.	(0.001)	(0.001)	(0.001)
		Dif No bank relationship	***0.003****	***0.004*****	***0.002****
Type of bank					
State-owned bank	649	Mean	-0.021***	-0.021***	-0.016***
		Std. Err.	(0.002)	(0.001)	(0.001)
		Dif No bank relationship	***0.004****	***0.005*****	***0.003****
Local	85	Mean	-0.026***	-0.024***	-0.020***
		Std. Err.	(0.004)	(0.003)	(0.004)
		Dif No bank relationship	***-0.0001***	***0.003***	***-0.001***
Joint	240	Mean	-0.025***	-0.024***	-0.018***
		Std. Err.	(0.003)	(0.002)	(0.002)
		Dif No bank relationship	***0.0005***	***0.002***	***0.001***
Foreign	31	Mean	-0.011	-0.020**	-0.009
		Std. Err.	(0.010)	(0.009)	(0.006)
		Dif No bank relationship	***0.015****	***0.006***	***0.010****

This table reports the mean and standard error for CARs in three event windows sorted by firm type. CARs are calculated from returns for daily stock price and market index weighted by market value. Of the 2,335 non-financial firms with stock price information available in the event window, 1,830 firms had outstanding loans at the end of 2012 (including 1,063 firms whose largest long-term loan lenders were banks, and 767 firms whose largest long-term loan lenders were non-bank institutions), while 505 firms had no reported outstanding loans. In the 1,063 firms whose largest long-term loan lenders were banks, 649 had borrowed from state-owned banks, 85 firms from local banks, 240 firms borrow from joint-stock banks, 31 firms borrow from foreign banks, and 60 firms borrow from banks without disclosing information sufficient to determine bank type. Definitions of bank-type variables (State-owned bank, Local bank, Joint stock bank, and Foreign bank), are listed in Appendix 2. Differences of the means between firm types are reported with significance indicated at the 1 %, 5 %, and 10 % levels, and indicated with ***, **, and *, respectively.

The second panel of Table 2 shows CARs in three event windows across four groups of firms are associated with four types of banks. The small number of firms borrowing from *Foreign* banks have the highest CARs in all three windows. Firms borrowing from *Local* banks have the lowest CARs

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among all four groups. For the other two groups, firms borrowing from *State-owned banks* consistently outperform firms borrowing from *Joint-stock banks*.

The differences in the CARs between firms borrowing from foreign banks and firms in the other three groups are always positive and significant at the 1 % level. This evidence suggests that firms having relationships with foreign banks are practically immune to policy-induced liquidity shocks. State-owned banks seem to offer a slight advantage over the remaining types of banks, because their borrowers seem to be better insulated from the impact of the interbank liquidity crunch. Investors ascribe least value to the fact that a firm has local banking relationships. In the view of investors, local banks are believed to suffer the most from an interbank liquidity crunch, so firms that have lending relationships with local banks experience the most negative market reactions from the liquidity crunch event.

4.2 Cross-sectional regressions

In Tables 3 and 4, we include loans and bank-firm relationship variables in the regression to distinguish between firms reporting and not reporting outstanding loans at the end of 2012, and between firms with and without bank relationships (i.e. firms relying mainly on bank lending).

Table 3 reports the regression results with an OLS model using a sample of 2,335 Chinese firms listed in the Shanghai and Shenzhen Stock Exchanges. The dependent variables are CAR[-1, 1], calculated using the daily stock return and market index weighted by the market value. In the first two columns, the main independent variable is *Loans*, which equals 1 if the firm had outstanding loans at the end of 2012, and 0 otherwise.

In addition, we include a set of firm balance sheet variables in the previous year 2012: *firm size* (total assets), *leverage*, *profitability* (EBIT), *Tobin's Q*, *state-owned* dummy, *special treatment*[9](ST) dummy, *sales growth* (growth in sales revenue), and *stock liquidity*. We also include the industry fixed effects in some regressions, and the standard errors are clustered at the industry level.

The coefficients of *Loans* are always negative and statistically significant (at least 5% level) in all 4 columns. For example, the coefficient is -0.004 in column (1), i.e. firms with outstanding loans at the end of 2012 have 0.4% lower CARs than otherwise. This makes sense as firms that reported no loans are considered having no financing needs and no relationships with lender in the interbank market. A negative liquidity shock in the interbank market is less likely to be transmitted

[9] A firm is designated as a special treatment (ST) firm by Chinese Securities Regulatory Commision (CSRC) if it incurs losses for two continuous years.

