International Exposure and the Transmission of Financial Shocks: Evidence from China *

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Abstract

This study explores the impact of the adverse financial shocks on Chinese firms through the bank lending channel and the firm borrowing channel. Using new data linking Chinese firms to their bank(s) and three measures of exposure to international markets, we find that banks with greater exposure to the international markets cut lending more during the financial crisis or when there was a negative shock to OECD GDP growth. Furthermore, state-owned bank loans are more procyclical than private bank loans. With regard to the firm borrowing channel, we find that firms with higher weighted aggregate exposure to the international markets through banks had lower net debt, and lower cash, employment, and capital investment during the financial crisis. Our results have significant implications for how the global financial shocks are transmitted in a regulated financial market such as that in China.

Keywords: Financial crisis, Chinese bank system, Bank lending, Ownership.
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1 Introduction

This study analyzes the effects of the United States financial crisis and the European sovereign debt crisis on Chinese banks' credit supply. China's credit market has attracted considerable research interest in recent decades. In 2016, China's total bank credit was 15.45 trillion USD, greater than that of the United States (12.44 trillion USD). This represented 137.95% of GDP, a much larger share than that of the United States (67.00%), implying that the credit market was more important in China than in the United States. Moreover, bank credit accounts for a greater share of capital than other financial instruments (stocks, fixed income, insurance, and investment funds) in China.

Did the financial crisis in the United States and the sovereign debt crisis in Europe impact Chinese banks? Some scholars have suggested that they had no effect because both crises occurred outside the country, and because China is one of the most regulated financial markets among the world's large economies. Figure 3 shows the bank assets and the return on assets (ROA) of Chinese banks. It can be seen that the crises did not affect the high rate of growth of Chinese bank assets, suggesting that the impact was limited. However, 2008 represented a significant turning point in terms of ROA. From 2000 to 2008, Chinese banks' ROA increased dramatically, but after 2008 it was steady, and in some cases even decreased. Thus, although these crises occurred outside China, they had a significant impact on Chinese banks with high levels of exposure. In other words, the liquidity problem was experienced by Chinese banks with a higher degree of openness, and the liquidity and funding shocks varied substantially across banks.

This study presents evidence suggesting that the financial crisis had an impact on the Chinese bank lending channel. We identified three supply-side bank lending channels. First, there is a passive and direct bond market channel. When international bond market contracts decreased following the financial crisis, the bank credits of high-exposure banks decreased. Second, there is an active and indirect stock market channel. The stock prices of foreign-listed firms declined significantly following the financial crisis, and the bank credit provided by high-exposure banks declined accordingly. Third, there is an active and indirect goods market channel. When firm exports of goods decreased following the financial crisis, the banks' balance sheet asset sides worsen in both quantity and quality.

We construct a novel data set that combines information on 281 major Chinese banks and 3302 listed Chinese firms from 2001 to 2016. We also use three variables to measure the degree of openness of the banks: International borrowing, which assesses a bank's level of exposure by dividing the bank's international commercial borrowing and bond holdings by its total assets; foreign listed, which is the total value of loans to B-share, H-

share, and overseas-listed firms as a fraction of total loans; and trade settlement, which is the ratio of bank-level trade settlements to total loans (see Section 2.3 for details regarding transmission channels).

Our identification strategy builds on and extends the literature on the credit impacts of exogenous shocks (Ivashina and Scharfstein, 2010; Puri et al., 2011; Chodorow-Reich, 2013).[1] Similarly, because the financial crisis originated outside China, we use the level of dispersion to expose the financial crisis as an exogenous driver of variations in credit availability to borrowers in the Chinese financial market. We also use the technical method proposed by Khwaja and Mian (2008) to simultaneously examine the bank lending channel and the firm borrowing channel. In particular, we use firm-year fixed effects to control for the endogenous impact from the demand side. Moreover, we use bank-level control variables to address the issue of bank heterogeneity.

This study provides several novel empirical findings. First, banks with higher levels of exposure to international markets reduced lending more following the recent financial crisis. Second, banks with higher levels of exposure to the global markets reduce lending more when there is a negative shock to the OECD GDP growth. Third, we considered both the market effect and the government regulation effect, and found that state-owned banks were more affected because of the government regulation effect. China experienced a domestic slowdown in the fourth quarter of 2008 following the global financial crisis, and since then, China's policy response has been extremely vigorous.[2] The results of our study show that the reduction in loans was greater among state-owned banks, over which the Chinese government has more control, implying that the regulatory pressure was significant.

In addition, we find that the shock to international financial markets impacted the firm borrowing channel in China. Specifically, firms with higher weighted aggregate exposure to global markets through the banks had lower net debt, cash, employment, and capital investment during the financial crisis, while firms with higher weighted aggregate exposure to international markets had higher net debt and lower cash, employment, and capital investment when there was a negative shock to the OECD GDP growth.

Finally, we present a model of banks in a partially open economy in which the banks differ in terms of their level of exposure to international markets. Based on Holmstrom and Tirole (1997), we developed an incentive-based model of financial intermediation in

[1] Ivashina and Scharfstein (2010), Puri et al. (2011), and Chodorow-Reich (2013) discuss the impact of the financial crisis on bank lending.

[2] At the beginning of 2009, the China Banking Regulatory Commission (CBRC) and the People's Bank of China (PBOC) imposed strict financial regulations on the banks with a high level of exposure to the international financial markets in an attempt to avoid the liquidity risk.

an attempt to illustrate the lending patterns observed during the recent financial crisis.[3] This general equilibrium model sheds light on the mechanism by which the transmission channels impact the bank lending channel. The proposed model predicts that banks with higher levels of exposure to international markets will reduce their lending through the balance sheet hit channel when global interest rate increases. In addition, when firm return decreases, banks with higher levels of international exposure will reduce their lending through the risk-limiting behavior channel. The predictions of the model are consistent with the key empirical results of this study.

There is much less evidence of the impact of the sovereign debt crises (Popov and Van Horen, 2015; Balduzzi et al., 2017; De Marco, 2019), than of the impact of the financial crisis. Acharya et al. (2018) discuss three potential transmission channels in relation to the sovereign debt crisis in Europe.[4] Compared with a typical banking crisis in which the lending supply shock is caused solely by the banks' poor financial health, the impact of the financial crisis and sovereign debt crisis on bank lending in China is much more complicated. In particular, there are three channels through which the financial crisis potentially affected banks' lending decisions: two active channels, involving a reduction in bank loans to foreign-listed and international trading firms as a result of the banks' risk-limiting behavior, and one passive channel related to the significant decline in the banks' international borrowings. Moreover, we used international borrowing, foreign listed, and trade settlement as proxies for the bond market, stock market, and goods market, respectively. After comparing the three potential channels in the three different markets, we found that the bond market and the stock market were more responsive to the financial crisis.

This study is also related to studies on international financial contagion (Peek and Rosengren, 2000; Cetorelli and Goldberg, 2012; Giannetti and Laeven, 2012; Jotikasthira et al., 2012; Popov and Udell, 2012; Schnabl, 2012; De Haas and Van Horen, 2013; Kalemli-Ozcan et al., 2013; Morais et al., 2019).[5] The results of this study complement the findings of previous studies on international financial contagion by examining the three different transmission channels of liquidity shocks to a partially open economy following financial and sovereign debt crises.

There is a growing body of literature analyzing the Chinese bank lending channel.

[3] This study assumes homogeneous firms and heterogeneous banks.

[4] Although we do not focus on the sovereign debt crisis, we focus on the media identified in Acharya et al. (2018).

[5] Schnabl (2012) examined the 1998 Russian default as an example of a negative liquidity shock to international banks and analyzed its transmission to Peru using loan-level data; Morais et al. (2019) identified the international credit channel at the loan level.

Qian et al. (2015) used the implementation of reforms delegating authority to individual loan officers by numerous Chinese banks in 2002 and 2003 as a plausible exogenous shock,[6] while Gao et al. (2021) used the announcement of the four trillion yuan stimulus package in 2009 as an exogenous shock.[7] This study is also related to studies on the differences between state-owned and private banks in China. However, most studies on the Chinese bank lending channel have only focused on the type of firm ownership (Li et al., 2017; Cong et al., 2019).[8]

This study also contributes to the body of literature on the Chinese banking system, which has played an important role in China's economic growth (Allen et al., 2005). Several studies have analyzed various aspects of the Chinese banking system. García-Herrero et al. (2006), Fu and Heffernan (2009), Lin and Zhang (2009), Jia (2009), and Dong et al. (2016) focused on the reform and/or performance of the Chinese banking system, especially in relation to ownership. Berger et al. (2009), Ariff and Luc (2008), and Asmild and Matthews (2012) investigated the efficiency of Chinese banks, Bailey et al. (2011) and Fenech et al. (2014) investigated the quality of bank loans and other characteristics of the Chinese banking system, and Chen et al. (2014), Wang et al. (2015), and Huang et al. (2019) investigated systemic risk in the Chinese banking system.

The rest of this paper is organized as follows. Section 2 presents background information on the Chinese banking system, the data we used, and the three potential channels to impacting the Chinese bank lending channel. Section 3 presents the effects of the financial crisis on bank lending. Section 4 presents the firm-level financial and real effects of the financial shocks. Section 5 presents the results of robustness checks. Section 6 develops a model of banks with heterogeneous levels of international market exposures to illustrate the various transmission channels, and Section 7 concludes.

[6] Qian et al. (2015) found that the bank's internal risk rating was a more reliable predictor of loan interest rates and ex-post outcomes after the reform.

[7] Gao et al. (2021) found that local governments' policy bank loans had significantly lower default rates than commercial bank loans with similar characteristics.

[8] Li et al. (2017) presented the novel empirical finding that the recent anti-corruption investigations in China were associated with bank loan reallocation from less productive state-owned enterprises (SOEs) to more productive non-SOEs, indicating that the competition effect dominated the contagion effect for non-SOEs. Cong et al. (2019) found that the stimulus-driven credit expansion disproportionately favored state-owned firms and firms with a lower average product of capital, reversing the process of capital reallocation toward private firms that characterized China's high growth rate before 2008.

2 Background, Data, and Channels

2.1 Background of the Chinese Banking System

Since 2008, the banking system has accounted for more than 90% of the total assets of financial institutions in China.[9] There are currently three policy banks, five large-scale commercial banks, 12 joint-stock commercial banks, 145 city commercial banks, around 600 rural commercial or cooperative banks, one postal savings bank, and around 100 foreign bank branches or non-bank financial institutions in China.[10]

In the 1990s, the banking system in China was dominated by four large state-owned banks. However, these banks faced several serious challenges, including high levels of non-performing loans and inefficient operation and management. Thus, the Chinese authorities initiated a series of reforms to the banking system in 2003.[11] Following these reforms, the Chinese banking system became more comprehensive and diversified, and assumed a dominant role in the China's financial system.[12] However, there are still numerous serious problems in the Chinese banking system. Although the system has become more diversified, it is still dominated by a few large banks.[13] Thus, China's banking sector, together with other sectors of strategic importance, has been subject to intensive monitoring by the government, mainly through its central bank (People's Bank of China, PBOC) and the China Banking Regulatory Commission (CBRC).[14]

2.2 Data and Summary Statistics

This study uses a novel data set containing information on bank-firm relationships in China, along with detailed bank- and firm-specific information. The sample period is from 2001 to 2016, providing a symmetrical time frame either side of the financial crisis

[9] Chinese Financial Stability Report (2009-2014).

[10] See the notes from the China Banking Regulatory Commission (CBRC) and the People's Bank of China (PBOC).

[11] The four state-owned banks became joint-stock commercial banks, and have been listed on the Shanghai Stock Exchange since 2006. Reforms were also implemented in other small and medium-sized commercial banks and rural credit cooperatives commencing in 2003.

[12] There were 117 Chinese banks in the 2015 list of the top 1000 banks, three of which (the Bank of China, the Industrial and Commercial Bank of China, and the Agricultural Bank of China) were rated as global systemically important banks. The Banker magazine reported that Chinese banks made $292 billion in aggregate pre-tax profits in 2013, accounting for 32% of total earnings by the world's top 1,000 banks.

[13] For example, the five large-scale commercial banks accounted for 43% of the total assets of the Chinese banking system at the end of 2013, while the 12 joint-stock commercial banks accounted for 18%.

[14] Qian et al. (2015) noted that PBOC limits the movements of interest rates on both deposits and loans by setting base rates with upper and lower bounds. These rates and bounds vary over business cycles and with loan maturities.

in the United States. Chinese data were obtained from three primary data sets: Wind Datafeed Service (referred to as Wind), GTA The China Stock Market and Accounting Research (referred to as CSMAR) database, and the Almanac of China's Finance and Banking (2001-2016). Information about bank-firm relationships was obtained from the bank loan data in the CSMAR database. The CSMAR database compiles data from the Chinese stock market and the financial statements of China's listed companies. It is a unique, comprehensive database of Chinese stock returns, covering all companies listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange. We collected information on bank loans to all of the listed firms in China.

We augmented the data on bank-firm relationships with bank- and firm-level data taken from Wind, which provides historical reference data, real-time market data, and historical intraday market data, covering stocks, bonds, futures, foreign exchange, funds, indices, warrants, and macro market data, as well as descriptions, real-time market data, financial data, dividend data, corporate actions, and historical intraday data. We combined this data set with bank-level information (trade settlements) from the Almanac of China's Finance and Banking (2001-2016). The Almanac of China's Finance and Banking is a highly informative yearbook sponsored by China society for finance and banking that has been published annually and supervised by People's Bank of China since 1986. We obtained data on the GDP of 35 OECD member countries from the websites of OECD data set. The definitions of all variables used are presented in Table 1.

In the following part, we present summary statistics and examine whether our assumptions regarding identification are plausible. Panel A in Table 2 presents summary statistics for the loan-level variables in our primary data set. Since our data cover all business loans to listed firms, there is considerable variation in loan size. For example, the average loan size is 358.828 million yuan, and the standard deviation is 2418.99 million yuan. Given this considerable variation in size, we used the log of the loan volume instead of the loan volume. The average of the log of the loan volume for state-owned banks was similar to that of private banks (18.842 vs. 18.548), and the average of the change in the log of the loan volume of state-owned banks was also similar to that of private banks (11.4% vs. 12.3%).

Panel B in Table 2 presents summary statistics for the bank-level variables in our data set, the variable 'Bad Loan' was used to measure the health of bank i in year t, and is given by:

$$Bad\ Loan_{i,t-1} = \frac{Subprime\ loan_{i,t-1} + Doubt\ loan_{i,t-1} + Loss\ loan_{i,t-1}}{Asset_{i,t-1}}. \tag{1}$$

The average bad loan ratio was higher for the state-owned banks than for private banks because the Chinese government has more control over state-owned banks, and in an effort to protect unprofitable or insolvent SOEs, it requires state-owned banks to provide credit to these firms. The loan managers in state-owned banks are forced to lend money to these firms, even though they know that these firms represent an extremely high risk of default. Moreover, we found that state-owned banks were able to borrow more money from the central bank, likely because state-owned banks have more connections with the Chinese government and the central bank (PBOC).

Panel C in Table 2 presents summary statistics for the firm-level variables in our data set. The average ratio of net debt to total assets is 3.8%, and the average ratio of cash to total assets is 16.6%. Chinese listed firms employ 4074 staff on average, and the ratio of sales to assets, capital investment to assets, and operating income before depreciation to assets is 60.4%, 4%, and 3.2%, respectively.

2.3 Three Transmission Channels

Compared with the impact of the financial crisis in the United States, where the lending supply shock was solely caused by the banks' poor financial health, the impact on bank lending in China was much more complex. In particular, there were three channels through which the financial crisis potentially affected banks' lending decisions: one passive channel, related to the significant decrease in international borrowing through balance sheet hit, and two active channels, related to the reduction in lending to foreign-listed and trading firms as a result of the banks' risk-limiting behavior.

