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Does Lending Relationship Help or Alleviate the Transmission of Liquidity Shocks? Evidence from a Liquidity Crunch in China[*]

By **Bai Yiyi, Tri Vi Dang, He Qing and Lu Liping** [*]

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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.

JEL Classification: G30, G140, G210
Keywords: lending relationship, interbank liquidity crunch, local banks

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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 (Bui et al, 2020). 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. The 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 for 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 relationships 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. 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 both 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 therefore 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 firms 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 the 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 two decades. Foreign banks have gradually come to play significant roles in the 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 concludes with an investigation of 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, our study is related to recent literature emphasizing 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 (Michaud and Upper, 2008; Cocco et al., 2009). One contribution of our study is to isolate a well-defined exogenous shock in liquidity providers and provide reliable evidence of its impacts on borrowers' performance.

Second, our study is closely related to the role of the bank-firm relationship in mitigating value-relevant friction and the effect of a bank's health on a borrower's performance. For instance, James (1987) and Lummer and McConnell (1989) find positive market reactions of bank loan announcements from the borrowing-firm 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; Billett et al., 1995;

[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. The 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 the CBRC, we simplify it into four groups: state-owned banks (including also policy banks), joint-stock banks (including postal saving bank), local banks (including city commercial banks, rural commercial banks, rural cooperative banks, rural credit unions and village banks), and foreign banks.

Ongena and Roscovan, 2013). Using the exogenous shock in supply side and detailed loan level data, i.e. loan size, maturity and main bank, we find that the impact of liquidity shock is weaker for firms with a bank-firm relationship. Hence, we provide new results on the value implications of a bank-firm relationship at the time of liquidity shortage.

Finally, this paper also relates to studies on the effect of central bank interventions in financial markets. A number of studies have examined the effectiveness of central bank interventions in foreign exchange markets (Sarno and Taylor, 2001; Chen et al., 2012; Watanabe and Yabu, 2013), bond markets (De Pooter et al., 2018; De Santis and Holm-Hadulla, 2017), loan market (Lewis and Roth, 2019), and interbank markets (Brunetti et al., 2011; Giannone et al., 2012). Our study adds to this literature by showing that the unexpectedly drastic action of the central bank in the interbank market as a signal of policy change works effectively in curbing subsequent excessive bank lending. We provide novel evidence that a liquidity shortage can propagate from the interbank market to the real economy through lending linkages of banking sectors. This finding has a valuable policy implication for the central bank interventions on the real economy through financial markets.

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

2. Institutional background and testable hypotheses

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 et al., 2015). According to China's National Bureau of Statistics, the 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 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 of the allocation of bank credit. The PBOC set the base interest rate along with upper and lower bounds for both the deposit and the lending market.[4] As a result, banks had no incentive to monitor borrowers actively or curtail

[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. The 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.

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 injecting funds into financial institutions.

Following China's entry into the World Trade Organization in 2001, the government has sought to deregulate the financial system in anticipation of 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. Banks are subject to many prudential requirements imposed by the regulators. For example, during our sample period, banks were still facing a variety of restrictions on lending practices, including capital ratio requirements and the deposit rate ceiling. Bankruptcy law is poorly enforced; government agencies often try to prevent defaults and bankruptcies for the sake of social stability and employment. Thus, with an expectation of government bailout ex ante, banks often adopt an aggressive strategy in making lending decisions.

Both the number and volume of bank loans have soared since 2009. In a response to the global financial crisis, the Chinese government launched an RMB 4 trillion (around USD 650 billion) stimulus plan on November 9, 2008. With abundant liquidity and a gloomy economy, banks that were mostly engaged in short-term funding activities (e.g. short-term credit) channeled their new funds to long-term projects with potentially higher returns. Even worse, many loans were extended through shadow banking activities with limited regulatory scrutiny (Acharya et al., 2016). To attract more savings, many banks issued wealth management products (WMP) to circumvent the ceiling and offer significantly higher yields.[5] WMPs financed a lot of risk projects that pay off in a longer period, such as real-estate investments and infrastructure projects. At the same time, many large companies had diverted funds in WMPs, or invested heavily in more profitable real estate due to soaring labor costs as well as declining business opportunities.

The rise of shadow banking activities has significantly contributed to the fragility of the Chinese banking system. When redemptions on their short-term funding came due, banks turned to the interbank market and borrowed at higher interest rates to cover their cash needs. Many commercial banks have used interbank transactions with banks and non-bank financial institutions aggressively to fund their lending or offload their loans, thus making the interbank market a critical part of their liquidity management (Acharya et al., 2016). The average interbank deposit ratio (interbank deposits/total assets) for China in the period from 1995 to 2015 is 10.74% (Allen et al., 2019). In addition, the PBOC intensively intervened in the interbank market, i.e., adjusting interbank liquidity, so as to influence bank credit in China (Fungáčová et al., 2016).

[5] The upper bounds of deposit rates were up to 1.5 times the base rates until 2015. The regulated deposit rate is much lower than the market rate.

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 interbank 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 of 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 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 fears in the interbank market. The market 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 a historic 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 by a potential contagion, the PBOC issued a statement on June 25 declaring its commitment to ensuring sufficient market liquidity and providing temporary funding to accommodate banks' liquidity needs. There was great relief in the 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.