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to these firms as they face no exposure to the lending channel. Adding industry fixed effects and firm balance sheet controls does not change the results. These results are robust to other event windows as well.[10]

Table 3 Borrowing and information disclosure of firms

	(1)	(2)	(3)	(4)
Loans	-0.004***	-0.004***	-0.008***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Total asset			-0.001	-0.001
			(0.001)	(0.002)
Leverage			0.007	0.005
			(0.005)	(0.004)
EBIT			-0.013	-0.013
			(0.016)	(0.016)
Tobin's Q			-0.002	-0.002
			(0.002)	(0.002)
SOE			-0.002	-0.003
			(0.002)	(0.002)
ST			0.011***	0.010***
			(0.002)	(0.002)
Sales growth			-0.001	-0.001
			(0.002)	(0.002)
Stock liquidity			-0.002***	-0.003***
			(0.001)	(0.000)
Constant	-0.019***	-0.014***	0.014	0.031
	(0.001)	(0.001)	(0.033)	(0.037)
Observations	2,335	2,335	2,207	2,207
R-squared	0.002	0.016	0.024	0.039
Industry FE	no	yes	no	yes

This table reports regression results with an OLS model using a sample of 2,335 Chinese firms listed on the Shanghai and Shenzhen exchanges. The dependent variables are CAR[-1, 1], calculated using daily stock return and market index weighted by market value. *Loans* equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise. Firm balance sheet controls include the following variables: *Log total assets* is the logarithm of total assets at the end of 2012 in 1,000 RMB; *Leverage* is total liabilities over total assets at the end of 2012; *EBIT* is the industry-adjusted EBIT at the end of 2012; *Tobin's Q* is the book value of total liabilities plus the market value of total equity over the book value of total assets at the end of 2012; *SOE* equals 1 if the firm was directly or indirectly controlled by the state the end of 2012, 0 otherwise; *ST* equals 1 if the firm is under special treatment, 0 otherwise. Other firm-level controls include the following variables: *Sales growth* is the rate of growth in sales revenue in 2012; *Stock liquidity* equals the average ratio of trading volume divided by tradable shares market value in 30 days before the event. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

[10] Results are available upon request.

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Having seen that firms with outstanding loans at the end of 2012 underperformed in the stock market during the interbank liquidity crunch, we now go a step further in exploring the variations in stock market performances of firms with outstanding loans. That is, did having a banking relationship play a role or not? Table 4 reports the regression results with an OLS model using a sample of 1,234 Chinese firms that disclosed their five largest long-term loans in their 2012 annual reports. Our aim here is to test whether having a bank as the largest provider of long-term loans affected the stock performance of a firm during the interbank liquidity crunch. In columns (3) and (4), the sample is enlarged to 1,830 firms that have institutional loans outstanding at the end of 2012 (i.e. including another 596 firms whose detailed long-term loan information is missing). In columns (5) and (6), the sample is enlarged to all 2,335 Chinese firms listed on the Shanghai and Shenzhen Stock Exchanges (i.e. including another 505 firms that did not report any outstanding institutional loans). The dependent variable is CAR[-1,1]. *Bank_firm* equals 1 if a firm's largest provider of long-term loans is a bank, and 0 otherwise.

The coefficients of *Bank_firm* are positive and statistically significant at the 1 % level in all six columns. For example, the coefficient is 0.007 in column (1). Firms with a bank is the largest provider of long-term loans tend to have 0.7 % higher CARs than otherwise. Adding firm balance sheet variables to control for other potential impacts from the firm side does not substantially change the results. The results are also robust in columns (5) and (6), where we enlarge the sample to include all 2,335 non-financial listed firms in China.

The results remain robust when other firm characteristics are added as control variables. The *ST dummy* has positive and significant coefficients in all four columns, and the coefficients of leverage, sales growth and stock liquidity are largely negative and significant, suggesting that firms having a higher leverage and liquidity in the stock market tend to have lower CARs. The remaining firm-level control variables are largely insignificant, indicating that none affected the market reactions during the interbank liquidity crunch.