To evaluate the passive channel, we need to determine the extent to which banks were affected by the international credit crunch. As in Acharya et al. (2018), we construct a variable to measure the exposure to global market of bank i in year t as follows,

$$International\ Borrowing_{i,t} = \frac{International\ bond_{i,t} + International\ commercial\ borrowing_{i,t}}{Asset_{i,t}}. \tag{2}$$

In particular, Chinese banks borrow money from three types of institutions: foreign commercial banks, other foreign financial institutions, and the World Bank. A primary concern regarding this measurement is that if most of the international borrowing was from the World Bank, it would not have been significantly affected during the period of the financial crisis. However, only two Chinese banks (China Investment Bank and Agricultural Bank of China) were able to borrow money from the World Bank, and the amounts borrowed were minimal. Moreover, average bank-level international borrowing declined

significantly at the beginning of 2009, directly impacting the banks' balance sheets.

The risk-limiting motive arose because as the risk of default by both foreign-listed firms and trading firms increased, the banks had an incentive to reduce the amount of credit provided to these firms. There are four types of stocks in China: A-shares, which are only available to Chinese citizens; B-shares, which are available to non-Chinese citizens; H-shares, which are listed in Hong Kong; and overseas-listed, which are listed in markets such as the United States, Japan, and Singapore. Since the financial policies and government regulations that apply in Hong Kong are entirely different to those that apply in mainland China, we treated firms listed in Hong Kong as foreign-listed firms. Thus, we could construct another variable to measure the exposure to international market of bank i in year t as follows,

$$Foreign\ Listed_{i,t} = \frac{\sum_j Loan\ to\ B\ ,\ H\text{-}share\ \&\ overseas\ listed\ Chinese\ firms_{ijt}}{Total\ loan_{i,t}}. \tag{3}$$

Our analysis of the data showed that the financial crisis had a significant impact on foreign-listed firms. First, the sales amount of the foreign-listed firms declined significantly compared with the sales of the A-share listed firms. Second, the capital expenditure (investment) of the foreign-listed firms fell dramatically compared with that of the A-share listed firms. Third, the rate of unemployment among workers in foreign-listed firms increased significantly compared with that among workers in A-share listed firms.

China joined the World Trade Organization (WTO) in 2001, and from then until 2008, China's level of international trade increased dramatically. However, after 2008, the upward trend in trade flattened, and eventually assumed a downward trend in 2013. We construct the third international exposure measurement of bank i in year t as follows,

$$Trade\ Settlement_{i,t} = \frac{Trade\ settlement_{i,t}}{Total\ loan_{i,t}}. \tag{4}$$

Note that we use the ratio of trade settlements to total loans to control for the size of the bank. In this study, we focus on the bank loans, and thus we use total loans instead of assets to classify the banks by size. Therefore, a bank with substantial assets but only a small loan portfolio is classified as a small bank in this study.

3 Effects of the Financial Crisis on Bank Loans

Before assessing the importance of the three channels (international borrowing, foreign listed, and trade settlement) separately, we analyze whether the global financial crisis

affected the financial market in China by changing the banks' lending behavior. All three channels could potentially have led to a reduction in the bank loan supply following the financial crisis, either by reducing a bank's debt capacity (international borrowing) or by promoting risk-limiting behavior (foreign listed and trade settlement). Hence, we expect that banks that were more dependent on global markets were more affected by the financial crisis. Moreover, state-owned banks, which were more affected by government regulation, differed from private banks in terms of financial decision-making following the financial crisis.

3.1 Empirical Methodology

Applying the Chow test for structural breaks, we developed a three-period model covering the pre-crisis, crisis, and post-crisis periods. We set the indicator variable $Crisis_t$ equal to 1 during the periods of the financial crisis (2008-2009) and the sovereign debt crisis (2010-2012), and the variable $Post_t$ equal to 1 for fiscal years after 2012. The first year of the research period, 2001, was a significant year for China, as it was the year in which China joined the WTO. We regard this as the point at which China opened the door to the outside world after it had remained closed for thousands of years. For the level effect of the bank-firm matched loans, we employ the following specification for bank i and firm j in year t:

$$\begin{aligned} L_{ijt} &= \beta_1 Exposure_{i,t-1} + \beta_2 Exposure_{i,t-1} \times State\text{-}owned_i + \beta_3 Exposure_{i,t-1} \times Crisis_t \\ &\quad + \beta_4 Exposure_{i,t-1} \times Crisis_t \times State\text{-}owned_i + \beta_5 Exposure_{i,t-1} \times Post_t \\ &\quad + \beta_6 Exposure_{i,t-1} \times Post_t \times State\text{-}owned_i + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{5}$$

where i represents bank, j represents firm, t represents year, L_{ijt} is the log of the loan size, $Crisis_t$ is an indicator variable equal 1 for fiscal years 2008-2012, $Post_t$ is an indicator variable equal 1 for fiscal years after 2012, $State\text{-}owned_i$ is also an indicator variable equal 1 if the bank is a state-owned bank, and it equal 0 if the bank is a privately-owned bank, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects. We use three foreign exposure measurements: international borrowing, foreign listed, and trade settlement.

The term ($Exposure_{i,t-1} \times State\text{-}owned_i$) is used to control for the different effects of state-owned and private banks on the measure of international exposure. If banks with greater exposure to international markets cut their lending more following the financial crisis, it seemed reasonable that banks with higher levels of exposure would reduce their lending after the financial crisis. That is, we expected β_3 in equation (5) to be negative.

Moreover, if the Chinese government tried to close the door again to avoid the substantial losses being incurred by the outside world following the financial crisis, the state-owned banks should have been affected more than the private banks. Therefore, we expected β_4 in equation (5) to be negative.

Here, $Crisis_t$ and $Post_t$ are only dummies. To learn more about the specific changes in relation to bank lending, we need a variable measuring international market shocks. In this study, we used the OECD GDP growth rate to measure the impact of the international market shock on China. This is based on the assumption that the OECD GDP growth rate reflected the impact of international financial shocks from 2001 to 2016. For the growth rate effect of the bank-firm matched loans, we employ the following specification for bank i and firm j in year t:

$$\Delta L_{ijt} = \beta_1 Exposure_{i,t-1} + \beta_2 Exposure_{i,t-1} \times gr_{Yt}^{OECD} + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \quad (6)$$

where i represents bank, j represents firm, t represents year, ΔL_{ijt} is the growth rate of loan size, gr_{Yt}^{OECD} is the OECD GDP growth rate, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects. We also use the three foreign exposure measurements here: international borrowing, foreign listed, and trade settlement. We expect banks with higher exposure to the international markets cut lending more when there is a negative shock in the OECD GDP growth. In other words, the higher the OECD GDP growth rate, the higher the impact of the exposure to the international markets, that is, we expect β_2 in equation (6) to be positive.

3.2 Identification Strategy

We used the technical method proposed by Khwaja and Mian (2008) to simultaneously estimate the bank lending and firm borrowing channels stems from identification concerns, which arise because events that trigger changes in liquidity supply, such as monetary policy innovations or financial shocks, are often accompanied by changes in investment returns and, consequently, credit demand. Therefore, changes in firm borrowing reflect changes in both credit supply and credit demand. We used firm-year fixed effects to control for credit shocks on the demand side.

One concern is the endogeneity problem in relation to the exposure measurement. Suppose that pre-crisis banks with greater exposure to international markets could switch to lower exposure banks at no cost, with no reason to expect differential outcomes to those at the pre-crisis level of exposure for different banks. Similar to Chodorow-Reich (2013), we conducted a preliminary test, using the demeaned value of exposure as the depen-

dent variable and $After_t$ (a dummy variable equal to 1 after 2008) as the independent variable. The results are shown in Table 3. We found that the coefficient of $After_t$ was insignificant, suggesting that there were no systematic changes in response to the liquidity supply shock in 2008.

Another concern regarding the omitted variable problem is heterogeneity in terms of banks' responses to financial shocks. Could the lending channel coefficient be driven by inherent differences in how banks respond to the shock induced by the credit crunch in international markets? This is possible if there is response heterogeneity that is systematically correlated with the banks degree of liquidity shock. For example, perhaps the lending channel estimate picks up differences in how state-owned and private banks react to a financial crisis, as we know that the Chinese government has more control over state-owned banks. At the beginning of 2009, the CBRC and PBOC imposed strict financial regulations on banks with high levels of exposure to the international financial market to reduce the liquidity risk. However, these banks had been strongly encouraged to participate in international markets prior to the financial crisis in 2008. Since state-owned banks should have been more affected by this increase in government regulation, we used an interaction term with state-owned banks to capture any differences.

We also addressed these concerns by including various bank characteristics as a proxy for such differential lending sensitivity as controls, such as the bank's size, ROA, bad loan ratio, amount borrowed from the central bank, the ratio of tangible assets to total assets, cash flow, and dummies for state-owned, policy, rural, and listed banks. These bank-level controls are designed to capture a bank's sensitivity to financial shocks. In particular, we use lagged values to avoid the endogeneity problem. The results showed that the lending channel coefficient remained robust to all bank-level controls.

Although firm fixed effects address the main concerns regarding identification noted in the literature, there may be additional problems. Since the fixed effects strategy does not require any assumptions about the correlation between liquidity supply and demand shocks, the concern regarding the reverse causality problem is that if the liquidity supply shocks are anticipated, either banks may adjust their lending or firms may adjust their borrowing prior to the shock. This would lead to either an under- or overestimate of the impact on the bank lending channel depending on the direction of the pre-shock loan adjustments. However, in this study, the natural experiment financial crisis was unanticipated. Furthermore, it happened outside China, in the international markets. Therefore, it would have been difficult for Chinese banks and firms to anticipate this type of liquidity supply shock. In particular, the underlying assumption regarding all of the level effect regressions in this study is that prior-year financial positions are not positively correlated

with unobserved within-bank changes in loan lending following the onset of the crisis.

To reduce measurement error, we winsorized all variables at the 1% and 99% levels to reduce the influence of outliers. Regarding the sample selection problem, our data set provides more comprehensive coverage of small, micro, and rural banks than other data sets, as we included all banks, both listed and non-listed. Our main concern regarding the sample selection problem is that our data set only provides information about listed firms. However, there are also numerous unlisted firms in China. Gertler and Gilchrist (1994) suggested that because size could serve as a proxy for financial constraints, a higher sensitivity of small firms would provide evidence in favor of the "financial accelerator," whereby financial friction was expected to exacerbate downturns. Crouzet and Mehrotra (2020) used new, confidential data obtained from the income statements and balance sheets of United States manufacturing firms to examine this idea. Thus, our analysis of the impact of the financial crisis on the Chinese bank lending channel could be regarded as an analysis of the "lower bound" impact. Since we only consider listed firms, if these firms were affected by the financial crisis, small and micro firms should have been affected even more.

3.3 Baseline Results

In this section, we examine the empirical results of the analysis. First, We present the results for the level effect, and then turn to the growth rate effect.

3.3.1 Level Effect

Table 4 presents estimates from panel regressions analyzing bank-firm-level annual bank loans from 2001 to 2016. The conditional information set includes Size, State-owned, Policy, Rural, Tangibility, ROA, Listed, Cash Flow, Borrowings from the Central Bank, Bad Loan, Bad Loan $\times$ Crisis, and Bad Loan $\times$ Post. Specifically, Size is ln(assets), and State-owned is an indicator variable that equals 1 if the bank is state-owned. Policy is an indicator variable that equals 1 if the bank is a policy bank. Policy banks are unique to China. The difference between policy and commercial banks is that the goal of policy banks is not profit maximization. Rather, their goal is to try to implement government policy in the financial markets. Notwithstanding, there are numerous differences between the central bank and the policy banks. However, the most significant difference for the purposes of this study is that the central bank cannot lend money directly to firms. It can only lend money to policy or commercial banks, which can then provide loans to firms. Rural is also an indicator variable that equals 1 if the bank is located in a rural

area. Tangibility is represented by the ratio of fixed assets to total assets. Listed is a dummy variable that equals 1 if the bank is listed. Cash Flow is the ratio of operating income before depreciation to total assets. Borrowings from the Central Bank is the ratio of money borrowed from the central bank to total assets. As noted previously, Bad Loan is a measure of the bank's health, and we use Bad Loan $\times$ Crisis and Bad Loan $\times$ Post to capture the different impacts of Bad Loan pre- and post-crisis.

Table 4 presents the fixed effects estimations using equation (5), which provides an unbiased estimate of the bank lending channel coefficient. All regressions include fixed effects. The robust standard errors presented below the coefficient estimates are clustered at the bank level. The results indicate a significant bank lending channel: column 1 in Table 4 shows that a one-percentage-point increase in international commercial lending and bonds as a fraction of assets leads to a decrease in private bank loans of 4.725 percentage points more during the financial crisis than before the crisis, and a decrease in state-owned bank loans of 10.385 percentage points more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in international borrowing leads to an increase in private bank loans of 0.893 percentage points more after the financial crisis than before the crisis, and an increase in state-owned bank loans of 7.071 percentage points more after the financial crisis than before the crisis. Column 3 in Table 4 shows that a one-percentage-point increase in loans to B-share, H-share, and overseas-listed Chinese firms as a fraction of total loans leads to a decrease in private bank loans of 5.149 percentage points more during the financial crisis than before the crisis, and a decrease in state-owned bank loans of 9.831 percentage points more during the financial crisis than before the crisis. Column 3 also shows that a one-percentage-point increase in foreign listed leads to an increase in private bank loans of 0.724 percentage points more after the financial crisis than before the crisis, and an increase in state-owned bank loans of 5.505 percentage points more after the financial crisis than before the crisis. Column 5 in Table 4 shows that a one-percentage-point increase in a bank's trade settlements as a fraction of its total loans leads to a decrease in private bank loans of 1.773 percentage points more during the financial crisis than before the crisis, and a decrease in state-owned bank loans of 2.054 percentage points more during the financial crisis than before the crisis. Furthermore, a one-percentage-point increase in trade settlements leads to an increase in private bank loans of 0.824 percentage points more after the financial crisis than before the crisis, and an increase in state-owned bank loans of 0.988 percentage points more after the financial crisis than before the crisis. In summary, banks with higher levels of international exposure tend to reduce their lending by more during the financial crisis, and state-owned bank loans are more procyclical.

To confirm the robustness of our results, we ran the above regressions again using less restrictive specifications. Columns 2, 4, and 6 present the results for the revised specifications, including those using only firm fixed effects and year fixed effects. Importantly, the results were similar, in terms of both economic and statistical significance, using either specification. Hence, the economic magnitude of the impact is also robust across different specifications. With more variations in the size of the international shocks, Table C.1 reports the similar results to Table 4.

Since Crisis and Post are indicator variables, they only address the difference before, during, and after the financial crisis. Our study sample covers a long period (16 years). Thus, we need to plot the year-specific effects of these three potential channels. We used the following specification for bank i and firm j in year t to determine the year-specific effects for both state-owned and private banks:

$$L_{ijt} = \beta_1 Exposure_{i,t-1} \times Year\ Dummy_t + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \tag{7}$$

where i represents bank, j represents firm, t represents year, L_{ijt} is the log of the loan size, Year Dummy equals 1 for each specific year, otherwise it equals 0, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects.

Figure 4 plots the year-specific effects of the three abovementioned exposure measures on the level of the log of the loan volume during the period 2001-2016. The red line represents the year-specific effects for state-owned banks, and the blue line represents the year-specific effects for private banks. Robust standard errors are clustered at the bank level. All three panels show that the trends of the year-specific log of the loan volume diverged following the onset of the financial crisis in 2008, but eventually converged again. Figure 5 reports similar results for the parallel trend test.