China's June 2013 liquidity crunch is considered an attempt by the government to rebalance economic growth while avoiding a debt-induced financial crisis. Regulators were concerned that the escalated shadow banking and China's local government debts in the economic boom induced by China's 2008 monetary stimulus package could endanger China's financial stability.[6] To push banks to curtail risky lending and shadow banking activities, 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.

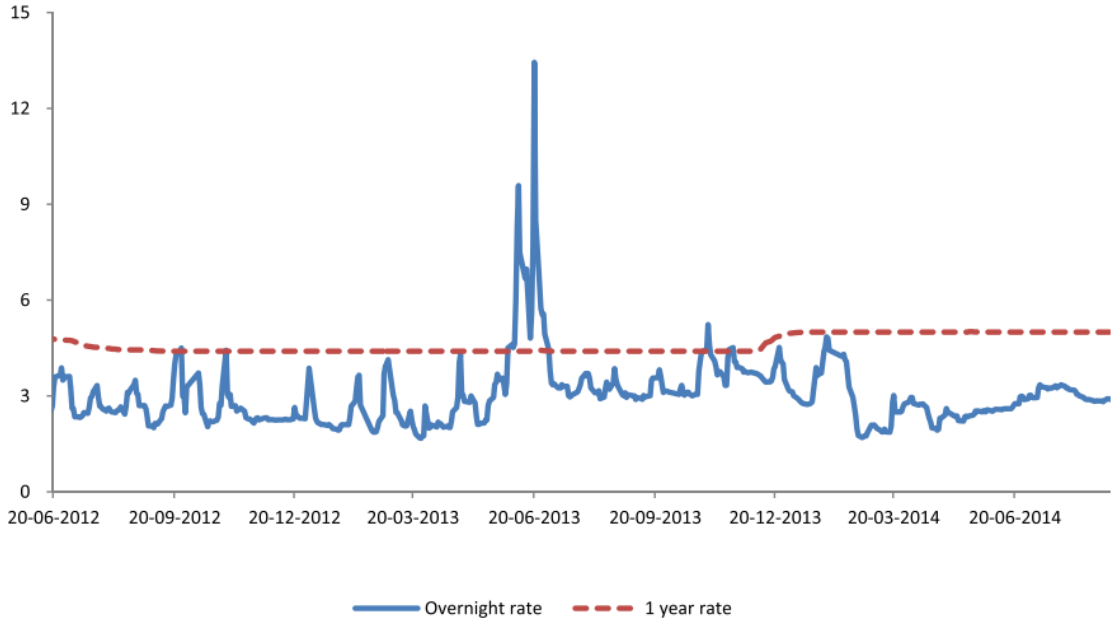

Figure 1. Interbank interest rate from one year before to one year after June 20, 2013 liquidity crunch.

This figure plots the interbank interest rates from one year before to one year after the 2013 liquidity crunch in China. The sample is daily over the period June 2012 to June 2014. The solid line depicts the Shanghai interbank overnight rate (SHIBOR) while the dashed line depicts the 1 year rate.

The main feature of the liquidity crunch in June 2013, therefore, is the power of PBOC's messaging on 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. By keeping money tight, and thereby pushing interbank borrowing rates up, PBOC is forcing banks to curb

[6] Jia, Li (December 2011), "The Chinese Credit Crunch", News China, archived from the original on 9 August 2014, retrieved 8 August 2014
Wildau, Gabriel; Jianxin, Lu (24 June 2013). "China cash squeeze eases, but bank shares take big hit". Shanghai. Reuters. Retrieved 8 August 2014
"Crunch Escalates as Money Funds Rival Shadow Banks: China Credit", Bloomberg News, 19 January 2014

risky loans and adjust to a more market-oriented environment.[7] Banks are more cautious about their new loans to risky sectors, and are clearing out non-performing loans. Consequently, the market witnessed a decline in new bank loans following the event.[8]

Figure 2 plots the growth rate of loan supply before and after the liquidity crunch. We obtain data for all newly issued loans disclosed by listed firms during the 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 the number of loans decreases by 17% after the liquidity crunch. In contrast, the amount of loans increases by 38% and the number of loans rises by 12% in the pre-crisis period.