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Table 4 Firms whose largest provider of long-term loans is a bank

	(1)	(2)	(3)	(4)	(5)	(6)
	Firms disclosing five largest long-term loans		All firms with loans		All firms	
Bank_firm	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Information Disclosure			-0.005**	-0.007**	-0.007***	-0.010***
			(0.002)	(0.003)	(0.002)	(0.003)
Total asset		-0.001		-0.002		-0.001
		(0.002)		(0.001)		(0.002)
Leverage		-0.001		0.004		0.003
		(0.005)		(0.004)		(0.005)
EBIT		-0.035		-0.035*		-0.016
		(0.023)		(0.018)		(0.016)
Tobin's Q		0.000		0.000		-0.002
		(0.003)		(0.002)		(0.002)
SOE		-0.004		-0.002		-0.003
		(0.003)		(0.003)		(0.002)
ST		0.015***		0.011***		0.011***
		(0.004)		(0.003)		(0.003)
Sales growth		-0.003		-0.001		-0.001
		(0.002)		(0.002)		(0.002)
Stock liquidity		-0.005***		-0.004***		-0.002***
		(0.001)		(0.000)		(0.000)
Constant	-0.032***	-0.003	-0.018***	0.027	-0.017***	0.018
	(0.001)	(0.038)	(0.001)	(0.036)	(0.001)	(0.037)
Observations	1,234	1,200	1,830	1,742	2,335	2,207
R-squared	0.028	0.073	0.018	0.054	0.016	0.039
Industry FE	yes	yes	yes	yes	yes	yes

This table reports regression results with an OLS model using a sample of the 1,234 Chinese firms that disclosed their five largest long-term loans in their 2012 annual reports. In columns (3) and (4), the sample was enlarged to 1,830 firms that had outstanding loans at the end of 2012 (includes another 596 firms for which detailed long-term loan information is absent). In columns (5) and (6), the sample was enlarged to encompass all 2,335 Chinese firms listed on the Shanghai and Shenzhen exchanges (includes another 505 firms that did not report any outstanding loans). The dependent variables are CAR[-1,1]. Bank_firm equals 1 if the firm's largest lender of long-term loans is a bank, 0 otherwise. Information disclosure equals 1 if a firm discloses its five largest long-term loans in its 2012 annual report, 0 otherwise. Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

4.3 Results by bank type and firm ownership

Table 5 reports the regression results with an OLS model using a sample of 1,830 Chinese firms that have outstanding loans by the end of 2012. The dependent variable is CAR[-1,1]. *State-owned banks* equals 1 if a firm's largest lender of long-term loans is one of the "Big Four" state-owned banks or three main policy banks; *Local banks*, *Joint-stock banks*, and *Foreign banks* equal 1 if a

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firm's largest lender of long-term loans is a local bank, a joint stock bank and a foreign bank respectively, and 0 otherwise. All four columns use 767 firms borrowing from non-bank institutions as the benchmark group.

Table 5 considers whether the ownership structure of relationship banks impacted the stock performance of firms. With the full sample of 1,830 firms, the coefficient of *State-owned bank* is 0.007 and significant at the 1 % level in column (1) of Table 5. The coefficient is 0.006 when we add industry fixed effects and several firm balance sheet control variables in column (4). The results are qualitatively similar for all columns. The positive coefficients of *State-owned bank* are always statistically significant at the 1 % level in all four columns, suggesting that firms whose largest lenders of long-term loans are state-owned banks tended to outperform in the stock market during the interbank liquidity crunch compared to firms borrowing from other domestic banks. *Foreign banks* also have significantly positive coefficients that have even larger economic significance than the coefficients of *State-owned banks*. This result comports with our third hypothesis.

Interestingly, compared to the coefficients of the other three bank types, we observe a consistent pattern whereby the coefficients of *State-owned banks* always have the second-highest economic significance, the coefficients of *Local banks* always have the lowest economic significance, and the coefficients for *Joint-stock bank*s have a slightly larger economic significance than for *Local banks*. This pattern persists after adding industry fixed effects and firm balance sheet variable as controls.

As explanation, it seems that local banks are often more fragile in an interbank market due to their small size and limited funding that exposes them more in an interbank liquidity crunch. Firms with lending relationships with local banks seem more prone to suffering from an interbank liquidity crunch than banks with regional and national bank lending relationships.