It is worth mentioning that the baseline results in this study is consistent with the effect identified in Russia. Fungáčová et al. (2013) also found that bank ownership affected credit supply during the financial crisis, and that the crisis led to an overall decrease in the credit supply, although the movement was in the opposite direction. Specifically, Fungáčová et al. (2013) suggested that Russian state-controlled banks reduced their credit supply less than Russian private banks, however, we found that Chinese state-owned banks reduced their credit supply more than Chinese private banks.

3.3.2 Growth Rate Effect

Table 5 presents the growth rate effect estimates from panel regressions analyzing bank-firm-level annual bank loans from 2001 to 2016. The OECD GDP growth rate can be repre-

sented by $\sum_{i=1}^{n} dlnGDP_i \times$ GDP share$_i$, where i is one of the 35 OECD member countries. The conditional information set includes Cash Flow, Borrowings from the Central Bank, Tangibility, ROA, Listed, Bad Loan, and Bad Loan $\times$ OECD GDP growth rate. Specifically, Cash Flow is the ratio of cash to total assets, Borrowings from the Central Bank is the log of the money borrowed from the central bank, and Tangibility is the ratio of fixed assets to total assets. Listed is an indicator variable that equals 1 if the bank is listed. As noted previously, Bad Loan is a measure of the bank's balance sheet health, and we use Bad Loan $\times$ OECD GDP growth rate to capture the different impacts of Bad Loan given different OECD GDP growth rates.

Table 5 presents the fixed effects estimations obtained using equation (6), which provides an unbiased estimate of the bank lending channel coefficients. All regressions include fixed effects. Robust standard errors presented below the coefficient estimates are clustered at the bank level. The results indicate a significant bank lending channel: column 1 in Table 5 shows that a one-percentage-point increase in international commercial lending and bonds as a fraction of assets leads to a decline in the growth rate of bank loans of 0.379 percentage points when the OECD GDP growth rate is 0, and this decline is substantially offset and even reversed when the OECD GDP growth rate increases. Column 4 in Table 5 shows that a one-percentage-point increase in loans lending to B-share, H-share, and overseas-listed Chinese firms as a fraction of total loans leads to a decline in the growth rate of bank loans of 0.424 percentage points when the OECD GDP growth rate is 0. This decline is substantially offset and then reversed as the OECD GDP growth rate increases. Column 7 in Table 5 shows that a one-percentage-point increase in a bank's trade settlements as a fraction of its total loans leads to a decline in the growth rate of bank loans of 0.609 percentage points when the OECD GDP growth rate is 0. This decline is substantially offset and eventually reversed as the OECD GDP growth rate increases. Using the same explanatory variable specification as in Part 3.3.1, Table C.2 reports the similar results to Table 5.

Figure 6 shows the average marginal bank credit effects of the three measures of the level of international exposure. Panel A in Figure 6 shows that the average marginal effects of international borrowing are positive, negative, and zero when the OECD GDP growth rate is greater than 1.192%, less than 1.192%, and 1.192%, respectively. The 95% confidence interval when the average marginal effects of international borrowing are zero is [-0.2%,3.8%]. Panel B in Figure 6 shows that the average marginal effects of foreign listed are positive, negative, and zero when the OECD GDP growth rate is greater than 1.750%, less than 1.750%, and 1.750%, respectively. The 95% confidence interval when the average marginal effects of foreign listed are zero is [1.5%,2.3%]. Panel C in Figure 6

shows that the average marginal effects of trade settlements are positive, negative, and zero when the OECD GDP growth rate is greater than 2.086%, less than 2.086%, and 2.086%, respectively. The 95% confidence interval when the average marginal effects of trade settlements are zero is [1.2%,5.8%].

3.4 Which Effect Dominates?

Since we have three different measures of international exposure, international borrowing, foreign listed, and trade settlement, international borrowing could be regarded as a proxy for the bond market, foreign listed as a proxy for the stock market, and trade settlement as a proxy for the goods market. Therefore, the question is which effect (if any) dominates: the impact on the bond market, the stock market, or the goods market? To answer this question, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} L_{ijt} &= \beta_1 International\ Borrowing_{i,t-1} + \beta_2 International\ Borrowing_{i,t-1} \times Crisis_t \\ &+\beta_3 International\ Borrowing_{i,t-1} \times Post_t + \beta_4 Foreign\ Listed_{i,t-1} \\ &+\beta_5 Foreign\ Listed_{i,t-1} \times Crisis_t + \beta_6 Foreign\ Listed_{i,t-1} \times Post_t \\ &+\beta_7 Trade\ Settlement_{i,t-1} + \beta_8 Trade\ Settlement_{i,t-1} \times Crisis_t \\ &+\beta_9 Trade\ Settlement_{i,t-1} \times Post_t + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{8}$$

where i represents bank, j represents firm, t represents year, L_{ijt} is the log of the loan size, $Crisis_t$ is an indicator variable equals 1 for fiscal years 2008-2012, $Post_t$ is an indicator variable equals 1 for fiscal years after 2012, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects. We used three foreign exposure measurements: international borrowing, foreign listed, and trade settlement. Columns 1 and 2 in Table 6 present the estimates of the level effect from panel regressions using equation (8). It can be seen that international borrowing in the bond market and foreign listed in the stock market were more severely affected by the financial crisis than trade settlements in the goods market. For the growth rate effect of the bank-firm matched loans, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} \Delta L_{ijt} &= \beta_1 International\ Borrowing_{i,t-1} + \beta_2 International\ Borrowing_{i,t-1} \times gr_{Yt}^{OECD} \\ &+\beta_3 Foreign\ Listed_{i,t-1} + \beta_4 Foreign\ Listed_{i,t-1} \times gr_{Yt}^{OECD} \\ &+\beta_5 Trade\ Settlement_{i,t-1} + \beta_6 Trade\ Settlement_{i,t-1} \times gr_{Yt}^{OECD} \\ &+\gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{9}$$

where i represents bank, j represents firm, t represents year, ΔL_{ijt} is the growth rate of the loan size, gr_{Yt}^{OECD} is the OECD GDP growth rate, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects. We also used three foreign exposure measurements: international borrowing, foreign listed, and trade settlement. Columns 3 and 4 in Table 6 show the estimates of the growth rate effect from panel regressions using equation (9). It can be seen that the results of the growth rate effect is similar to the results of the level effect. International borrowing in the bond market and foreign listed in the stock market were more severely affected by the financial crisis than trade settlements in the goods market.

4 Firm-level Effects of the Financial Crisis: Loans and Real Outcomes

We have seen that adverse shocks to a bank's liquidity supply translate into a fall in its client firms' loans for both state-owned and private firms. However, such bank lending channels may not have any aggregate effect if firms can compensate for the loss of bank-specific loans by borrowing more from other banks with higher levels of liquidity. In this section, we discuss the firm-level effects of the financial crisis and the sovereign debt crisis.

4.1 Empirical Methodology

We also utilize both the fixed effects and generalized method of moments (GMM) estimates of the firm borrowing channel to argue that we can present conservative estimates of the impact of the liquidity and funding shock on firm-level financial outcomes such as a firm's net debt and cash, as well as firm-level real outcomes such as a firm's sales, capital investment, and employment. Let Y_{jt} be a firm-level attribute of interest in period t (such as a firm's net debt, log of cash, log of sales, log of capital investment, and log of employment). The reduced form firm borrowing channel can be determined by estimating the following equation:

$$\begin{aligned} Y_{jt} &= \beta_1^F \overline{Exposure}_{j,t-1} + \beta_2^F \overline{Exposure}_{j,t-1} \times Crisis_t + \beta_3^F \overline{Exposure}_{j,t-1} \times Post_t \\ &\quad + \beta_4^F \frac{CF_{j,t-1}}{Assets_{j,t-2}} + \beta_5^F \frac{Sales_{j,t-1}}{Assets_{j,t-2}} + \gamma X_{j,t-1} + \lambda_j + \mu_t + \eta_{jt}, \end{aligned} \tag{10}$$

and

$$Y_{jt} = \beta_1^F \overline{Exposure}_{j,t-1} + \beta_2^F \overline{Exposure}_{j,t-1} \times gr_{Yt}^{OECD} + \beta_3^F \frac{CF_{j,t-1}}{Assets_{j,t-2}} + \beta_4^F \frac{Sales_{j,t-1}}{Assets_{j,t-2}} + \gamma X_{j,t-1} + \lambda_j + \mu_t + \eta_{jt}, \quad (11)$$

where $\overline{Exposure}_{j,t-1}$ is the weighted aggregate exposure to international markets faced by firm j's banks in period $t-1$, which is measured by international borrowing, foreign listed, and trade settlement. $Crisis_t$ equals 1 only in the period of financial crisis (2008-2009) and sovereign debt crisis (2010-2012), and $Post_t$ equals 1 for fiscal years after 2012, gr_{Yt}^{OECD} is the OECD GDP growth rate, $Cash\ Flow_{j,t-1}$ is calculated by (Operating income before depreciation$_{j,t-1}$/Assets$_{j,t-1}$). $X_{j,t-1}$ is the firm-level control variables, which include Sales, Cash Flow, Size, State-owned, Tangibility, ROA. Specifically, Size is ln(assets), State-owned is an indicator variable equals 1 if the firm is state-owned. Tangibility is represented by (fixed assets/assets). λ_j is the firm fixed effects, μ_t is the year fixed effects. If the firm borrowing channel completely insulates a firm from the bank lending channels, then the liquidity shocks should have no net impact on the firm's aggregate outcomes, i.e., β_2^F and β_3^F in (10) as well as β_2^F in (11) should be zero.

4.2 Results

Table 7 presents the fixed effects estimations using equation (10), which provides an unbiased estimate of the firm borrowing channel coefficients. All regressions include fixed effects. Robust standard errors presented below the coefficient estimates are clustered at the firm level. The results indicate a significant firm borrowing channel: column 1 in Panel A shows that a one-percentage-point increase in the banks' international borrowing aggregated at the firm level leads to a decrease in firms' net debt of 1.172 percentage points more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in weighted aggregate international borrowing leads to a decline in firms' net debt of 1.333 percentage points more after the financial crisis than before the crisis. Columns 2, 3, and 4 in Panel A show that a one-percentage-point increase in the banks' international borrowing aggregated at the firm level leads to a decrease in firms' cash, employment, and capital investment of 2.738, 0.0772, and 3.717 percentage points, respectively, more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in weighted aggregate international borrowing leads to an increase in firms' cash, employment, and capital investment of 9.046, 9.911, and 19.78

percentage points more after the financial crisis than before the crisis.

Column 1 in Panel B shows that a one-percentage-point increase in the banks' foreign listed aggregated at the firm level leads to a decrease in firm's net debt of 0.372 percentage points more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in weighted aggregate foreign listed leads to a decrease in firms' net debt of 1.169 percentage points more after the financial crisis than before the crisis. Columns 2, 3, and 4 in Panel B show that a one-percentage-point increase in the banks' foreign listed aggregated at the firm level leads to a decrease in firms' cash, employment, and capital investment of 0.398, 0.153, and 1.144 percentage points, respectively, more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in the weighted aggregate foreign listed leads to a rise in firms' cash, employment, and capital investment of 7.318, 8.472, and 12.06 percentage points, respectively, more after the financial crisis than before the crisis.

Column 1 in Panel C reports that a one-percentage-point increase in the banks' trade settlements aggregated at the firm level leads to a decrease in firms' net debt of 0.139 percentage points more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in weighted aggregate trade settlements leads to a decrease in firms' net debt of 0.171 percentage points more after the financial crisis than before the crisis. Columns 2, 3, and 4 in Panel C show that a one-percentage-point increase in the banks' trade settlements aggregated at the firm level leads to a decrease in firms' cash, employment, and capital investment of 0.366, 0.486, and 1.558 percentage points, respectively, more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in weighted aggregate trade settlements leads to a rise in firms' cash, employment, and capital investment of 0.877, 0.850, and 2.286 percentage points more after the financial crisis than before the crisis.

Table 8 presents the two-step GMM system estimates using equation (11), which provides an unbiased estimate of the firm borrowing channel coefficients. All regressions include fixed effects. Robust standard errors presented below the coefficient estimates are clustered at the firm level. The results indicate a significant firm borrowing channel: column 1 in Panel A shows that a one-percentage-point increase in the banks' international borrowing aggregated at the firm level leads to a decline in firms' net debt of 4.351 percentage points when the OECD GDP growth rate is 0. This decline accelerates as the OECD GDP growth rate increases. Columns 2, 3, and 4 in Panel A show that firms with higher weighted aggregate international borrowing will experience a decline in cash stock, employment, and capital investment when there is a negative shock to the OECD GDP growth. Column 1 in Panel B shows that firms with higher banks' foreign listed

which is aggregated at the firm level will experience an increase in net debt when there is a negative shock to the OECD GDP growth. Columns 2, 3, and 4 in Panel B show that firms with higher weighted aggregate foreign listed will experience a decline in cash stock, employment, and capital investment when there is a negative shock to the OECD GDP growth. Column 1 in Panel C shows that firms with higher banks' trade settlements aggregated at the firm level will experience an increase in net debt when there is a negative shock to the OECD GDP growth. Columns 2, 3, and 4 in Panel C show that firms with higher weighted aggregate trade settlements will experience a decline in cash stock, employment, and capital investment when there is a negative shock to the OECD GDP growth.

We also conducted fixed effects estimations (see Table C.3) and pooled regressions (see Table 9). All results remained robust.

5 Robustness

5.1 International Exposure and the Endogeneity Problem

In this subsection, we used the initial year instead of the previous year to measure exposure, thereby avoiding the endogeneity problem in relation to international exposure. Table 10 shows that the results remained robust.

5.2 Bank Health

Chodorow-Reich (2013) focused on the impact of the financial crisis associated with the bank balance sheet's health. In this subsection, we replicate the specifications used by Chodorow-Reich (2013) using Chinese data. For the level effect of the bank-firm matched loans, we employ the following specification for bank i and firm j in year t:

$$\begin{aligned} L_{ijt} \;=\; & \beta_1 Bad\ Loan_{i,t-1} + \beta_2 Bad\ Loan_{i,t-1} \times State\text{-}owned_i + \beta_3 Bad\ Loan_{i,t-1} \times Crisis_t \\ & + \beta_4 Bad\ Loan_{i,t-1} \times Crisis_t \times State\text{-}owned_i + \beta_5 Bad\ Loan_{i,t-1} \times Post_t \\ & + \beta_6 Bad\ Loan_{i,t-1} \times Post_t \times State\text{-}owned_i + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{12}$$

where i represents bank, j represents firm, and t represents year, L_{ijt} is the log of the loan size, Bad Loan$_{i,t-1}$ is (Subprime loans$_{i,t-1}$+Doubt loans$_{i,t-1}$+Loss loans$_{i,t-1}$)/Assets$_{i,t-1}$, $Crisis_t$ is an indicator variable equal 1 for fiscal years 2008-2012, $Post_t$ is an indicator variable equal 1 for fiscal years after 2012, $State\text{-}owned_i$ is also an indicator variable equal

1 if the bank is a state-owned bank, and it equal 0 if the bank is a privately-owned bank, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects.