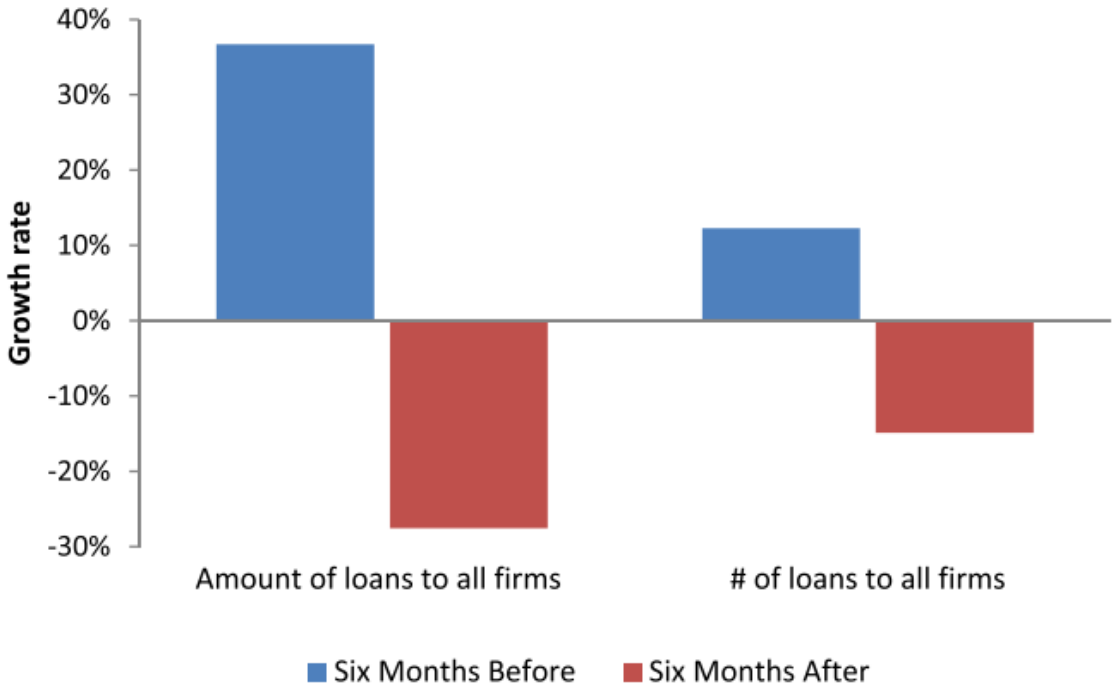

Figure 2. Growth of newly issued bank loans (quarterly, Jan. 2013 – Dec. 2013).

This figure plots the growth rate of all loans obtained by Chinese listed firms six months before (represented by the blue bars) and after the liquidity crunch (represented by the red bars). The growth rates are calculated based on the amount of loans in the left panel, and the number of loans in the right panel.

We also obtain data on the total volume of long-term loans[9] 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 between January 2012 and October 2014 in Figure 3, and find a descending trend in the year-on-year growth in the percentage of long-term loans over all loans.

[7] It is also a way to flush out reckless shadow banking in China.
[8] Bloomberg News, 12 May 2014, "China's New Credit Declines".
[9] Long-term loans are typically loans that have a maturity longer than a year.

This result indicates that banks moved to a more cautious lending strategy and changed their liquidity management approach after the liquidity crunch.[10] It is broadly in line with the significant drop in the growth of loans shown in Figure 2. We notice that this effect doesn't appear in 2012 and 2014, suggesting that this is not a seasonal phenomenon happening in June every year. 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.

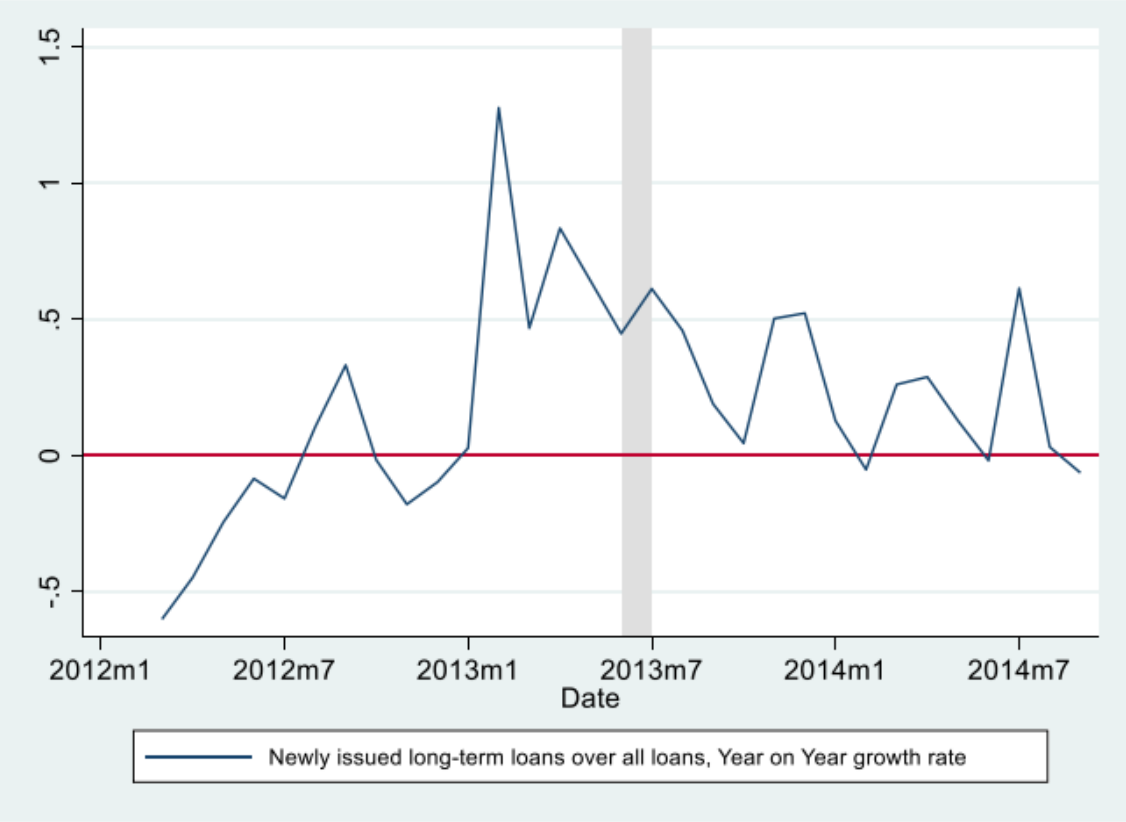

Figure 3. Term structure of loans newly issued by financial institutions (monthly, Jan. 2012 – Oct. 2014).