Next, we estimate the regression separately by firm ownership. Brant and Li (2003) note that state-owned enterprises (SOEs) in China are treated favorably by commercial banks, especially state-owned commercial banks. Non-SOEs, in contrast, face obstacles in obtaining external finance from state-owned banks due to their short borrowing histories or simple discrimination. In general, we expect stronger effects for non-SOEs that borrow mainly from foreign banks because foreign banks are more likely to allocate credit based on commercial judgments. We define a firm as an SOE if its ultimate largest shareholder is the government or government-related entity. We add controls for industrial fixed effects and a set of firm characteristic variables.

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Table 5 Results by bank type and firm ownership

Panel A Whole sample

	(1)	(2)	(3)	(4)
State-owned banks	0.006***	0.006***	0.006***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Local banks	0.002	0.001	0.004	0.002
	(0.003)	(0.004)	(0.003)	(0.004)
Joint-stock banks	0.002	0.003	0.004	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Foreign banks	0.017***	0.017***	0.018***	0.018***
	(0.004)	(0.003)	(0.005)	(0.005)
Firm balance sheet controls	no	no	yes	yes
Observations	1,830	1,830	1,742	1,742
R-squared	0.005	0.020	0.037	0.056
Industry FE	no	yes	no	yes

Panel B Non-SOEs vs SOEs

	(1)	(2)	(3)	(4)
	Non-SOE		SOE	
State-owned banks	-0.005**	-0.004**	0.012***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)
Local banks	-0.009**	-0.011*	0.015**	0.012*
	(0.004)	(0.006)	(0.006)	(0.006)
Joint-stock banks	-0.004	-0.003	0.005	0.005
	(0.003)	(0.003)	(0.003)	(0.003)
Foreign banks	0.012**	0.013***	0.011***	0.011***
	(0.004)	(0.003)	(0.003)	(0.003)
Firm balance sheet controls	yes	yes	yes	yes
Observations	927	927	815	815
R-squared	0.037	0.061	0.094	0.134
Industry FE	no	yes	no	yes

This table reports regression results by bank type and firm ownership. Panel A shows results from an OLS model using a sample of 1,830 Chinese firms that showed outstanding loans in 2012 annual reports. The dependent variables are CAR[-1,1]. *State-owned banks* equals 1 if the firm's largest lender of long-term loans is one of the four large state-owned banks or three major policy banks. *Local banks, Joint stock banks,* and *Foreign banks* equal 1 if the firm's largest lender of long-term loans is a local bank or a joint-stock bank or a foreign bank, and 0 otherwise. All four columns use 171 firms that borrowed from non-bank institutions as the underlying comparison group. Firm balance sheet controls are the same as in Table 3. In Panel B, we split the sample into Non-SOEs and SOEs. The dependent variables and independent variables are the same as in Panel A. Standard errors are clustered at industry level in all four columns, and are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

Panel B reports the results for Non-SOEs and SOEs. We find that the coefficients of *State-owned banks* are around 0.012 and significant at the 1% level for SOEs, while negative and insignificant for Non-SOEs. The long-term lending relationships with local banks have a positive effect in SOEs while a negative effect in Non-SOEs. A possible explanation is that *State-owned bank*s and local

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banks are inefficient in accessing information form non-SOEs, and thus less likely to mitigate liquidity shocks to their borrowing non-SOEs. In addition, the results also show that the coefficients of *Foreign banks* are around 0.018 for non-SOEs and 0.010 for SOEs. Consistent with our hypothesis, foreign banks allocate credit by commercial judgements, especially for extending credits to Non-SOEs.

4.4 Bank strength and market reaction

Table 6 examines whether firms' performances in stock market are associated with their banks' stock price change and interbank position. The first two columns in Table 6 are OLS regression results using a sample of 680 Chinese firms whose largest long-term loan lenders are one of the 16 listed banks in China. *Bank CAR* is the CAR of the bank which is the largest lender of long-term loans of a firm, also calculated in the event window of [-1,1]. Given that all 16 Chinese listed banks are domestic, *State-owned banks* and *Local banks* are added as control variables in columns (2). Controlling for firm characteristics and industry fixed effects (and bank fixed effects in some specifications), we find that the results are still robust.