Moreover, for the growth rate effect of the bank-firm matched loans, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} \Delta L_{ijt} &= \beta_1 Bad\ Loan_{i,t-1} + \beta_2 Bad\ Loan_{i,t-1} \times gr_{Yt}^{OECD} \\ &\quad + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{13}$$

where i represents bank, j represents firm, and t represents year, ΔL_{ijt} is the growth rate of the loan size, Bad Loan$_{i,t-1}$ is (Subprime loans$_{i,t-1}$+Doubt loans$_{i,t-1}$+Loss loans$_{i,t-1}$)/Assets$_{i,t-1}$, gr_{Yt}^{OECD} is the OECD GDP growth rate, $X_{i,t-1}$ represents the bank-level control variables, λ_{jt} is the firm-year fixed effects.

Table 11 presents the fixed effects estimations using equation (12) and equation (13), which provides an unbiased estimate of the bank lending channel coefficients. The results indicate a large bank lending channel: column 1 shows that a one-percentage-point increase in bad loans as a fraction of assets leads to a decrease in private bank loans of 14.85 percentage points more during the financial crisis than before the crisis, and a decrease in state-owned bank loans of 22.327 percentage points more during the financial crisis than before the crisis. Moreover, a one-percentage-point increase in bad loans leads to an increase in private bank loans of 10.31 percentage points more during the financial crisis than before the crisis, and an increase in state-owned bank loans of 30.43 percentage points more during the financial crisis than before the crisis. In addition, column 3 in Table 11 shows that a one-percentage-point increase in bad loans as a fraction of assets leads to a decline in the growth rate of bank loans of 5.785 percentage points when the OECD GDP growth rate is zero. This decline is substantially offset and eventually reversed as the OECD GDP growth rate increases.

Moreover, Panel E of Figure 6 shows that the average marginal effects of bad loans are positive, negative, and zero when the OECD GDP growth rate is greater than 2.940%, less than 2.940%, and 2.940%, respectively. The 95% confidence interval when the average marginal effects of the bad loans are zero is [1.1%,6.0%].

5.3 An Alternative Measure of International Exposure

As a further robustness check, we adopted an alternative definition of our key explanatory variable: exchange gains as a fraction of total income. This alternative measure is

constructed as follows:

$$(Exchange/Income)_{i,t} = \frac{Exchange\ gains_{i,t}}{Total\ income_{i,t}}. \tag{14}$$

China maintains a closed capital account, meaning that companies, banks, and individuals are unable to transfer money into or out of the country unless they comply with strict rules. The PBOC and the State Administration of Foreign Exchange (SAFE) regulate the flow of foreign exchange in and out of the country and set exchange rates through a managed float system. The scheme is aimed at preventing the flight of foreign currency overseas and the inflow of foreign capital from destabilizing the Chinese economy. Then, for the level effect of the bank-firm matched loans, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} L_{ijt} \quad = \quad & \beta_1(Exchange/Income)_{i,t-1} + \beta_2(Exchange/Income)_{i,t-1} \times State\text{-}owned_i \\ & + \beta_3(Exchange/Income)_{i,t-1} \times Crisis_t \\ & + \beta_4(Exchange/Income)_{i,t-1} \times Crisis_t \times State\text{-}owned_i \\ & + \beta_5(Exchange/Income)_{i,t-1} \times Post_t \\ & + \beta_6(Exchange/Income)_{i,t-1} \times Post_t \times State\text{-}owned_i + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{15}$$

where i represents bank, j represents firm, and t represents year. L_{ijt} is the log of the loan size, $State\text{-}owned_i$ is an indicator variable equals 1 if the bank is state-owned, $X_{i,t-1}$ represents the bank-level control variables, λ_{jt} is the firm-year fixed effects.

Moreover, for the growth rate effect of the bank-firm matched loans, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} \Delta L_{ijt} \quad = \quad & \beta_1(Exchange/Income)_{i,t-1} + \beta_2(Exchange/Income)_{i,t-1} \times gr_{Yt}^{OECD} \\ & + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{16}$$

where i represents bank, j represents firm, and t represents year. ΔL_{ijt} is the growth rate of the loan size, gr_{Yt}^{OECD} is the OECD GDP growth rate, $X_{i,t-1}$ represents the bank-level control variables, λ_{jt} is the firm-year fixed effects.

Table 12 presents the results of the bank lending channel regressions using equation (15) and equation (16). Column 1 in Table 12 shows that a one-percentage-point increase in exchange income as a fraction of total income leads to a decrease in private bank loans of 2.009 percentage points more during the financial crisis than before the crisis, and a decrease in state-owned bank loans of 8.297 percentage points more during the financial

crisis than before the crisis. Column 1 also shows that a one-percentage-point increase in Exchange/Income leads to an increase in private bank loans of 1.641 percentage points more after the financial crisis than before the crisis, and an increase in state-owned bank loans of 7.250 percentage points more after the financial crisis than before the crisis. In addition, column 3 in Table 12 shows that a one-percentage-point increase in exchange gains as a fraction of total income leads to a decline in the growth rate of bank loans by 1.110 percentage points when the OECD GDP growth rate is 0. This decline is substantially offset and eventually reversed as the OECD GDP growth rate increases.

Figure 6 shows that the average marginal effects of the ratio of exchange income to total income are positive, negative, and zero when the OECD GDP growth rate is greater than 1.961%, less than 1.961%, and 1.961%, respectively. The 95% confidence interval when the average marginal effects of the ratio of exchange income to total income is zero is [0.5%,5.5%].

5.4 Two-period Model

Following Duchin et al. (2010), we set the indicator variable $After_t$ to 1 for fiscal years after 2008 to divide the sample period equally into the pre-crisis period (2001-2008) and the post-crisis period (2009-2016). For the level effect of the bank-firm matched loans, we employed the following specification for bank i and firm j in year t:

$$\begin{aligned} L_{ijt} &= \beta_1 Exposure_{i,t-1} + \beta_2 Exposure_{i,t-1} \times State\text{-}owned_i + \beta_3 Exposure_{i,t-1} \times After_t \\ &\quad + \beta_4 Exposure_{i,t-1} \times After_t \times State\text{-}owned_i + \gamma X_{i,t-1} + \lambda_{jt} + \epsilon_{ijt}, \end{aligned} \tag{17}$$

where i represents bank, j represents firm, t represents year, L_{ijt} is the log of the loan size, $After_t$ is an indicator variable equals 1 for fiscal years after 2008, $State\text{-}owned_i$ is also an indicator variable equals 1 if the bank is state-owned, $X_{i,t-1}$ is the bank-level control variables, λ_{jt} is the firm-year fixed effects. We used three foreign exposure measurements: international borrowing, foreign listed, and trade settlement.

Table 13 presents estimates from panel regressions explaining bank-firm-level annual bank loans from 2001 to 2016. The conditional information set includes Size, State-owned, Policy, Rural, List, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank, Bad Loan, Bad Loan $\times$ After. All regressions include fixed effects. Robust standard errors presented below the coefficient estimates are clustered at the bank level. The results indicate a large bank lending channel: column 1 in Table 13 shows that a one-percentage-point increase in international commercial lending and bonds as a fraction of assets leads to

a decrease in private bank loans of 0.839 percentage points more after the onset of the financial crisis than before the crisis, and a decrease in state-owned bank loans of 3.111 percentage points more after the onset of the financial crisis than before the crisis. Column 3 in Table 13 shows that a one-percentage-point increase in loans lending to B-share, H-share, and overseas-listed Chinese firms as a fraction of total loans leads to a decrease in private bank loans of 4.012 percentage points more after the beginning of the financial crisis than before the crisis, and a decrease in state-owned bank loans of 4.519 percentage points more after the financial crisis than before the crisis. Column 5 in Table 13 shows that a one-percentage-point increase in the banks' trade settlements as a fraction of total loans leads to a decrease in private bank loans of 0.121 percentage points more after the onset of the financial crisis than before the crisis, and a decrease in state-owned bank loans of 1.723 percentage points more after the financial crisis than before the crisis.

To confirm the robustness of our results, we ran the above regressions again using less restrictive specifications. Columns 2, 4, and 6 present the results for the different specifications, including those using only firm fixed effects and year fixed effects. Importantly, the results were similar, in terms of both economic and statistical significance using either specification. Hence, the economic magnitude of the impact described is stable across different specifications.

6 Conceptual Framework

In this section, we present a general equilibrium model of bank lending in a partially open financial market that sheds light on the mechanism underlying the transmission channels that impact the bank lending channel. The proposed model predicts that banks with higher exposure to the international market will reduce more bank credits through the balance sheet hit channel when global interest rates increase. In addition, when firm returns decrease, banks with higher levels of international exposure will reduce their lending through the risk-limiting behavior channel.

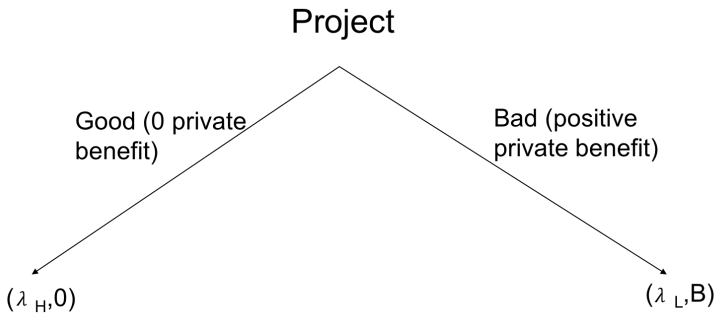
This model is based on the framework proposed by Holmstrom and Tirole (1997), and is related to the work of Ju and Wei (2010) and Niepmann (2015).[15] Our model has three types of agents: firms, banks, and depositors. All parties are risk-neutral and protected by limited liability, and so no one should end up in a negative cash position. Firms are run by entrepreneurs who, in the absence of proper incentives or outside monitoring, may deliberately reduce the probability of success to enjoy a private benefit. This model

[15] Ju and Wei (2010) focused on differences among banks across countries, while Niepmann (2015) investigated heterogeneity in bank efficiency.

formalizes the moral hazard problem by assuming that the entrepreneur can privately choose between two versions of the project, as described in Figure 1. There are two periods. In the first period, financial contracts are signed and investments are made. In the second period, investment returns are realized, and claims are settled. In this period, the investment generates a verifiable financial return equaling either 0 (failure) or R (success). The function of the banks is to monitor firms and thereby alleviate the moral hazard problem. In the case of bank lending, covenants are particularly typical and extensive, and are intended to reduce the firm's opportunity cost of being diligent. With that in mind, we assume that a bank could monitor a firm to prevent it from undertaking the bad project by costing γ. Thus, bank incentive compatibility condition could be written as

$$\lambda_H R_m - \gamma \geq \lambda_L R_m. \tag{18}$$

Figure 1: Firm Projects



6.1 Setup

There is a continuum of capitalists of measure K, who can become either bankers or depositors. Each capitalist is endowed with one unit of capital, and there is a continuum of potential entrepreneurs who can run firms. Moreover, in developing countries such as China, becoming a banker is subject to stringent verification procedures and the awarding of a license by the central government. Thus, we assume that the number of bankers is proportional to the total number of capitalists and is fixed at δ.

Bankers have two tasks in the economy: first, they channel capital from depositors to firms. Second, they monitor the firms they lend to at a cost to increase the probability that their investment is successful. As suppliers of capital, bankers collect the gross return on capital R in the second period. There are two types of depositors: domestic depositors who receive the endogenous domestic deposit rate of r and foreign depositors who

receive the exogenous foreign deposit rate of r^w. Depositors invest their endowments in banks and obtain the endogenously determined return r. Before each banker makes his or her investment decision, he or she learns about his or her efficiency as a banker. Each banker draws a level of exposure to the international markets s from a continuous distribution g(s) with support $s \in [0,1]$. Therefore, the financing cost can be written as follows:

$$c(s) = sr^w + (1-s)r = r + s(r^w - r) \quad with \quad r^w < r. \tag{19}$$

The lower the financing cost draw the higher the capitalist's efficiency as a banker. The timeline is presented in Figure 2.

Incentive compatibility requires that the banker's expected return under monitoring is higher than the return without monitoring, which results in the following condition:

$$\lambda_H Rz - \lambda_H c(s)(z - v(s)) - \gamma z \geq \lambda_L Rz - \lambda_L c(s)(z - v(s)), \tag{20}$$

where capital input per firm z is fixed, each capitalist (endowed with one unit of capital) decides whether to become a banker or a depositor. γz is the total monitoring cost, and v is the banker's capital invested in the firm. Thus, in equilibrium (minimizing v, equation (20)) holds with equality, banker's own capital in each bank loan is

$$v(s) = (1 - \frac{R}{c(s)} + \frac{\gamma}{\Delta\lambda c(s)})z. \tag{21}$$

The number of firms that one banker endowed with one unit of capital can monitor is

$$n(s) = 1/v(s). \tag{22}$$

Normalize z to 1, a banker with exposure s operates under the leverage:

$$\frac{\text{debt}}{\text{equity}} = \frac{\text{depositor capital}}{\text{bank capital}} = \frac{n(s)(1 - v(s))}{1} = \frac{1}{v(s)} - 1. \tag{23}$$

Banker's expected return per firm is

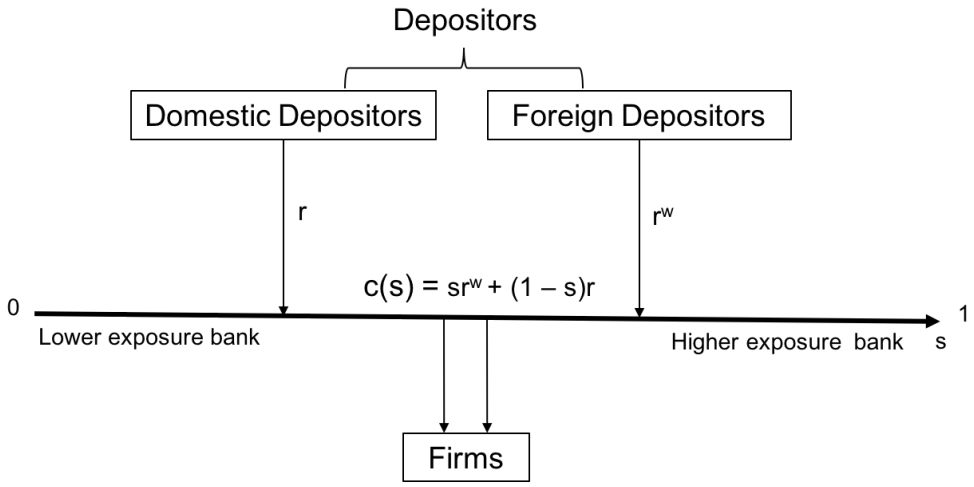
$$\lambda_L R - \lambda_L c(s)(1 - v(s)) = \frac{\gamma\lambda_L}{\Delta\lambda}. \tag{24}$$

Total bank loans of the bank with exposure s could be represented as

$$I(s) = n(s) = \frac{c(s)}{c(s) - \beta}, \tag{25}$$

where we assume $c(s) > \beta = R - \gamma/\Delta\lambda > 0$ for all s.