This figure presents the year on year growth rate of the percentage of long-term loans over all loans that are newly issued by Chinese financial institutions. The sample is monthly over the period of January 2012 to October 2014. The event period (i.e. June 2013) is represented in the shaded area.

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

[10] Besides, banks choose to be more cautious as they expect PBOC will be stricter in providing liquidity.

frictions (e.g. moral hazard and information asymmetry) can undermine the ability of a firm to access alternative financing 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 and Purnanamdam, 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 short-term 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.*

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 from reduced costs of 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 relationships. 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 et al. (1995), Maskara and Mullineaux (2011) and Ongena and Roscovan (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 periods.

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 lending relationships with foreign banks and state-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 that of 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 level comparable to that 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 will 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 use an equal-weighted universal market index[11] for all listed firms from both the Shanghai and the Shenzhen stock exchanges. We calculate the CARs over the event windows of [-1, +1] as our main dependent variable. We link the CARs to bank-firm relationship, firm and bank level characteristics in the regression equation:

$$CAR_i = \propto + \beta Bank\_firm_i + \sum_{m=1}^{M} \gamma_m FIRM_{(m),i} + \sum_{n=1}^{N} \delta_n BANK_{(n),i} + Industry\ FE + \epsilon_i \quad (1)$$

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),[12] joint-stock banks, local banks, and foreign banks. Bank balance sheet data is retrieved from BankFocus. State-owned banks have dominated the Chinese banking sector since the 1980s. They are often considered the safest banks as they

[11] One potential concern is that using an equal-weighted market index might have potentially twisted the results since in China small stocks are more volatile particularly during a sharp market crash. We use a value-weighted market index as the alternative measure to address this point. It turns out that our primary results remain qualitatively unchanged. These results are consistent with the notion that the estimation results of event study are not sensitive to such choice as the use of equal-weighted versus value-weighted market indices (Peterson, 1989). For the sake of brevity, the results are not reported, but are available upon request.

[12] As only a small number of listed firms borrow from policy banks, our results remain qualitatively unchanged by excluding the three banks.

enjoy implicit government guarantees. Therefore, we propose that firms having relationships with state-owned banks may perform better in the stock market during an 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.

$FIRM_{(m),i}$ 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 on 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.[13] Thus, the firm's relationship bank can be identified by the major lender from 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 BankFocus: bank total assets, bank liquidity ratio, and bank equity ratio. BankFocus 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 long-term bank 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, and 1,063 firms that had banks as their largest lenders of long-term loans), and 505 firms did not report any loans.

Of the 1,063 firms whose largest lenders of long-term loans were banks in 2012,[14] 31 firms reported most of their loans came from foreign banks, 85 firms had loans from 38 local banks, and 240 firms had loans from 12 joint-stock banks. The remaining 649 firms borrowed mainly from China's Big Four state-owned banks or three main policy banks.

[13] The China Securities Regulatory Commission (CSRC) requires all listed firms to disclose relevant information on their five largest outstanding loans in the annual reports, e.g. lender name, loan outstanding, maturity, etc.

[14] This includes 58 firms that did not disclose details of their five largest long-term loans in their 2012 annual reports, i.e. they simply reported that they had *some* long-term bank loans outstanding.

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 -0.022 and is significant at the 1% level. This means that the stock prices on average decreased abnormally by 2.2% 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 borrowing firms' performance as well.

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). The equal-weighted universal market index 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 five different event windows sorted by bank type.

Following previous studies, we choose the standard event window and focus on the CAR over a three-day window [-1, 1]. We obtain similar results when checking other windows such as [0, 1], [-1, 0], [-3, 3] and [-5, 5] as a robustness test.

Firms reporting outstanding loans at the end of 2012 underperformed their peers. The differences are negative and significant in all five event windows. It suggests 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. 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.

Table 2. Firm CARs sorted by firm type

	# of firms		CAR [−1, 1]	CAR [0, 1]	CAR [−1, 0]	CAR [−3, 3]	CAR [−5, 5]
Non-financial firms							
Overall	2335	Mean	−0.023***	−0.023***	−0.017***	−0.044***	−0.045***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
No loans	505	Mean	−0.019***	−0.020***	−0.015***	−0.029***	−0.012***
		Std. Err.	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
Loans	1830	Mean	−0.024***	−0.024***	−0.017***	−0.049***	−0.054***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
		Dif No loans	***−0.004****	***−0.003****	***−0.002****	***−0.020*****	***−0.043*****
No relationship	767	Mean	−0.025***	−0.026***	−0.019***	−0.047***	−0.051***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Bank relationship	1063	Mean	−0.022***	−0.022***	−0.017***	−0.050***	−0.056***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
		Dif No bank relationship	***0.003****	***0.004*****	***0.002****	***−0.004***	***−0.005***
Type of bank							
State−owned bank	649	Mean	−0.021***	−0.021***	−0.016***	−0.050***	−0.059***
		Std. Err.	(0.002)	(0.001)	(0.001)	(0.003)	(0.004)
		Dif No bank relationship	***0.004****	***0.005*****	***0.003****	***0.003***	***0.007****
Local	85	Mean	−0.026***	−0.024***	−0.020***	−0.056***	−0.067***
		Std. Err.	(0.004)	(0.003)	(0.004)	(0.008)	(0.010)
		Dif No bank relationship	***−0.0001***	***0.003***	***−0.001***	***−0.010***	***−0.016****
Joint	240	Mean	−0.025***	−0.024***	−0.018***	−0.051***	−0.046***
		Std. Err.	(0.003)	(0.002)	(0.002)	(0.004)	(0.006)
		Dif No bank relationship	***0.0005***	***0.002***	***0.001***	***−0.005***	***0.006***
Foreign	31	Mean	−0.011	−0.020**	−0.009	−0.031	−0.040**
		Std. Err.	(0.010)	(0.009)	(0.006)	(0.016)	(0.019)
		Dif No bank relationship	***0.015****	***0.006***	***0.010****	***0.015***	***0.011***