In column (1) of Table 6, we find that the coefficient of *Bank CAR* is 0.014, indicating that a 1% increase in *Bank CAR* corresponds to a roughly 1.4 % increase in the CARs of firms borrowing from banks. This result suggests a positive relationship between firm CAR and bank CAR, which makes sense as the flagging financial health of a lending bank could bleed over and distress borrower firms. It is understandable that the coefficient is insignificant given that our group of 16 listed banks represents but a small fraction of the full sample of 78 banks. The relationship becomes more pronounced in column (2), where the coefficient of *Bank CAR* rises to 0.834 and becomes significant at the 10% level when we add the two dummy variables *State-owned banks* and *Local banks* to control for any potential effect from the bank side. Investors seem to believe that firms are likely to suffer less during an interbank liquidity crunch if their relationship banks also suffer less from the liquidity shock.

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Table 6 Heterogeneity across bank CARs and bank interbank positions

	(1)	(2)	(3)	(4)
Bank CAR	0.014	0.834*		
	(0.033)	(0.411)		
Bank Interbank Position			0.028***	0.016
			(0.008)	(0.029)
State-owned bank		-0.014***		-0.014***
		(0.003)		(0.003)
Local		-0.105**		-0.020
		(0.045)		(0.013)
Firm balance sheet controls	yes	yes	yes	yes
Observations	680	680	921	921
R-squared	0.140	0.141	0.137	0.137
Industry FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes

This table reports regression results with an OLS model that explores the heterogeneity across bank CARs and bank interbank positions. The first two columns use a sample of 680 Chinese firms whose largest long-term loan lender is one of China's 16 listed banks, while the last two columns use a sample of 921 Chinese firms whose largest long-term loan lender is among the 50 banks for which 2012 Bankscope interbank market information is available. The dependent variables are CAR[-1,1]. Bank CAR is the CAR of the bank which is the largest lender of long-term loans of a firm, also calculated in the window of [-1,1]. The main independent variable is Bank Interbank Position, which equals the average ratio of interbank assets over interbank liability in 2012. Given that all 16 Chinese listed banks are domestic, *State-owned banks* and *Local banks* are added in as control variables in columns (2) and (4). Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

The last two columns in Table 6 report the regression results with an OLS model using a sample of 921 Chinese firms whose largest long-term loan lenders are among the 50 banks with 2012 Bankscope interbank market information available. The main independent variable is *Bank Interbank Position*, which equals the average ratio of interbank assets over interbank liability in 2012. A value above 100 % indicates that the bank has a high liquidity in the interbank market. We propose that the higher the liquidity of a bank in the interbank market the lower the shock to the stock price of its borrower firms (i.e. those firms with which it has lending relationships). Standard errors are clustered at the industry level in all four columns. Column (4), which includes *State-owned banks* and *Local banks* as control variables, shows qualitatively similar results.

In column (3) of Table 6, we find that the coefficient of *Bank Interbank Position* is 0.028 and significant at the 1 % level, indicating a positive relationship between firm CAR and a bank's position in the interbank market. The makes sense as net lenders in the interbank market (*Bank Interbank Position* greater than 1) are less likely to be negatively affected by a liquidity crunch – and may even benefit from it. In contrast, net borrowers suffer more than others as the liquidity

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crunch dries up alternative funding sources in the interbank market. Such relationships remain positive, but insignificant when we add bank type characteristics as control variables. This may be due to the fact that bank type dummies take away some of the variation in bank interbank position. State-owned banks typically are the ones who lend to small local banks in the Chinese interbank market.

4.5 Impacts on investment

As this liquidity crunch had a temporary and exogenous impact on liquidity supply, analysis of stock returns allows us to investigate the effects of liquidity shortage and bank-firm relationship on firm value. Notably, market reaction is unaffected by subsequent changes in bank lending in response to the liquidity crunch. Figures 2 and 3 both show that banks significantly reduced their lending after the crunch, so we flesh out our study to include firm investment behavior and provide a more market-based analysis. Specifically, we estimate the following difference-in-difference regression model:

$$\mathrm{Y}_{it} = a_i + b_1 Bank_firm_i(Loan_i) + b_2 After_t + b_3 Bank_firm_i(Loan_i) * After_t + b_4 Controls_i + b_5 Industry_i + \epsilon_i \quad (2)$$

The dependent variable Y_{it} is investment ratio, which is the ratio of investment over total assets for firm i in year t. a_i is the firm fixed effect. $Bank_firm_i(Loan_i)$ is a dummy variable that equals one if a firm's largest provider of long-term loans is a bank (i.e. a firm borrows from financial institutions), and 0 otherwise. *After* is a dummy that equals 1 for observations in 2013 or after (i.e. post-crisis). The coefficients of interaction term identify the effects of the liquidity crunch on a firm's investment activities.