Figure 2: Timeline



6.2 Equilibrium

The equilibrium condition in this model is the market for financial intermediation clears. All active bankers together must intermediate the existing capital in the economy. The economy is endowed with domestic capital of measure K and foreign capital of measure K^*. A banker of type s can supply a measure of $n(s)$ firms with capital. Thus the market clears (financial intermediation) condition is

$$K + K^* = N \int_0^1 I(s)g(s)ds = N \int_s^1 \frac{c(s)}{c(s) - \beta} g(s)ds, \tag{26}$$

where N is the number of banks. In the regulated financial markets, the capital inflow's total amount is strictly controlled by the central government. Specifically speaking, in China, it is limited as a proportional to domestic capital. In this model, we assume $K^* = \rho K$. Furthermore, we assume that the number of bankers is proportional to total capitalists and fixed at the rate δ, thus

$$(1 + \rho)K = \delta K \int_0^1 \frac{c(s)}{c(s) - \beta} g(s)ds, \tag{27}$$

which could be simplified as

$$\frac{1 + \rho - \delta}{\delta} = \int_0^1 \frac{\beta}{c(s) - \beta} g(s)ds. \tag{28}$$

For simplicity, our model assumes $g(s)$ follows uniform distribution $s \sim U[0,1]$, thus $g(s) = 1$, equation (28) could be rewritten as

$$\frac{1+\rho-\delta}{\delta} = \beta \frac{\ln(r^w - \beta) - \ln(r - \beta)}{r^w - r}. \tag{29}$$

Take derivative respect to r^w, we have

$$\frac{dr}{dr^w} = \frac{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r^w-\beta}}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}}. \tag{30}$$

Proposition 1. *Assume r^w is large enough, i.e., $r^w > \frac{\beta(1+\rho)}{1+\rho-\delta}$, then $0 < \frac{dr}{dr^w} < 1$.*

Proof. See appendix A.1. □

Take derivative respect to R, we have

$$\frac{dr}{dR} = \frac{\frac{1+\rho-\delta}{\beta\delta}(r - r^w) + (\frac{\beta}{r^w-\beta} - \frac{\beta}{r-\beta})}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}}. \tag{31}$$

Proposition 2. *Assume r^w is large enough, i.e., $r^w > \frac{\beta(1+\rho)}{1+\rho-\delta}$ and close to r, then $0 < \frac{dr}{dR} < 1$.*

Proof. See appendix A.2. □

Take derivative respect to r^w, we have the first-order effect

$$\frac{\partial I}{\partial r^w} = \underbrace{-\frac{\beta s}{(c-\beta)^2}}_{Direct\ effect} \underbrace{-\frac{\beta(1-s)}{(c-\beta)^2}\frac{dr}{dr^w}}_{General\ equilibrium\ effect}, \tag{32}$$

and the asymmetric effect across banks is

$$\frac{\partial I^2}{\partial r^w \partial s} = -\beta \frac{(1 - dr/dr^w)(c-\beta) + 2(r - r^w)(s + (1-s)dr/dr^w)}{(c-\beta)^3}, \tag{33}$$

Proposition 3. *Channel I: Balance Sheet Hit. The first-order effect $\frac{\partial I}{\partial r^w} < 0$ under the sufficient condition $0 < \frac{dr}{dr^w} < 1$, and the asymmetric effect across banks $\frac{\partial I^2}{\partial r^w \partial s} < 0$ under the sufficient condition $0 < \frac{dr}{dr^w} < 1$.*

Proof. See appendix A.3. □

Take derivative respect to R, we have the first-order effect

$$\frac{\partial I}{\partial R} = \underbrace{\frac{c}{(c-\beta)^2}}_{Direct\ effect} \quad \underbrace{-\frac{\beta(1-s)}{(c-\beta)^2}\frac{dr}{dR}}_{General\ equilibrium\ effect}, \tag{34}$$

and the asymmetric effect across banks is

$$\frac{\partial I^2}{\partial R \partial s} = \frac{\beta dr/dR(c-\beta) + (r-r^w)(c+\beta-2\beta(1-s)dr/dR)}{(c-\beta)^3}, \tag{35}$$

Proposition 4. *Channel II: Risk-limiting Behavior. The first-order effect* $\frac{\partial I}{\partial R} > 0$ *under the sufficient condition* $0 < \frac{dr}{dR} < 1$, *and the asymmetric effect across banks* $\frac{\partial I^2}{\partial R \partial s} > 0$ *under the sufficient condition* $0 < \frac{dr}{dR} < 1$.

Proof. See appendix A.4. □

In summary, our proposed model predicts two channels through which financial shocks potentially affect banks' lending decisions. Through the balance sheet hit channel, higher global interest rate is associated with a reduction in bank loans. Banks with higher levels of exposure to the international market will reduce their lending more when global interest rate increases. Furthermore, lower firm return is associated with insufficient bank lending through the risk-limiting behavior channel. Banks with higher levels of international exposure will reduce their lending more when firm return decreases.

7 Conclusion

In this study, we show that the credit crunch following the global financial crisis impacted the Chinese bank lending channel. In particular, we find that banks with a higher level of exposure to the global markets reduced their lending more following the financial crisis, and state-owned bank loans are more procyclical than private bank loans. Banks with a higher level of exposure to international markets reduce their lending more when there is a negative shock to OECD GDP growth. Moreover, we compared the effects of international borrowing in the bond market, foreign listed in the stock market, and trade settlements in the goods market, and found that the effect of the financial crisis on the bond market and the stock market was more significant than that on the goods market.

Furthermore, we find that the financial shock to the international markets also impacted the Chinese firm borrowing channel. Specifically, firms with higher weighted ag-

gregate exposure to global markets through the banks had lower net debt, cash, employment, and capital investment during the financial crisis, while firms with higher weighted aggregate exposure to the international markets had higher net debt and lower cash, employment, and capital investment when there was a negative shock to the OECD GDP growth.

In our analysis, we take advantage of a novel data set covering a large number of small, privately owned, and rural banks that includes information on firm-bank relationships. To our knowledge, this paper is the first to analyze the impact of the United States financial crisis and the European sovereign debt crisis on the Chinese bank lending channel and the firm borrowing channel. To further explore the effects of financial shocks on bank lending, it would be interesting to extend our analysis to identify the industries that are most affected by exogenous financial shocks. The findings of our study increase our understanding of the unfolding of the impact of the financial crisis on the Chinese bank lending channel and firm borrowing channel. Our results also confirm that both market-driven and government-driven factors play critical roles in China's financial markets.

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Tables

Table 1: Variable Definitions

Variable	Definition
Bank-level	
Dependent Variables (winsorized at the 1% level)	
L	Natural logarithm of bank loans
ΔL	ln(bank loan$_{t+1}$−bank loan$_t$)
Key Explanatory Variables (winsorized at the 1% level)	
$After_t$	Dummy equals one if the year is after 2008
$Crisis_t$	Dummy equals one if the year is 2008-2012
gr_{Yt}^{OECD}	OECD GDP growth rate
$Bad\ Loan_{i,t}$	(Subprime loan$_{i,t}$+Doubt loan$_{i,t}$+Loss loan$_{i,t}$)/Asset$_{i,t}$
$International\ Borrowing_{i,t}$	(International bond$_{i,t}$+International commercial borrowing$_{i,t}$)/Asset$_{i,t}$
$Foreign\ Listed_{i,t}$	(Loan to B-, H-share & overseas listed Chinese firms$_{i,t}$)/Total loan$_{i,t}$
$Trade\ Settlement_{i,t}$	Trade settlements$_{i,t}$/ Total loan$_{i,t}$
$(Exchange/Income)_{i,t}$	Exchange gains$_{i,t}$/Total income$_{i,t}$
Control Variables (winsorized at the 1% level)	
$State\text{-}owned_i$	Dummy equals one if the bank is a state-owned bank
$Policy_i$	Dummy equals one if the bank is a policy bank
$Rural_i$	Dummy equals one if the bank is a rural bank
$List_{i,t}$	Dummy equals one if the bank is a listed bank
$Size_{i,t}$	ln(Assets$_{i,t}$)
$ROA_{i,t}$	Net income$_{i,t}$/((Assets$_{i,t-1}$+Assets$_{i,t}$)/2)
$Tangibility_{i,t}$	Fixed assets$_{i,t}$/Assets$_{i,t}$
$Cash\ Flow_{i,t}$	Operating Income Before Depreciation$_{i,t}$/((Assets$_{i,t-1}$+Assets$_{i,t}$)/2)
$Lend\ Central\ Bank_{i,t}$	Debt lent from central bank$_{i,t}$/Assets$_{i,t}$
Firm-level	
Dependent Variables (winsorized at the 1% level)	
$Net\ Debt$	(Current+Non-Current Liabilities−Cash)/(Total Assets)
$\Delta Cash$	(Cash$_{t+1}$−Cash$_t$)/(Total Asset$_t$)
$Employment\ Growth$	ln(Employment$_t$)−ln(Employment$_{t-1}$)
$CAPX$	(Fixed Assets$_{t+1}$−Fixed Assets$_t$+Depreciation$_t$)/Assets$_t$, set to 0 if negative
Key Explanatory Variables (winsorized at the 1% level)	
$\overline{TL}_{j,t-1}$	$\frac{1}{I}\sum_{i=1}^{I}$Total Loan$_{ijt}$
Control Variables (winsorized at the 1% level)	
$Sales\ Growth$	ln(Sales$_t$)−ln(Sales$_{t-1}$)
$Cash\ Flow_{i,t}$	Operating Income Before Depreciation$_{i,t}$/Assets$_{i,t-1}$

Table 2: Summary Statistics

Panel A: Firm-bank Pairwise									
	State-owned Banks			Private Banks			All Banks		
Variable	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
loan	502.619	3,717.35	9,840	264.614	780.71	15,018	358.828	2,418.99	24,858
lnloan	18.842	1.38	9,840	18.548	1.22	15,018	18.664	1.29	24,858
dlnloan	0.114	0.91	4,822	0.123	0.77	6,655	0.119	0.83	11,477
Observations	9840			15018			24858		
Panel B: Bank-level									
	State-owned Banks			Private Banks			All Banks		
Variable	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
Bad Loan	0.029	0.05	101	0.007	0.01	731	0.010	0.02	832
Exchange/Income	0.028	0.08	122	0.008	0.03	1,010	0.010	0.04	1,132
International Borrowing	0.009	0.03	99	0.002	0.01	749	0.002	0.01	848
Trade Settlement	0.086	0.34	100	0.000	0.01	820	0.010	0.12	920
Foreign Listed	0.060	0.15	110	0.052	0.21	617	0.053	0.20	727
Size	28.993	1.24	107	25.728	1.34	772	26.126	1.70	879
Profit	23.676	2.20	107	20.925	1.46	772	21.260	1.81	879
Cash Flow	0.095	0.06	107	0.150	0.04	772	0.143	0.05	879
Roa	0.012	0.01	93	0.011	0.00	568	0.011	0.01	661
List	0.402	0.49	122	0.126	0.33	994	0.156	0.36	1,116
Deposit	28.367	1.83	103	25.333	1.32	817	25.673	1.69	920
EBITDA	25.124	1.71	107	22.118	1.34	773	22.483	1.70	880
Tangibility	0.009	0.01	107	0.007	0.01	772	0.007	0.01	879
Lend Central Bank	0.022	0.06	122	0.002	0.01	1,010	0.004	0.02	1,132
Policy	0.344	0.48	122	0.000	0.00	1,010	0.037	0.19	1,132
Rural	0.000	0.00	122	0.139	0.35	1,010	0.124	0.33	1,132
Observations	122			1010			1132		
Panel C: Firm-level									
Variable	Mean	S.D.	N						
Net Debt	0.038	0.206	7213						
Cash	0.166	0.114	6245						
Employment	4073.728	9104.401	7288						
Sales	0.604	0.521	7295						
Capital Investment	0.04	0.361	7285						
Cash Flow	0.032	0.054	7221						

Notes. Panel A presents descriptive statistics of firm-bank pairwise dependent variables split into state-owned and private banks. State-owned is an indicator variable equals one if the bank is a state-owned bank. The sample consists of all firms that are listed in the A-share, B-share, H-share, and oversea stocks market. Panel B presents descriptive statistics of bank-level explanatory variables split into state-owned and private banks. The sample consists of all banks that are located in China. Panel C presents descriptive statistics of firm-level explanatory variables. The sample consists of all listed Chinese firms.

Table 3: Preliminary Test

	(1) Demean (International Borrowing)	(2) Demean (Foreign Listed)	(3) Demean (Trade Settlement)
Crisis	0.000993	-0.000576	0.00485
	(0.0174)	(0.0220)	(0.0139)
Post	-0.000519	-0.00376	0.00375
	(0.0150)	(0.0166)	(0.0150)
Observations	18396	23202	22150
R^2	0.101	0.071	0.164
Firm Fixed Effect	YES	YES	YES
Clusters at Bank Level	132	177	170

Notes. This table presents the results of a preliminary test regression. The unit of observation is a bank-year. The dependent variable is the exposure measurement. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 4: The Bank Lending Channel—Level Effect

Log(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (Foreign Listed)	(4) Exposure (Foreign Listed)	(5) Exposure (Trade Settlement)	(6) Exposure (Trade Settlement)
Bad Loan	-1.289***	-0.903**	-1.532	-1.720*	-1.504***	-1.291**
	(0.471)	(0.377)	(0.957)	(0.910)	(0.506)	(0.518)
Bad Loan x Post	-2.051	3.273	-3.644	2.008	12.31**	11.37**
	(12.20)	(11.18)	(6.567)	(6.183)	(5.934)	(5.524)
Bad Loan x Crisis	3.514	-0.0869	-1.148	-4.178	-16.92*	-20.64**
	(7.711)	(6.406)	(5.275)	(5.253)	(8.916)	(8.652)
Exposure	-1.827*	-3.619***	0.501	-0.639	0.745	1.361**
	(1.021)	(1.185)	(1.714)	(1.635)	(0.752)	(0.648)
Expo. x State-owned	2.563***	4.400***	5.828***	7.793***	1.513***	1.752***
	(0.954)	(1.160)	(1.885)	(1.802)	(0.344)	(0.325)
Exposure x Crisis	-4.725***	-1.942	-5.149***	-6.046***	-1.773**	-1.820***
	(1.541)	(1.379)	(1.221)	(1.168)	(0.857)	(0.612)
Expo. x Crisis x State-owned	-5.660*	-8.028***	-4.682**	-6.159***	-0.281	-0.381
	(3.347)	(2.978)	(1.999)	(1.908)	(0.802)	(0.489)
Expo. x Post	0.893	1.695	0.724	0.355	0.824	0.0179
	(1.104)	(1.300)	(1.729)	(1.647)	(1.101)	(0.864)
Expo. x Post x State-owned	6.178***	2.909**	4.781**	6.816***	0.164***	0.164***
	(1.266)	(1.458)	(1.888)	(1.805)	(0.0587)	(0.0537)
Observations	13934	13934	18895	18895	17222	17222
R^2	0.686	0.593	0.669	0.575	0.670	0.575
Bank Controls	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO	YES	NO
Clusters at Bank Level	132	132	177	177	170	170

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume. Bank Controls include Size, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 5: The Bank Lending Channel—Growth Rate Effect

dLog(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (International Borrowing)	(4) Exposure (Foreign Listed)	(5) Exposure (Foreign Listed)	(6) Exposure (Foreign Listed)	(7) Exposure (Trade Settlement)	(8) Exposure (Trade Settlement)	(9) Exposure (Trade Settlement)
Bad Loan	-4.877**	-4.720	-1.147	-5.479**	-3.509	-1.348	-6.962**	-3.553	-0.335
	(2.155)	(3.317)	(1.052)	(2.372)	(3.213)	(2.591)	(2.866)	(3.521)	(1.642)
Bad Loan x OECD GDP G.R.	1.851**	2.615**	0.503	1.413**	1.766	0.403	2.544**	1.874	0.560
	(0.772)	(1.070)	(1.018)	(0.687)	(1.122)	(0.872)	(1.033)	(1.239)	(1.041)
Exposure	-0.379	-0.714*	-0.255	-0.424***	-0.317**	-0.357**	-0.609	-0.535	-0.840**
	(0.290)	(0.426)	(0.254)	(0.138)	(0.154)	(0.153)	(0.375)	(0.454)	(0.403)
Exposure x OECD GDP G.R.	0.318***	0.505***	0.187*	0.234***	0.207**	0.181**	0.292**	0.377**	0.474**
	(0.0854)	(0.137)	(0.106)	(0.0812)	(0.0925)	(0.0920)	(0.133)	(0.167)	(0.194)
OECD GDP G.R.			0.0271**			0.0242*			0.0494***
			(0.0119)			(0.0145)			(0.0169)
Observations	7627	7627	7627	9968	9968	9968	8909	8909	8909
R^2	0.195	0.180	0.171	0.182	0.167	0.156	0.169	0.151	0.141
Bank Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	YES	NO	YES	YES	NO	YES	YES
Year Fixed Effect	NO	YES	NO	NO	YES	NO	NO	YES	NO
Firm-Year Fixed Effect	YES	NO	NO	YES	NO	NO	YES	NO	NO
Clusters at Bank Level	118	118	118	141	141	141	133	133	133