This table reports the mean and standard error for CARs in five event windows sorted by firm type. CARs are calculated from returns for daily stock price and an equal-weighted market index. 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 58 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 five event windows across four groups of firms that are associated with four types of banks. The small number of firms borrowing from foreign banks have the highest CARs in all five windows. Firms borrowing from local banks have the lowest CARs among all four groups. For the other two groups, firms borrowing from state-owned banks almost 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. 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 a 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 on the Shanghai and Shenzhen stock exchanges. The dependent variables are CAR[-1, 1], calculated using the daily stock return and an equal-weighted universal market index. 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*[15](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 the 1% level in all four 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 as having no financing needs and no relationships with lenders in the interbank market. A negative liquidity shock in the interbank market is less likely to be transmitted 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 much. These results are robust to other event windows as well.[16]

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	2335	2335	2207	2207
R-squared	0.002	0.016	0.024	0.039
Industry FE	no	yes	no	yes

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

[16] Results are available upon request.

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]. *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.

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 had 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 as 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 three columns, and the coefficients of EBIT and stock liquidity are largely negative and significant, suggesting that SOE firms having a higher profitability 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.

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	1234	1200	1830	1742	2335	2207
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 whose 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.

Before turning to heterogeneity across bank and firm ownership in the transmission of interbank liquidity crunch, we perform a variety of robustness checks on our main results. First, to show that what we observe here is not just a seasonal phenomenon, we do a placebo test with baseline regressions by setting the event date as June 20, 2012, exactly a year before the event. The empirical results are reported in Panel A of Table 5. The coefficients of *Loans* and *Bank_firm* are both insignificant in all four columns, indicating that there is no such effect in 2012. Second, there are concerns that bank-firm relationships are not randomly established. Firms with stronger balance sheets may be more likely to build relationships with banks, and at the same time experience smaller decreases in stock prices because they are more resilient to adverse shocks. To address the selection bias, we therefore run propensity score matching between firms with and without outstanding loans, as well as firms with and without bank-firm relationships at the end of 2012, which are otherwise identical. The results remain robust as shown in Panel B of Table 5. It indicates that firms with outstanding loans have lower probability of experiencing a high CAR. The average difference in probability is -0.009 in column (1) and decreases to -0.005 in column (2) with industry fixed effects. Similarly, firms with a bank as the largest provider of long-term loans tend to have a higher CAR than otherwise.

Third, we use external financial dependence as an alternative proxy for firms' exposure to liquidity shock. Apart from partitioning firms by existing bank loans, we split the sample by

dependence on external finance to see whether it has any impact on the results. Following Rajan and Zingales (1998), we calculate a firm's dependence on external finance as capital expenditures minus cash flow from operations divided by capital expenditures between 2010 and 2012 (i.e. three years before the event), and use the industry median to smooth temporal fluctuations and reduce effects of outliers. We then rerun Tables 3 and 4 with the two subsamples. As shown in Panel C of Table 5, the coefficients of *Loans* are always negative and statistically significant in both columns. Meanwhile, we do not observe a significant difference between the two groups of firms whose dependence on external finance is above and below median. We find our results remain robust after splitting the sample by firms' dependence on external finance. The reason that the coefficient *Loans* remains significant and similar between the two subsamples could be that *dependence on External Finance* is constructed at the industry level and therefore has less variation than *Loans*, which is constructed at the firm level. In the last six columns of the table, our results also hold as the coefficient of *Bank_firm* remains positive and significant in all but one column. Moreover, we find that the coefficient of *Bank_firm* has slightly higher statistical and economic significance in the subsample of firms with below median dependence on external finance. This indicates that among all firms with bank relationships, those firms having lower external financial dependence slightly outperform in the stock market during the liquidity crunch.

Noting that the impact of the event may have gone beyond the presumed event window of [-1, +1], we also calculate CARs over longer event windows as dependent variables. Specifically, we re-estimate the regressions in Tables 3 and 4 using CAR[-3, 3] and CAR[-5, 5] as dependent variables to check the robustness of our results. As shown in Panel D of Table 5, our primary results remain qualitatively unchanged. The coefficients of *Loans* in columns (1) - (2) are negative and statistically significant at the 1% confidence level, and the coefficients of *Bank_firm* remain positive and significant in columns (3) - (8). These results again provide supporting evidence for our first and second hypotheses.