$Bank_firm_i(Loan_i) * After_t$ measures changes in investment behavior of firms with long-term bank relationships (i.e. firms with access to institutional lenders) to investment changes of their counterparts in the post-crisis period. We estimate the model using data from two years before and after the liquidity crunch year of 2013, the period from 2011 to 2015, aiming to test for a long-run effect from the liquidity crunch on the operations of borrower firms.

Columns (1) and (2), which involve a sample containing all 2,355 non-financial listed firms, presents the results on whether the liquidity shock influenced operations of borrower firms through lending channels. The results in columns (3) and (4) are based on a sample of 1,830 firms

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with outstanding loans. Here, the purpose is to examine whether bank-firm relationships impact the transmission channel.

Table 7 Long-term effect

	(1)	(2)	(3)	(4)
	All firms		Firms with loans	
After * Loans	-0.049***	-0.049***		
	(0.001)	(0.001)		
Loans	0.014*	0.015*		
	(0.072)	(0.060)		
After * Bank			0.013**	0.013**
			(0.013)	(0.017)
Bank_firm			0.014***	0.015***
			(0.004)	(0.002)
After	0.051***	0.050***	-0.010***	-0.011***
	(0.001)	(0.001)	(0.047)	(0.046)
Firm Balance sheet controls	yes	yes	yes	yes
Observations	8,247	8,247	6,719	6,719
R-squared	0.026	0.036	0.060	0.094
Year FE	yes	yes	yes	yes
Industry FE	no	yes	no	yes

This table reports OLS regression results using a panel data of 2,335 Chinese listed firms during 2011 and 2015, two years before and after the liquidity crunch. The dependent variable is investment ratio, i.e. the ratio of investment over total assets. Bank_firm equals 1 if the firm's largest lender of long-term loans is a bank, 0 otherwise. After is a dummy that equals 1 for observations in 2013 and onwards. The sample contains all 2,355 non-financial listed firms in columns (1) and (2), and only 1,830 firms with loans in columns (3) and (4). Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

Column (1) of Table 7 shows that the interaction terms between *Loan* and *After* are always negative and statistically significant at the 1% level. This suggests that firms with financing needs (i.e. those having outstanding loans at the end of 2012) tended to invest less after the liquidity crunch than their peers due to because the negative shock to bank funding. On the other hand, we find positive and significant coefficients for the interaction term between *Bank_firm* and *After* in the final two columns. Here, firms that have lending relationships with banks maintain their levels of investment better than firms that only have lending relationships with non-bank financial institutions. This evidence bolsters our fourth hypothesis. The result is robust to including year and industry fixed effects, as well as certain firm balance sheet variables.

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In summary, we find that financial institution lending was a transmission channel for the June 2013 liquidity shock. On the one hand, firms that had outstanding loans performed worse during the liquidity crunch than firms without long-term loans, indicating that their lending relationship with banks induced a transmission of the liquidity shocks to them. On the other hand, such relationships also proved to help firms alleviate the liquidity shock impacts during and after the crisis relative to firms that borrowed mainly from non-bank institutions.

5 Conclusions

We used China's June 2013 liquidity crunch in the interbank market to study in a natural setting the negative shock to banks and wealth effects on borrower firms. While institutional lending was shown to provide a channel for transmission of liquidity shocks, we find that firms with long-term banking relationships experienced smaller valuation losses than firms that borrowed from non-bank institutions. Unremarkably, firms that had no long-term loans going into the crisis (i.e. reported no outstanding loans at the end of 2012), and thus lending relationships, were unscathed by the liquidity crunch. The effect was strongest for state-owned banks and foreign banks, and weakest for local banks. We further documented a positive relationship between the stock performances of borrower firms and the stock performances of their lender banks and the liquidity positions of such banks in the interbank market. We also found evidence of a long-term impact of relationship lending on firm investment in the aftermath of the liquidity crunch.