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the change in log loan volume. Bank Controls include Size, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 6: The Bank Lending Channel—Level and Growth Rate Effect (All Exposures)

	(1) Log(Loan)	(2) Log(Loan)	(3) dLog(Loan)	(4) dLog(Loan)
Bad Loan	-1.419**	-1.131*	-1.054	-3.749
	(0.639)	(0.677)	(2.192)	(3.099)
International Borrowing	1.245***	0.966	-2.858***	-3.361***
	(0.467)	(0.700)	(1.042)	(1.232)
Foreign Listed	3.026***	3.449***	-0.810**	-0.778***
	(1.067)	(1.226)	(0.310)	(0.281)
Trade Settlement	-2.065	-1.390	-2.788***	-3.263***
	(1.485)	(1.676)	(0.886)	(0.587)
International Borrowing x Crisis	-6.266***	-4.906***		
	(1.142)	(1.286)		
Foreign Listed x Crisis	-3.515***	-3.931***		
	(1.112)	(1.324)		
Trade Settlement x Crisis	-0.694	-0.291		
	(1.590)	(1.674)		
International Borrowing x Post	1.629*	2.307***		
	(0.884)	(0.811)		
Foreign Listed x Post	2.882***	3.285***		
	(1.064)	(1.228)		
Trade Settlement x Post	3.380**	2.418		
	(1.402)	(1.561)		
Bad Loan x OECD GDP Growth Rate			1.416*	2.071**
			(0.795)	(0.854)
International Borrowing x OECD GDP Growth Rate			1.572***	1.535***
			(0.408)	(0.380)
Foreign Listed x OECD GDP Growth Rate			0.473**	0.456***
			(0.203)	(0.173)
Trade Settlement x OECD GDP Growth Rate			0.115	0.239
			(0.180)	(0.231)
Observations	11987	11987	6543	6543
R^2	0.686	0.590	0.178	0.161
Bank Controls	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO
Clusters at Bank Level	128	128	113	113

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume or the change in log loan volume. Bank Controls include Size, State-owned, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 7: The Firm Borrowing Channel-Level Effect

Panel A: International Borrowing	(1) Net Debt	(2) Cash	(3) Employment	(4) Capital Investment
$\overline{International\ Borrowing}$	0.535	-0.201	-2.875	-13.51*
	(0.325)	(2.609)	(1.517)	(5.665)
$\overline{International\ Borrowing}$ x Crisis	-1.172*	-2.738	-0.0772	-3.717
	(0.493)	(3.813)	(2.283)	(8.466)
$\overline{International\ Borrowing}$ x Post	-1.333***	9.046***	9.911***	19.78***
	(0.397)	(3.261)	(1.845)	(7.005)
Observations	6841	7060	7053	4197
R^2	0.751	0.766	0.860	0.640
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1967	1992	1991	1657
Panel B: Foreign Listed				
$\overline{Foreign\ Listed}$	0.198***	-2.054***	-1.661***	-1.992
	(0.0730)	(0.441)	(0.335)	(1.290)
$\overline{Foreign\ Listed}$ x Crisis	-0.372*	-0.398	-0.153	-1.144
	(0.158)	(1.144)	(0.718)	(2.750)
$\overline{Foreign\ Listed}$ x Post	-1.169***	7.318***	8.472***	12.06***
	(0.221)	(1.378)	(1.005)	(3.932)
Observations	5842	6249	6310	3772
R^2	0.765	0.837	0.875	0.650
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1321	1902	1911	1573
Panel C: Trade Settlement				
$\overline{Trade\ Settlement}$	0.129***	-0.244	-0.494***	-0.462
	(0.0299)	(0.194)	(0.138)	(0.546)
$\overline{Trade\ Settlement}$ x Crisis	-0.139*	-0.366	-0.486*	-1.558
	(0.0551)	(0.371)	(0.247)	(0.957)
$\overline{Trade\ Settlement}$ x Post	-0.171***	0.877***	0.850***	2.286***
	(0.0354)	(0.244)	(0.172)	(0.648)
Observations	6214	6660	6720	3993
R^2	0.762	0.832	0.888	0.653
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1349	1943	1952	1611

Notes. This table presents the results of a Chinese firm borrowing channel regression. The unit of observation is a firm-year. The dependent variable is the net debt, cash/asset, log employment, and capital investment/asset. Firm Controls include Sales, Cash Flow, Size, State-owned, Tangibility, ROA. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the firm-level.

Table 8: The Firm Borrowing Channel—Growth Rate Effect (GMM)

Panel A: International Borrowing	(1) Net Debt	(2) Cash	(3) Employment	(4) Capital Investment
International Borrowing	4.351***	-0.536***	-2.488***	-18.02
	(1.317)	(0.147)	(0.815)	(13.79)
International Borrowing x OECD GDP G.R.	-0.781***	0.0744***	0.400***	4.234*
	(0.247)	(0.0244)	(0.145)	(2.561)
Observations	6841	7060	7053	4197
Firms	1967	1992	1991	1657
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Sargan test (p-value)	0.0369	0.0820	0.117	0.296
Serial correlation test (p-value)	0.624	0.785	0.120	0.390
Panel B: Foreign Listed				
Foreign Listed	-0.282***	0.513**	2.684***	-0.599
	(0.0542)	(0.250)	(0.416)	(2.129)
Foreign Listed x OECD GDP G.R.	-0.0531***	0.149***	0.309***	1.073***
	(0.0199)	(0.0528)	(0.108)	(0.407)
Observations	5842	6249	6310	3772
Firms	1321	1902	1911	1573
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Sargan test (p-value)	0.753	0.357	0.543	0.362
Serial correlation test (p-value)	0.0303	0.808	0.0983	0.613
Panel C: Trade Settlement				
Trade Settlement	-0.0696***	0.150***	1.215***	-0.435
	(0.0193)	(0.0465)	(0.157)	(0.285)
Trade Settlement x OECD GDP G.R.	-0.0519***	0.234***	0.477***	0.733**
	(0.0162)	(0.0563)	(0.108)	(0.334)
Observations	6214	6660	6720	3993
Firms	1349	1943	1952	1611
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Sargan test (p-value)	0.901	0.0104	0.855	0.796
Serial correlation test (p-value)	0.476	0.808	0.423	0.604

Notes. This table presents the results of a Chinese firm borrowing channel regression. We conduct the two-step GMM system estimation using lagged 3-4 values as instruments. The unit of observation is a firm-year. The dependent variable is the net debt, cash/asset, log employment, and capital investment/asset. Firm Controls include Sales, Cash Flow, Size, State-owned, Tangibility, ROA. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Windmeijer corrected robust standard errors are given below.

Table 9: The Firm Borrowing Channel—Growth Rate Effect (All Exposures, GMM)

	(1) Net Debt	(2) Cash	(3) Employment	(4) Capital Investment
$\overline{\textit{International Borrowing}}$ x OECD GDP G.R.	-0.183	0.216***	0.0819	5.141**
	(0.136)	(0.0656)	(0.169)	(2.178)
$\overline{\textit{Foreign Listed}}$ x OECD GDP G.R.	-0.310*	0.151***	0.596***	1.556
	(0.175)	(0.0284)	(0.221)	(2.612)
$\overline{\textit{Trade Settlement}}$ x OECD GDP G.R.	-0.0383	0.00879	0.0220	3.915***
	(0.0814)	(0.0129)	(0.0455)	(0.874)
Sales	0.0460***	0.0193***	0.0635***	0.315
	(0.0176)	(0.000936)	(0.00417)	(0.380)
Cash Flow	-0.916***	0.420***	0.754***	1.167
	(0.119)	(0.0420)	(0.212)	(1.992)
Constant	0.140***	0.158***	7.015***	17.64***
	(0.0151)	(0.00730)	(0.0455)	(0.198)
Observations	5842	6145	6140	3665
Firms	1321	1890	1889	1546
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Sargan test (p-value)	0.219	0.538	0.772	0.364
Serial correlation test (p-value)	0.449	0.826	0.125	0.859

Notes. This table presents the results of a Chinese firm borrowing channel regression. We conduct the two-step GMM system estimation using lagged 3-4 values as instruments. The unit of observation is a firm-year. The dependent variable is the net debt, cash/asset, log employment, and capital investment/asset. Firm Controls include Sales, Cash Flow, Size, State-owned, Tangibility, ROA. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Windmeijer corrected robust standard errors are given below.

Table 10: The Bank Lending Channel—Growth Rate Effect (Initial Value)

dLog(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (Foreign Listed)	(4) Exposure (Foreign Listed)	(5) Exposure (Trade Settlement)	(6) Exposure (Trade Settlement)
Bad Loan	-4.704**	-3.651	-6.804***	-2.322	-5.541**	-1.264
	(2.217)	(2.674)	(2.345)	(3.166)	(2.154)	(3.239)
Bad Loan x OECD G.R.	1.905**	2.310**	1.907***	1.303	1.388*	0.789
	(0.749)	(0.964)	(0.668)	(1.099)	(0.780)	(1.154)
Exposure	-0.836	-0.0827	-0.420***	-0.371**	-0.113	-0.259***
	(0.587)	(0.471)	(0.154)	(0.153)	(0.0998)	(0.0789)
Exposure x OECD G.R.	0.267*	0.408**	0.0890**	0.0872**	0.0830***	0.0753***
	(0.146)	(0.196)	(0.0384)	(0.0395)	(0.00943)	(0.0280)
Observations	7627	7627	9968	9968	9981	9981
R^2	0.195	0.180	0.182	0.167	0.182	0.168
Bank Controls	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO	YES	NO
Clusters at Bank Level	118	118	141	141	133	133

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the change in log loan volume. Bank Controls include Size, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 11: The Bank Lending Channel—Level and Growth Rate Effect (Bad Loan)

	(1) lnloan	(2) lnloan	(3) dlnloan	(4) dlnloan	(5) dlnloan
Bad Loan	-9.737*	-16.65***	-5.785**	-2.059	-0.566
	(5.832)	(5.402)	(2.317)	(3.120)	(2.547)
Bad Loan x State-owned	7.576	14.15***			
	(5.700)	(5.264)			
Bad Loan x Crisis	-14.85*	-11.65			
	(7.960)	(7.666)			
Bad Loan x Crisis x State-owned	-7.477	-7.210			
	(8.750)	(8.097)			
Bad Loan x Post	10.31	17.03*			
	(10.74)	(10.12)			
Bad Loan x Post x State-owned	20.12***	13.16*			
	(7.401)	(7.023)			
Bad Loan x OECD GDP growth rate			1.968***	1.250	0.223
			(0.662)	(1.094)	(0.853)
OECD GDP growth rate					0.0365***
					(0.0123)
Observations	19212	19212	9986	9986	9986
R^2	0.669	0.576	0.185	0.168	0.159
Bank Controls	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	YES
Year Fixed Effect	NO	YES	NO	YES	NO
Firm-Year Fixed Effect	YES	NO	YES	NO	NO
Clusters at Bank Level	177	177	141	141	141

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume or the change in log loan volume. Bank Controls include Size, State-owned, Policy, Rural, Tangibility, ROA, List, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table 12: The Bank Lending Channel—Level and Growth Rate Effect (Alternative Exposure)

	(1) lnloan	(2) lnloan	(3) dlnloan	(4) dlnloan	(5) dlnloan
Bad Loan	-2.276**	-2.633***	-6.647***	-2.982	-1.315
	(0.912)	(0.864)	(2.408)	(2.690)	(1.086)
Bad Loan x Crisis	-2.817	2.636			
	(6.584)	(6.198)			
Bad Loan x Post	8.934*	4.924			
	(4.858)	(4.835)			
Exchange/Income	-0.0724	-0.268	-1.110*	-0.352	-0.853*
	(0.439)	(0.432)	(0.566)	(0.466)	(0.493)
Exchange/Income x State-owned	-4.006*	-7.551***			
	(2.213)	(2.071)			
Exchange/Income x Crisis	-2.009***	-2.022***			
	(0.752)	(0.756)			
Exchange/Income x Crisis x State-owned	-6.288*	-11.88***			
	(3.520)	(3.353)			
Exchange/Income x Post	1.641	3.580			
	(2.575)	(2.476)			
Exchange/Income x Post x State-owned	5.609**	9.128***			
	(2.381)	(2.247)			
Bad Loan x OECD GDP growth rate			2.339***	1.612*	0.514
			(0.612)	(0.950)	(0.981)
Exchange/Income x OECD GDP growth rate			0.566**	0.424**	0.401**
			(0.254)	(0.206)	(0.188)
OECD GDP growth rate					0.0362**
					(0.0147)
Observations	19212	19212	9986	9986	9986
R^2	0.668	0.575	0.185	0.168	0.159
Bank Controls	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	YES
Year Fixed Effect	NO	YES	NO	YES	NO
Firm-Year Fixed Effect	YES	NO	YES	NO	NO
Clusters at Bank Level	177	177	141	141	141

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume or the change in log loan volume. Bank Controls include Size, State-owned, Policy, Rural, Tangibility, ROA, List, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

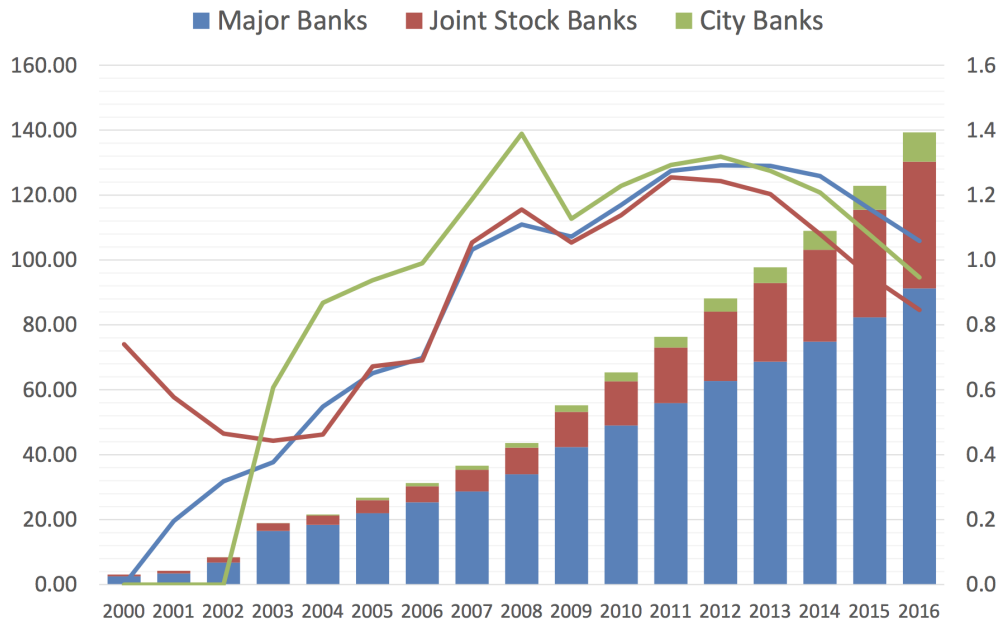
Table 13: The Bank Lending Channel—Level Effect (Alternative Periods)

Log(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (Foreign Listed)	(4) Exposure (Foreign Listed)	(5) Exposure (Trade Settlement)	(6) Exposure (Trade Settlement)
Bad Loan	-1.792***	-1.922***	-1.253**	-1.352	-1.515	-1.398
	(0.645)	(0.577)	(0.537)	(0.909)	(0.929)	(0.883)
Bad Loan x After	6.427	7.155	-8.034	-6.506	-6.399	-7.903*
	(6.286)	(6.408)	(6.155)	(4.257)	(4.419)	(4.324)
Exposure	0.602**	0.576**	4.671**	4.903***	0.280*	0.241*
	(0.303)	(0.264)	(2.011)	(1.028)	(0.167)	(0.141)
Exposure x State-owned	0.165**	0.182***	0.133**	0.121***	0.146***	0.135***
	(0.0647)	(0.0578)	(0.0524)	(0.0259)	(0.0419)	(0.0414)
Exposure x After	-0.839	-0.991	-4.012**	-4.276***	-0.121	-0.180
	(1.592)	(1.375)	(1.978)	(1.047)	(0.576)	(0.558)
Exposure x After x State-owned	-2.272*	-1.540	-0.507***	-0.487**	-1.602**	-1.520**
	(1.313)	(1.159)	(0.171)	(0.201)	(0.753)	(0.739)
Observations	13934	13934	18895	18895	17222	17222
R^2	0.685	0.593	0.669	0.575	0.670	0.575
Bank Controls	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO	YES	NO
Clusters at Bank Level	132	132	177	177	170	170

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume. Bank Controls include Size, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Figures

Figure 3: Bank Assets (RMB Trillion) and ROA (%)



Source: Jiang Wang (MIT), "China's Financial System: Developments and Challenges", MIT Golub Center for Finance and Policy 4th Annual Conference.