Table 5. Robustness

Panel A Placebo test				
	(1)	(2)	(3)	(4)
	All firms		Firms with loans	
Loans	-0.001	0.001		
	(0.001)	(0.001)		
Bank_firm			0.001	0.001
			(0.002)	(0.001)
Firm balance sheet controls	yes	yes	yes	yes
Observations	2067	2067	1619	1619
R-squared	0.09	0.119	0.084	0.111
Industry FE	yes	yes	yes	yes

Panel B Propensity score matching				
	(1)	(2)	(3)	(4)
Loans	-0.009***	-0.005**		
	(0.003)	(0.002)		
Bank_firm			0.006*	0.006*
			(0.003)	(0.003)
Firm balance sheet controls	yes	yes	yes	yes
Observations	2207	2207	1200	1189
Industry FE	no	yes	no	yes

Panel C. Splitting samples by firms' dependence on external finance								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Firms disclosing five largest long-term loans		All firms with loans	
	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median
Loans	-0.009***	-0.010***						
	(0.001)	(0.003)						
Bank_firm			0.004	0.010***	0.006**	0.010***	0.005*	0.010***
			(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Firm balance sheet controls	yes	yes	yes	yes	yes	yes	yes	yes
Information disclosure control	no	no	yes	yes	no	no	yes	yes
Observations	940	687	940	687	465	385	727	547
R-squared	0.068	0.059	0.067	0.056	0.086	0.074	0.071	0.068
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Panel D. Robustness test with extended event windows								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Firms disclosing five largest long-term loans s		All firms with loans	
	CAR(−3,3)	CAR(−5,5)	CAR(−3,3)	CAR(−5,5)	CAR(−3,3)	CAR(−5,5)	CAR(−3,3)	CAR(−5,5)
Loans	-0.013***	-0.018***						
	(0.002)	(0.003)						
Bank_firm			0.008***	0.015**	0.010***	0.016***	0.009***	0.016**
			(0.003)	(0.007)	(0.002)	(0.007)	(0.003)	(0.007)
Firm balance sheet controls	yes	yes	yes	yes	yes	yes	yes	yes
Information Disclosure control	no	no	yes	yes	no	no	yes	yes
Observations	2207	2207	2207	2207	1200	1200	1742	1742
R-squared	0.074	0.155	0.073	0.153	0.045	0.088	0.044	0.100
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Panel A reports results of the placebo test on previous dates. The dependent variables are CAR[-1, 1]. We define 20th June 2012, exactly a year before the event, as the new event day, and rerun the baseline regressions as we did in Tables 3 and 4. Panel B reports regression results of propensity score matching between firms with and without outstanding loans, as well as firms with and without bank-firm relationships at the end of 2012, that are otherwise identical. Panel C reports regression results with splitting samples by firms' dependence on external finance. Panel D reports results of robustness test using extended event windows. Similarly, the independent variables and control variables in columns 3-8, are the same as in Table 4. *Loans* equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise. *Bank_firm* equals 1 if the firm's largest lender of long-term loans is a bank, 0 otherwise. Standard errors are clustered at industry level in regressions, and are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

4.3 Results by bank type and firm ownership

Table 6 reports the regression results with an OLS model using a sample of 1,830 Chinese firms that had 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 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.

Panel A in Table 6 considers whether the ownership structure of relationship banks impacted the stock performance of firms. In column (1) of Panel A, with the full sample of 1,830 firms, the coefficient of *state-owned banks* is 0.006 and significant at the 1% level. The coefficient remains the same when we include 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 banks* 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 variables as controls.

As an explanation, it seems that local banks are often more fragile in an interbank market due to their small size and limited funding, which 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 firms with regional and national bank lending relationships.

Next, we estimate the regression separately by firm ownership. Brandt 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 (He et al., 2017). 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 a government-related entity. We add controls for industrial fixed effects and a set of firm characteristic variables.

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. In contrast, the coefficients of *state-owned banks* are negative and significant at the 5% level for non-SOEs. Long-term lending relationships with local banks have a positive effect in SOEs, while they have a negative effect in non-SOEs. A possible explanation is that state-owned banks and local banks are less efficient in accessing information of non-SOEs than of SOEs. To ensure sufficient credit supply to SOEs, state-owned banks and local banks are more likely to cut their credits to non-SOEs when faced with liquidity shock. In other words, the non-SOEs may be crowded out

during the tightening of credit supply. These findings are in line with Ru (2018), who shows that government credits to SOEs crowd out private firms in the same industry, especially during macroeconomic downturns. In addition, the results also show that the coefficients of *foreign banks* are around 0.013 for non-SOEs and 0.011 for SOEs. Consistent with our hypothesis, foreign banks allocate credit by commercial judgments, especially for extending credits to non-SOEs.

Table 6. 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	1830	1830	1742	1742
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.

4.4 Bank strength and market reaction

Table 7 examines whether firms' performances in the stock market are associated with their banks' stock price change and interbank position. The first two columns in Table 7 are OLS regression results using a subsample of 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, Dummies of *state-owned banks* and *local banks* are added as control variables in column (2). After controlling for bank characteristics and industry fixed effects (and firm balance sheet in some specifications), we find our results still robust.[17]

In column (1) of Table 7, we find that the coefficient of *Bank CAR* is 0.018, indicating that a 1% increase in *Bank CAR* corresponds to a roughly 1.8% 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 0.188, and becomes significant at the 10% level when we add firm balance sheet variables to control for any potential effect from the firm 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.