Policymakers may find it worthwhile to consider both the short-term reactions of the stock market to an interbank liquidity crunch and the long-term impacts on firm investment. The PBOC is now well aware of the advantages and drawbacks of this policy tool in motivating prudent behavior and reducing moral hazard. Beyond this, we identify specific features of institutional lending and the bank-firm lending relationship in transmission of shocks in the interbank market to the stock market and the real economy that should be helpful to PBOC policymakers in optimizing future policies.

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Appendix 1

Major financial events around or during the June 20, 2013 interbank liquidity crunch

Date	Event
2013/6/5	Agriculture Development Bank of China bond issue fails to attract subscribers.
2013/6/14	Treasury bond issue fails to attract subscribers.
2013/6/19	Premier Li Keqiang expresses government support for financial reforms. The overnight rate increases by about 200 basis points to 7.66 %. The PBOC holds private talks with several big banks, prompting the banks to inject RMB 400 billion in liquidity into the system. The interbank market delays its closing by 30 minutes.
2013/6/20	The overnight rate is hiked by 578 basis points to 13.44 %. The PBOC begins to issues central bank bills to reduce liquidity in the interbank market. A rumor flies that the Bank of China has defaulted in the interbank market.
2013/6/21	PBOC supplies RMB 50 billion RMB to Industrial and Commercial Bank of China. The overnight interbank interest rate drops about 500 basis points from the previous day to 8.49 %.
2013/6/23	Several branches of the Industrial and Commercial Bank of China in Beijing and Shanghai are closed unexpectedly.
2013/6/24	Bank stocks crash. Shanghai Stock Exchange Composite Index decreases by about 5 %, while stock prices of Ping An Bank, China Minsheng Bank, and China Industrial Bank each fall about 10 %.
2013/6/25	PBOC suspends bill issue and declines to supply liquidity support to certain financial institutions.
2013/6/26	Overnight interbank interest rate cut to 5.55 %.

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Appendix 2

This table reports definition and descriptive statistics for the bank-firm relationship, as well as firm and bank characteristics. The data are sourced from *CSMAR*, *Bankscope*, and *Wind*.

Variable	Definition	Mean	Median	Std. Dev.	Obs.
Loans	Equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise.	0.774	1	0.418	2,377
Information disclosure	Equals 1 if a firm discloses long-term loan information in its 2012 annual report.	0.522	1	0.500	2,377
Bank_firm	Equals 1 if firm has relationship bank, 0 otherwise.	0.581	1	0.494	1,830
State-owned banks	Equals 1 if a firm's relationship bank is with one of the four large state-owned banks or three main policy banks.	0.646	1	0.498	1,005
Local banks	Equals 1 if firm's relationship bank is with a local bank	0.085	0	0.259	1,005
Joint-stock banks	Equals 1 if firm's relationship bank is with a joint-stock commercial bank.	0.239	0	0.169	1,005
Foreign banks	Equals 1 if firm's relationship bank is with a foreign bank.	0.308	0	0.146	1,005
Bank Interbank Position	Interbank Asset / Interbank Liability of bank that was the firm's biggest lender in 2012.	0.75	0.732	0.384	949
Bank CAR	CAR[-3, 3] of bank with which a firm had a relationship in 2012.	-0.057	-0.034	0.041	702
Total asset	Total assets (in RMB 1,000) in 2012	5.04E+07	2.64E+06	6.31E+08	2,377
Leverage	Total liabilities to total assets in 2012	0.435	0.434	0.232	2,377
EBIT	Industry-adjusted EBIT in 2012	0.057	0.053	0.052	2,377
Tobin's Q	Book value of total liabilities plus market value of total equity over book value of total assets in 2012.	1.893	1.583	1.087	2,377
SOE	Equals 1 if firm was ultimately controlled by the government in 2012, 0 otherwise.	0.402	0	0.49	2,377
ST	Equals 1 if firm received special treatment in 2012, 0 otherwise.	0.018	0	0.133	2,377
Sales growth	Rate of sales growth in 2012.	0.156	0.066	0.543	2,250
Stock liquidity	30-day average ratio of trading volume divided by tradable shares market value prior to event.	2.453	1.717	2.377	2,375
Investment ratio	Investment over total assets.	0.116	0.053	2.138	11.982

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