Figure 4: Year-specific Effects (Coefficients β_1)

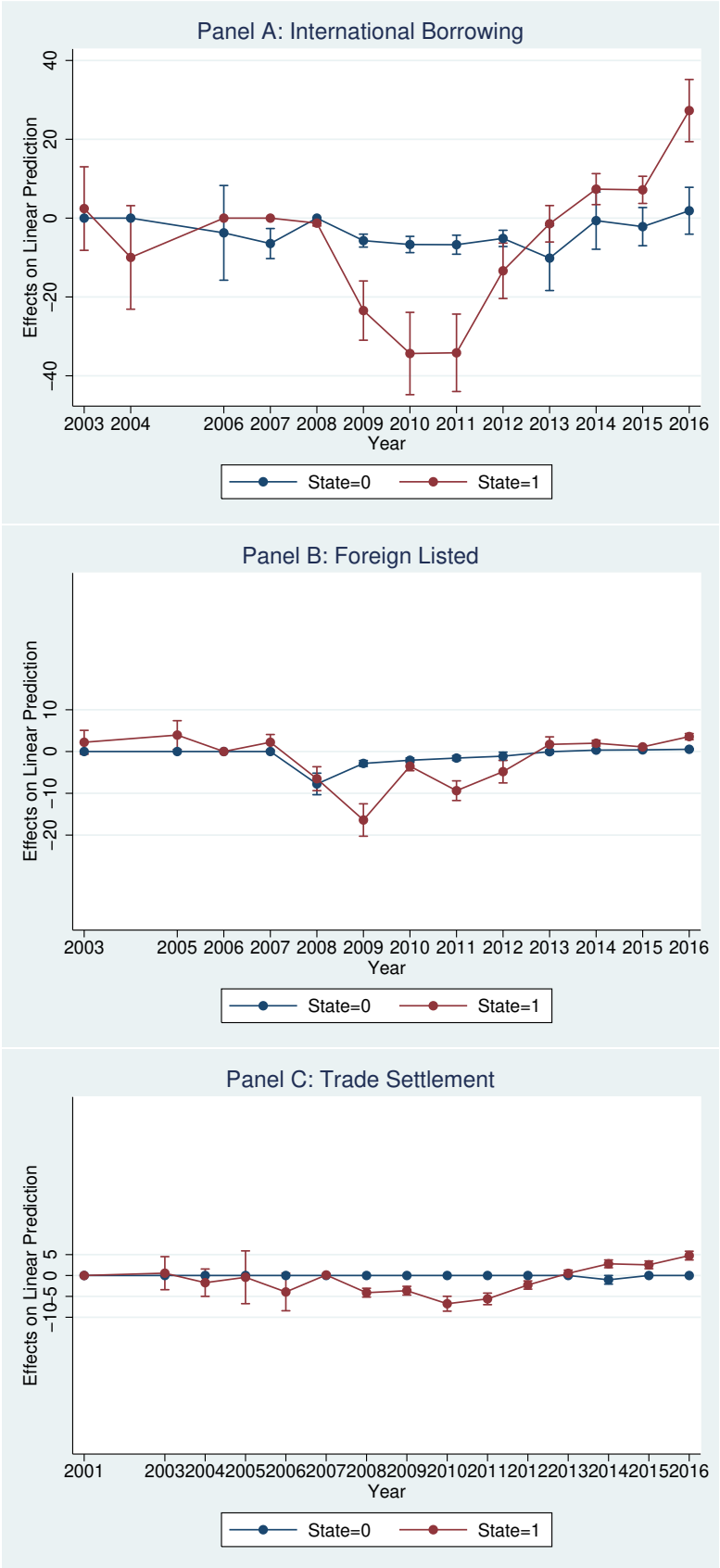


Figure 5: Parallel Trend

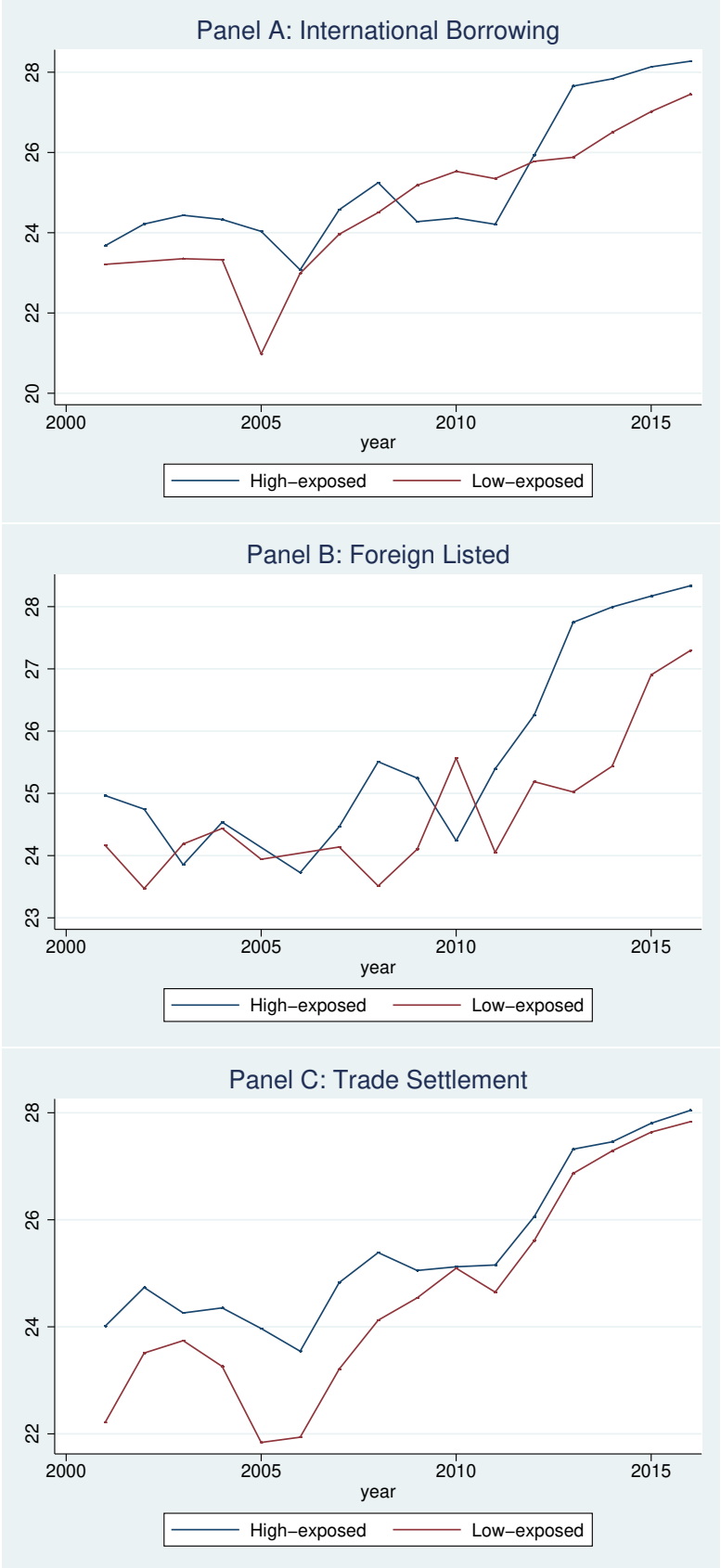
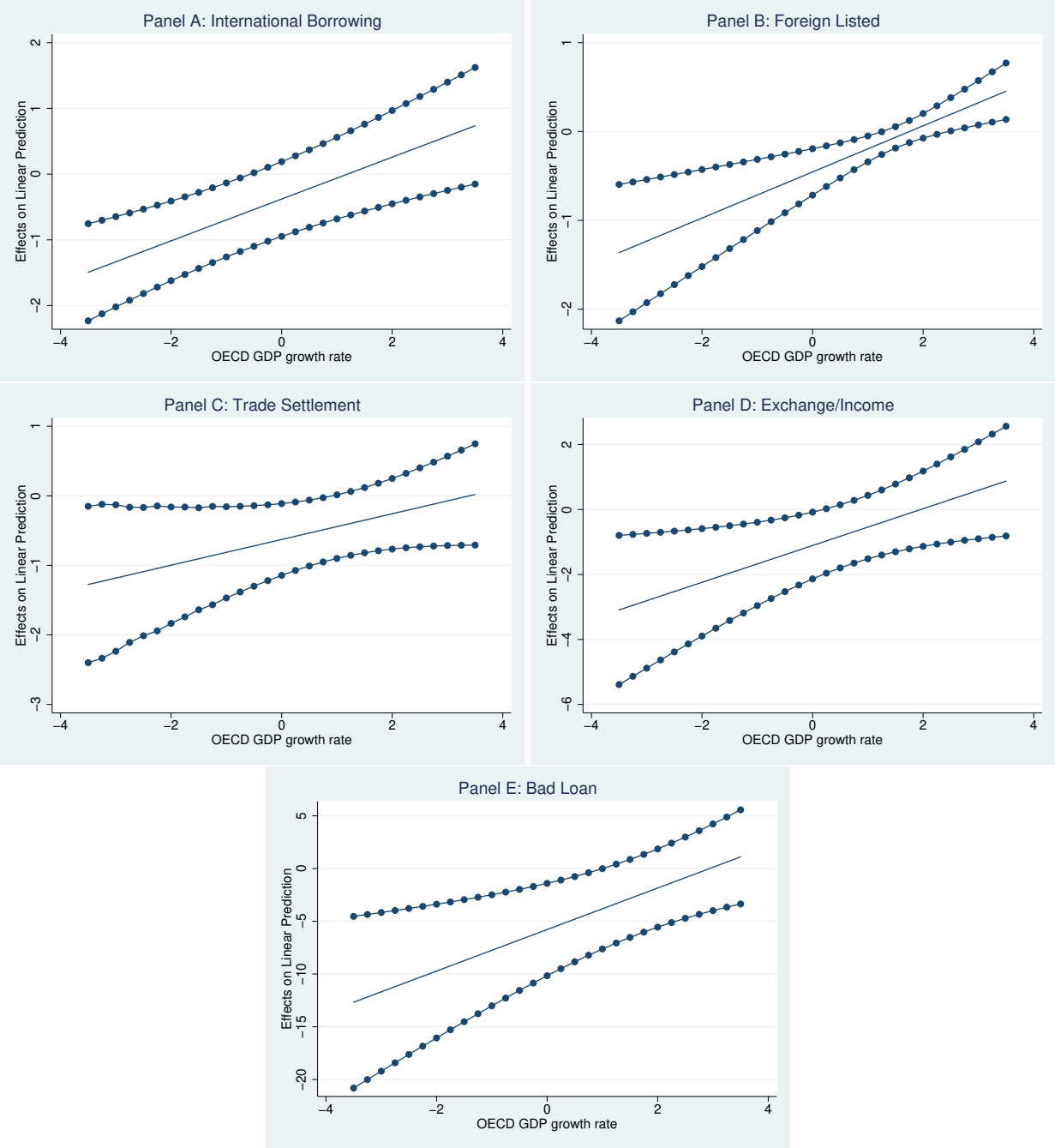


Figure 6: Marginal Effects



A Appendix Proofs

A.1 Proof of Proposition 1

Given $r^w > \frac{\beta(1+\rho)}{1+\rho-\delta}$ and $r > r^w$, we have $r > \frac{\beta(1+\rho)}{1+\rho-\delta}$,

$$r^w > \frac{\beta(1+\rho)}{1+\rho-\delta} \Leftrightarrow \frac{1+\rho-\delta}{\delta} - \frac{\beta}{r^w-\beta} > 0,$$

$$r > \frac{\beta(1+\rho)}{1+\rho-\delta} \Leftrightarrow \frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta} > 0,$$

$$r > r^w \Leftrightarrow \frac{\beta}{r-\beta} - \frac{\beta}{r^w-\beta} < 0,$$

$$\Rightarrow \frac{dr}{dr^w} = \frac{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r^w-\beta}}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}} > 0; \quad \frac{dr}{dr^w} - 1 = \frac{\frac{\beta}{r-\beta} - \frac{\beta}{r^w-\beta}}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}} < 0 \Rightarrow \frac{dr}{dr^w} < 1.$$

A.2 Proof of Proposition 2

Given $r^w > \frac{\beta(1+\rho)}{1+\rho-\delta}$ and $r > r^w$, we have $r > \frac{\beta(1+\rho)}{1+\rho-\delta}$,

$$r > \frac{\beta(1+\rho)}{1+\rho-\delta} \Leftrightarrow \frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta} > 0,$$

$$r > r^w \Leftrightarrow \frac{1+\rho-\delta}{\beta\delta}(r-r^w); \quad \frac{\beta}{r^w-\beta} - \frac{\beta}{r-\beta} > 0 \Rightarrow \frac{1+\rho-\delta}{\beta\delta}(r-r^w) + (\frac{\beta}{r^w-\beta} - \frac{\beta}{r-\beta}) > 0,$$

$$r^w > \frac{\beta(1+\rho)}{1+\rho-\delta} \quad and \quad r^w \approx r \Leftrightarrow \frac{\beta}{r^w-\beta} + \frac{1+\rho-\delta}{\delta}(\frac{r-r^w}{\beta} - 1) < 0,$$

$$\Rightarrow \frac{dr}{dR} = \frac{\frac{1+\rho-\delta}{\beta\delta}(r-r^w) + (\frac{\beta}{r^w-\beta} - \frac{\beta}{r-\beta})}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}} > 0; \quad \frac{dr}{dR} - 1 = \frac{\frac{\beta}{r^w-\beta} + \frac{1+\rho-\delta}{\delta}(\frac{r-r^w}{\beta} - 1)}{\frac{1+\rho-\delta}{\delta} - \frac{\beta}{r-\beta}} < 0 \Rightarrow \frac{dr}{dR} < 1.$$