Table 7. Heterogeneity across bank CARs and bank interbank positions

	(1)	(2)	(3)	(4)
Bank CAR	0.018	0.188*		
	(0.066)	(0.101)		
Bank Interbank Position			0.011**	0.013
			(0.005)	(0.008)
Firm balance sheet controls	no	yes	no	yes
Bank balance sheet	yes	yes	yes	yes
Observations	472	329	472	329
R-squared	0.061	0.162	0.062	0.120
Industry 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 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. Industry fixed effects, and bank balance sheet controls, including bank total assets, equity ratio and revenue growth rates, are added in all four columns. Given that all 16 Chinese listed banks are domestic, *state-owned banks* and *local banks* are also added in as control variables for bank ownerships in all columns. 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 7 report the regression results with an OLS model using a subsample of Chinese firms whose largest long-term loan lenders are among the 50 banks with

[17] Note that we do not include bank-level fixed effects in our regressions, because cross-sectional regressions have no variation in time dimension.

2012 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 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 firm balance sheet variables as controls, shows qualitatively similar results.

In column (3) of Table 7, we find that the coefficient of *Bank Interbank Position* is 0.011 and significant at the 5% level, indicating a positive relationship between firm CAR and a bank's position in the interbank market. This 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 crunch dries up alternative funding sources in the interbank market. Such relationships remain positive, but insignificant when we add firm balance sheets as control variables.

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. Nevertheless, the liquidity crunch substantially altered lending practices of Chinese banks. By keeping money tight, and thereby pushing interbank borrowing rates up, PBOC is forcing banks to curb risky loans and adjust to a more market-oriented environment. Figures 2 and 3 both show that banks significantly reduced their lending after the crunch, so we flesh out our study on the relationship between the liquidity crunch and firms' investment behaviors.

Figure 4 shows the average ratio of investment over total assets for firms with and without outstanding loans before and after the liquidity crunch. There is no substantial difference in year-to-year investment ratio between the two groups of firms before the liquidity crunch. In 2013, investment ratios for firms without loans increase almost 2%, while that of firms with loans remain relatively flat. For both groups of firms, investment ratio declines about 0.5% in the two years subsequent to the liquidity crunch, a bit more so for the first year than for the second. This graph provides strong visual evidence of common trend for both types of firms, and a treatment effect (liquidity crunch) that shows a significant deviation from this trend.

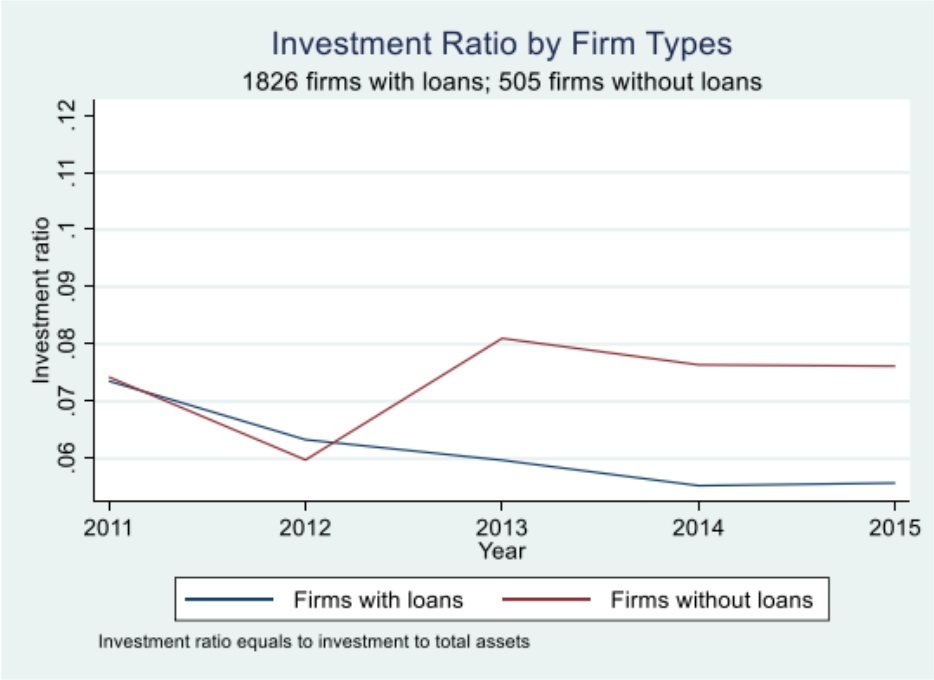

Figure 4. Investment ratios for firms with and without outstanding loans around the liquidity crunch

Figure 4 shows the average ratio of investment over total assets for firms with loans and firms without loans before and after the liquidity crunch.

For the firms with outstanding loans, Figure 5 distinguishes between firms with and without long-term bank relationships and plots their average year-to-year investment ratios. Investment ratios for both types of firms were reasonably flat with a downward trend before the liquidity crunch. For firms without long-term bank relationships, the investment ratio declines about 1% in the two years subsequent to the liquidity crunch. In contrast, the investment ratio for firms with long-term bank relationships experiences a slight decline in the first year after the liquidity crunch, and rises back to the baseline level. It shows both types of firms have a relatively common underlying trend, and a treatment effect (liquidity crunch) that introduces a sharp deviation from this trend.

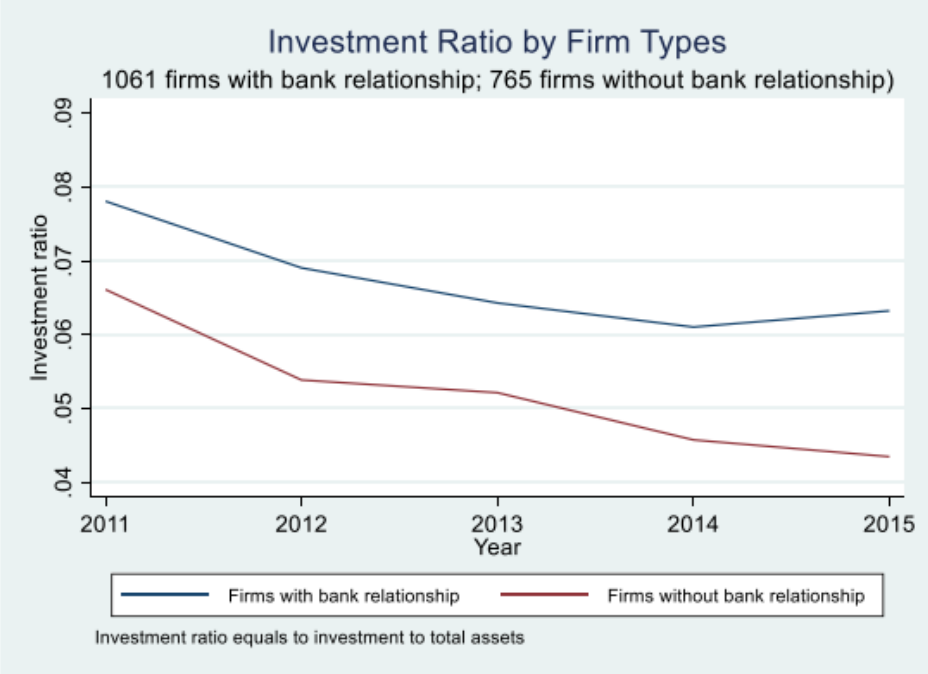

Figure 5. Investment ratios for firms with and without long-term bank relationships around the liquidity crunch

Figure 5 shows the average ratio of investment over total assets for firms with long-term bank relationship and firms without long-term bank relationships before and after the liquidity crunch.

Next, we estimate the following difference-in-difference regression model:

$$Y_{it} = \alpha + \beta Bank\_firm_i + \gamma After_t + \delta Bank\_firm_i * After_t + \sum_{n=1}^{N} \varphi_n FIRM_{(n),it} + \sum_{m=1}^{M} \omega_m BANK_{(m),it} + Industry\ FE + \epsilon_i \quad (2)$$

The dependent variable Y_{it} is investment ratio, which is the ratio of investment over total assets for firm i in year t. $Bank\_firm_i$ is a dummy variable that equals 1 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.

$Bank\_firm_i * After_t$ 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 of 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 of 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 with outstanding loans. Here, the purpose is to examine whether bank-firm relationships impact the transmission channel.

Table 8. 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_firm			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	8247	8247	6719	6719
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 8 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 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 last 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 include year and industry fixed effects, as well as certain firm balance sheet variables. We also investigate whether the ownership structure of relationship banks is related to the levels of investment. It shows that firms with lending relationships with foreign banks or state-owned banks have a significantly higher level of investments than firms without long-term bank relationships.[18]

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 relationships 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.[19]

[18] These empirical results are not reported here, but are available upon request.

[19] We also implement a dynamic treatment effects test through leads and lags of treatment as regressors. We plot the coefficients, as well as the confidence intervals, of the interaction terms between year and various firm type

5. Conclusions

We use China's June 2013 liquidity crunch in the interbank market to study, in a natural setting, the negative shock to banks and the 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. Firms that had no long-term loans (i.e. reported no outstanding loans at the end of 2012) were unscathed by the liquidity crunch. The effect was strongest for state-owned banks and foreign banks, and weakest for local banks. We further document 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 find 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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dummies. All coefficients are insignificant before the event year 2013 and statistically significantly different from zero after 2013. For the sake of brevity, we do not report these figures.

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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 min.
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%.

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*, *BankFocus*, 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	2377
Information disclosure	Equals 1 if a firm discloses long-term loan information in its 2012 annual report.	0.522	1	0.500	2377
Bank_firm	Equals 1 if firm has relationship bank, 0 otherwise.	0.581	1	0.494	1830
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	1005
Local banks	Equals 1 if firm's relationship bank is with a local bank	0.085	0	0.259	1005
Joint-stock banks	Equals 1 if firm's relationship bank is with a joint-stock commercial bank.	0.239	0	0.169	1005
Foreign banks	Equals 1 if firm's relationship bank is with a foreign bank.	0.308	0	0.146	1005
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[−1, 1] of bank with which a firm had a relationship in 2012.	-0.046	-0.030	0.036	702
Total asset	Total assets (in RMB 1000) in 2012	5.04E+07	2.64E+06	6.31E+08	2377
Leverage	Total liabilities to total assets in 2012	0.435	0.434	0.232	2377
EBIT	Industry-adjusted EBIT in 2012	0.057	0.053	0.052	2377
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	2377
SOE	Equals 1 if firm was ultimately controlled by the government in 2012, 0 otherwise.	0.402	0	0.49	2377
ST	Equals 1 if firm received special treatment in 2012, 0 otherwise.	0.018	0	0.133	2377
Sales growth	Rate of sales growth in 2012.	0.156	0.066	0.543	2250
Stock liquidity	30-day average ratio of trading volume divided by tradable shares market value prior to event.	2.453	1.717	2.377	2375
Investment ratio	Investment over total assets.	0.116	0.053	2.138	11.982