A.3 Proof of Proposition 3

Given $c(s) > \beta = R - \gamma/\Delta\lambda > 0$, $0 < s < 1$, and $0 < \frac{dr}{dr^w} < 1$, we have

$$-\frac{\beta s}{(c-\beta)^2} < 0\,; \; -\frac{\beta(1-s)}{(c-\beta)^2}\frac{dr}{dr^w} < 0,$$

$$\Rightarrow \frac{\partial I}{\partial r^w} = -\frac{\beta s}{(c-\beta)^2} - \frac{\beta(1-s)}{(c-\beta)^2}\frac{dr}{dr^w} < 0,$$

$$(1 - dr/dr^w)(c-\beta) + 2(r - r^w)(s + (1-s)dr/dr^w) > 0\ ;\ (c-\beta)^3 > 0,$$

$$\Rightarrow \frac{\partial I^2}{\partial r^w \partial s} = -\beta\frac{(1 - dr/dr^w)(c-\beta) + 2(r - r^w)(s + (1-s)dr/dr^w)}{(c-\beta)^3} < 0.$$

A.4 Proof of Proposition 4

Given $c(s) > \beta = R - \gamma/\Delta\lambda > 0$, $0 < s < 1$, and $0 < \frac{dr}{dR} < 1$, we have

$$c - \beta(1-s)\frac{dr}{dR} > 0\ ;\ (c-\beta)^2 > 0,$$

$$\Rightarrow \frac{\partial I}{\partial R} = \frac{c}{(c-\beta)^2} - \frac{\beta(1-s)}{(c-\beta)^2}\frac{dr}{dR} > 0,$$

$$\beta dr/dR(c-\beta) > 0\ ;\ (r - r^w)(c + \beta - 2\beta(1-s)dr/dR) > 0\ ;\ (c-\beta)^3 > 0,$$

$$\Rightarrow \frac{\partial I^2}{\partial R \partial s} = \frac{\beta dr/dR(c-\beta) + (r - r^w)(c + \beta - 2\beta(1-s)dr/dR)}{(c-\beta)^3} > 0.$$

B Appendix: Structural Breaks

B.1 Detection for the Structural Breaks

The goal of this analysis is to detect the structural breakpoints for the Chinese bank lending channel. We conduct the structural Wald test for each period, respectively. Figure B.1 plots the Wald test statistics of the change-point diagnostics. First, we use international borrowing to measure international exposure. The Wald test statistic is above the 95% critical value for the year 2009 and 2013-2016, implying two structural breakpoints, the year of 2009 and 2013.[16] Secondly, we choose foreign listed to measure external exposure, the Wald test statistic is above the 95% critical value for the year 2008-2009 and 2013-2016, implying two structural breakpoints, the year of 2008 and 2013. Thirdly, we change the exposure measurement to trade settlement, the Wald test statistic is above the 95% critical value for the year 2008 and 2013-2016, implying two structural breakpoints, the year of 2008 and 2013.

B.2 Techniques for Structural Breaks

Denote the sample period as $t = 1, ..., n$, the break date (date of the change) as T_1, the full break model could be written as

$$\begin{aligned} Y_1 &= X_1\beta_1 + e_1; \\ Y_2 &= X_2\beta_2 + e_2, \end{aligned} \tag{36}$$

or

$$y_t = \beta_1' x_t 1(t \leq T_1) + \beta_2' x_t 1(t > T_1) + e_t, \tag{37}$$

where $Y_1 = (y_1, ..., y_{T_1})'$, $Y_2 = (y_{T_1+1}, ..., y_n)'$, $y_t = Log(loan_t)$, $X_1 = (x_1, ..., x_{T_1})'$, $X_2 = (x_{T_1+1}, ..., x_n)'$, x_t = (1, Exposure Measurement, Size, Policy, Rural, ROA, Bad Loan)$'_{t-1}$, $e_1 = (\epsilon_1, ..., \epsilon_{T_1})'$, $e_2 = (\epsilon_{T_1+1}, ..., \epsilon_n)'$. Thus we have

$$\begin{aligned} \hat{\beta}_1 &= (X_1'X_1)^{-1}(X_1'Y_1); \\ \hat{\beta}_2 &= (X_2'X_2)^{-1}(X_2'Y_2). \end{aligned} \tag{38}$$

Assume break dates are unknown; the null hypothesis is $\beta_1 = \beta_2$, we use the standard

[16] In the years of 2014-2016, hypothesis H_0 is also rejected. But we drop them because consecutive break points imply the same structural break.

linear hypothesis test (Wald test). The Wald test statistic is

$$W(T_1) = n(\hat{\beta}_1 - \hat{\beta}_2)'(\hat{V}_1 \frac{n}{T_1} + \hat{V}_2 \frac{n}{n - T_1})^{-1}(\hat{\beta}_1 - \hat{\beta}_2), \tag{39}$$

where $\hat{V}_1$ and $\hat{V}_2$ are standard asymptotic variance estimators for $\hat{\beta}_1$ and $\hat{\beta}_2$ (on the split samples):

$$\begin{aligned} \hat{V}_1 &= \hat{Q}_1^{-1}\hat{\Omega}_1\hat{Q}_1^{-1}; \\ \hat{V}_2 &= \hat{Q}_2^{-1}\hat{\Omega}_2\hat{Q}_2^{-1}, \end{aligned} \tag{40}$$

and

$$\begin{aligned} \hat{Q}_1 &= \frac{1}{T_1}X_1'X_1; \\ \hat{Q}_2 &= \frac{1}{n - T_1}X_2'X_2. \end{aligned} \tag{41}$$

We assume that e_t is independent identical distributed, thus

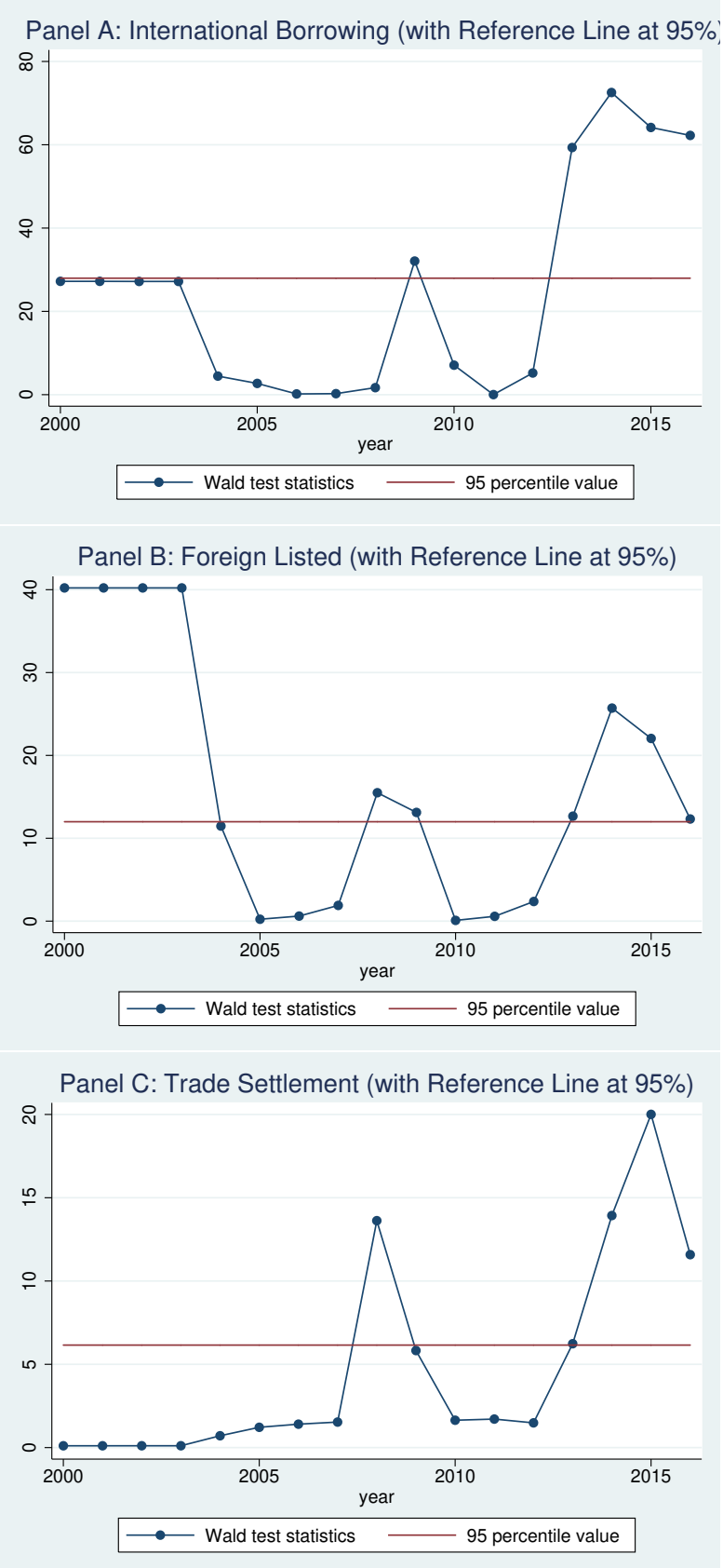
$$\begin{aligned} \hat{\Omega}_1 &= \frac{1}{T_1 - k}(\hat{e}_1'\hat{e}_1)\hat{Q}_1; \\ \hat{\Omega}_2 &= \frac{1}{n - T_1 - k}(\hat{e}_2'\hat{e}_2)\hat{Q}_2. \end{aligned} \tag{42}$$

Under H_0, if the number of observations pre- and post-break are large, then under homoskedasticity, and in general

$$W(T_1) \longrightarrow_d \chi_k^2, \tag{43}$$

where k represents the number of the independent variables, we have $k = 7$. We can reject H_0 in favor of H_1 if the test exceeds the critical value, thus "find a break" if the test rejects.

Figure B.1: Structural-break Wald Statistic Plot



C Appendix to Tables and Figures

Table C.1: The Bank Lending Channel—Alternative Specification I

Log(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (Foreign Listed)	(4) Exposure (Foreign Listed)	(5) Exposure (Trade Settlement)	(6) Exposure (Trade Settlement)
Bad Loan	-1.352	-1.410	-2.049**	-1.151	-2.095*	-2.335
	(1.351)	(1.854)	(0.960)	(1.222)	(1.080)	(1.861)
Bad Loan x OECD	0.0523	0.392	0.129	0.344	0.120	0.432
	(0.376)	(0.605)	(0.267)	(0.581)	(0.343)	(0.571)
Exposure	-2.194***	-2.515***	-0.252	-0.0503	-0.877	-1.243**
	(0.509)	(0.514)	(0.200)	(0.172)	(0.650)	(0.622)
Exposure x OECD growth rate	0.0139	0.0115	0.0775	0.0376	1.204***	1.333***
	(0.163)	(0.175)	(0.0900)	(0.0771)	(0.324)	(0.316)
Exposure x OECD x State-owned	1.659***	1.883***	0.472***	0.529***	1.073***	1.106***
	(0.360)	(0.359)	(0.171)	(0.201)	(0.190)	(0.188)
Observations	15503	15503	20528	20528	19144	19144
R^2	0.623	0.593	0.606	0.574	0.607	0.573
Bank Controls	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO	YES	NO
Clusters at Bank Level	132	132	177	177	170	170

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the level of log loan volume. Bank Controls includes Size, Policy, Rural, Tangibility, Roa, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table C.2: The Bank Lending Channel—Alternative Specification II

dLog(Loan)	(1) Exposure (International Borrowing)	(2) Exposure (International Borrowing)	(3) Exposure (Foreign Listed)	(4) Exposure (Foreign Listed)	(5) Exposure (Trade Settlement)	(6) Exposure (Trade Settlement)
Bad Loan	1.095	0.900	0.136	0.869	0.589	1.098
	(1.420)	(1.477)	(1.811)	(1.083)	(1.379)	(1.321)
Exposure	-0.584	-0.748	-1.141	-0.853	-3.422	-3.764**
	(0.616)	(0.752)	(3.145)	(1.573)	(2.205)	(1.777)
Exposure x Crisis	-0.970	-0.645	-1.192	-0.839	-0.421	-0.0993
	(0.692)	(0.778)	(3.201)	(1.540)	(0.458)	(0.430)
Expo. x Crisis x State-owned	-4.379*	-3.024	-1.017	-0.664	-4.802**	-4.720**
	(2.565)	(1.977)	(0.773)	(1.054)	(2.407)	(1.956)
Expo. x Post	0.581	1.468	1.150	0.872	0.0506	0.0265
	(0.972)	(1.092)	(3.149)	(1.582)	(0.0433)	(0.0294)
Expo. x Post x State-owned	3.030***	2.592**	0.221*	0.314**	3.996*	4.439**
	(1.077)	(1.023)	(0.112)	(0.132)	(2.210)	(1.753)
Observations	6903	6903	9212	9212	5818	5818
R^2	0.426	0.198	0.390	0.184	0.417	0.180
Bank Controls	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	NO	YES	NO	YES
Year Fixed Effect	NO	YES	NO	YES	NO	YES
Firm-Year Fixed Effect	YES	NO	YES	NO	YES	NO
Clusters at Bank Level	109	109	135	135	103	103

Notes. This table presents the results of a Chinese bank lending channel regression. The unit of observation is a bank-firm-year. The dependent variable is the growth rate of the loan volume. Bank Controls includes Size, State-owned, Policy, Rural, Tangibility, ROA, Cash Flow, Borrowings from the Central Bank. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the bank-level.

Table C.3: The Firm Borrowing Channel—Fixed Effects Estimates

Panel A: International Borrowing	(1) Net Debt	(2) Cash	(3) Employment	(4) Capital Investment
$\overline{\textit{International Borrowing}}$	-5.362**	0.708	0.115	-8.104
	(2.400)	(1.465)	(0.965)	(4.944)
$\overline{\textit{International Borrowing}}$ x OECD GDP G.R.	-0.171	0.320**	0.215**	2.083***
	(0.243)	(0.138)	(0.0953)	(0.526)
Observations	6841	7060	7053	4197
R^2	0.756	0.823	0.871	0.652
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1967	1992	1991	1657
Panel B: Foreign Listed				
$\overline{\textit{Foreign Listed}}$	0.0822	-1.748***	-1.014***	-1.605
	(0.0691)	(0.421)	(0.300)	(1.358)
$\overline{\textit{Foreign Listed}}$ x OECD GDP G.R.	-0.0578***	0.288**	0.220***	1.484***
	(0.0202)	(0.118)	(0.0801)	(0.448)
Observations	5842	6249	6310	3772
R^2	0.777	0.840	0.885	0.666
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1321	1902	1911	1573
Panel C: Trade Settlement				
$\overline{\textit{Trade Settlement}}$	0.0283	0.166	-0.0516	0.285
	(0.0188)	(0.117)	(0.0816)	(0.353)
$\overline{\textit{Trade Settlement}}$ x OECD GDP G.R.	-0.0544***	0.320***	0.229***	1.393***
	(0.0191)	(0.114)	(0.0745)	(0.422)
Observations	6214	6660	6720	3993
R^2	0.772	0.834	0.886	0.663
Firm Controls	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES
Clusters at Firm Level	1349	1943	1952	1611

Notes. This table presents the results of a Chinese firm borrowing channel regression. The unit of observation is a firm-year. The dependent variable is the net debt, cash/asset, log employment, and capital investment/asset. Firm Controls include Sales, Cash Flow, Size, State-owned, Tangibility, ROA. All variables are defined in Table 1. All regressions include fixed effects. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively. Robust standard errors given below coefficient estimates are clustered at the firm-level.