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State ownership, cross-border acquisition, and risk-taking: Evidence from China's banking industry ☆

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ABSTRACT

Does state ownership breed risk-taking behavior in commercial banks? This paper examines this issue using a panel of Chinese banks. We find that state-ownership is in general associated with higher risks. In addition, we find that banks controlled by the central government have the highest credit risk, while those owned by local governments have the lowest capital adequacy ratio and liquidity ratio. By compiling a complete list of cross-border acquisitions in China's banking sector, we investigate the impact of foreign acquisition on state-owned banks' risk-taking using differences-in-differences and matching estimators. We find that foreign acquisition has a reducing effect on state-owned banks' risk-taking and this effect is particularly significant for banks that are controlled by central or local government. We also find that this risk-reducing effect depends on the percentage of foreign ownership, the local business involvement of the foreign investors, and the number of foreign members on the banks' boards of directors.

1. Introduction

Ownership structure is often viewed as an instrumental determinant of bank performance and risks in the finance and economics literature. In many countries, the banking industry operates under a two-tier ownership structure consisting of state (or publicly)-owned banks and privately-owned banks. State-ownership in the banking sector is pervasive all over the world, especially in developing countries, in the form of either partial or whole state ownership (Porta et al., 2002). According to Gonzalez-Garcia and Grigoli (2013), states control about 21% of the assets in the global banking sector. The existing literature has established a negative linkage between state ownership and performance in the banking sector (Bonin et al., 2005a,b; Berger et al., 2005, 2009; Cornett et al., 2010; Lin and Zhang, 2009; Unite and Sullivan, 2003; Sapienza, 2004; Stiglitz, 1993). To our knowledge, however, insufficient prior studies have focused on the direct link between banks' state-ownership and risk-taking in China.

The ownership literature has provided two contrasting predictions on bank ownership and risk-taking behavior. The first view is based on theories of *agency cost*, *moral hazard*, and *social lending*, and argues that state-ownership is associated with higher risk-taking as state-owned banks are more likely to suffer from inefficient resource allocation and weak managerial incentives, and are more likely to take on socially beneficial projects (Atkinson and Stiglitz, 1980; Barry et al., 2011; Berger et al., 2005; Merton, 1977; Sapienza, 2004; Shleifer and Vishny, 1986, 1997; Stiglitz, 1993). The alternative view is based on the theories of *market risk* and *soft budget constraint*. The *soft budget constraint* theory argues that state-owned banks utilize their political connections to receive government support such as source of finance and non-performing loan resolution, which may lead to reduction in measured risks. Using samples of large European banks, Iannotta et al. (2007) and Iannotta et al. (2013) find that on average, government-owned banks have a lower default risk than their

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private counterparts, and this lower default risk derives from governmental support. In addition, the theory of *market risk* argues that foreign banks, when compared with local banks, are more susceptible to risks as they are more likely to be disadvantaged in the host-country market in terms of language, culture, informal institutions, regulations, legal system as well as the extent of market imperfections and asymmetric information problems (Amihud et al., 2002; Berger et al., 2000, 2013; Buch and DeLong, 2004; Gleason et al., 2006; Iannotta et al., 2007; Méon and Weill, 2005; Winton, 1999). The implication of the argument is that domestic banks are less risky than foreign banks. In China, at least for now, domestic banks are synonymous to state-owned banks. Thus the second view predicts that state-owned banks in China have lower risk measures than their foreign-owned counterparts.

Using data of 123 banks in China from the year 2000 to 2013 with different risk measures including credit risk, capital adequacy ratio, return volatility, and liquidity coverage ratio, we examine which of the two arguments above warrant empirical support in explaining the difference in risk-taking between state-owned and foreign banks in China. Our results show that state-owned banks in general have higher risks compared with foreign banks. We further test if the risk-taking behavior is homogeneous across different types of state-owned banks. By comparing three major types of state-owned banks in China, namely the Big Five, joint-stock banks, and city and rural commercial banks, with their foreign counterparts, we find that the city and rural commercial banks exhibit relatively higher level of credit risk, lower capital adequacy ratio, and lower liquidity ratio. The Big Five exhibit higher credit risk and return volatility than foreign banks, while the joint-stock banks have higher return volatility and lower capital adequacy ratio compared with foreign banks.

The existing literature has largely ignored partial private ownership in state-owned banks. Most of the existing literature has been focusing on the privatization in the banking sector and its outcomes in terms of risk and efficiency improvement (Boubakri et al., 2005; Bonin et al., 2005a,b; Otchere, 2005). For example, Boubakri et al. (2005) document that privatization yields significant improvement in economic efficiency and credit risk in the long-term with a sample of 81 banks from 22 developing countries. Also, banks that are controlled by industrial groups become more exposed to credit risk and interest rate risk after privatization. Starting from 1996, foreign investors are allowed to purchase shares of state-owned banks in China. Examining the effect of foreign minority ownership on the risk-taking behavior of state-owned banks can shed light on our understanding of the relationship between foreign acquisition and bank risk-taking. According to the literature, under the *learning effect*, foreign acquisition is a potential source of capital and advanced knowledge, which are presumably beneficial to the FDI recipients (Aggarwal et al., 2011; Blomström, 1986; Buckley et al., 2007; Kokko, 1994; Spencer, 2008; Wei and Liu, 2006; Zhang and Li, 2010). The *monitoring effect* also suggests that institutional investors can serve as active outside monitors of the target firms and improve firms risk management (Holmström and Tirole, 1993; Tirole, 2001, 2010). We examine the role of foreign minority shareholder in state-owned banks' risk-taking using both the OLS and the matching estimator (ME) approaches. We find that the foreign investors are effective in lowering the risk measures of the acquired state-owned banks, in terms of both capital and liquidity buffers. Among the three types of state-owned banks, the Big Five and city and rural commercial banks benefited more from foreign acquisition.

Our paper relates to the existing literature along the following dimensions. First, our study bridges a gap in the emerging market banking literature by investigating the relations between bank state ownership and risk-taking behavior. We distinguish different types of government ownership and examine their risk patterns separately. Second, we look at how foreign ownership within state-owned banks in China affects their risk-taking and how this foreign acquisition effects vary across different types of state-owned banks. The results are important to understand the relationship between banks' ownership and their risk-taking behavior. Not only do we find that banks' ownership matters in determining the levels of their risk-taking, we also find that changes in banks' ownership type is associated with changes in their risk-taking behavior, possibly through the monitoring of new shareholders.

We proceed as follows. We provide some background information about China's banking industry in Section 2. Our hypotheses development are presented and discussed in Section 3. Section 4 describes the data and construction of different risk measures. Section 5 presents the empirical strategies and results. Robustness checks are conducted in Section 6. Session 7 reports extensional tests. Section 8 concludes.

2. Background of China's banking industry

China's banking industry is the largest and most complex among developing countries. There are several milestones in the institutional reform of China's banking sector in the past few decades. Before the economic reform started in 1978, there was only one bank in China – the People's bank of China (PBC), which functioned as both the central bank and a commercial bank (a mono-bank model). Since 1978, four big state-owned banks were established, including Bank of China (BOC), China Construction Bank (CCB), Agriculture Bank of China (ABC), and Industrial and Commercial Bank of China (ICBC)(commonly known as the "Big Four" in China). These banks, fully controlled by the government, were designated to serve specific economic sectors. In 1986, another major state-owned bank, Bank of Communications (BOCOM), was established, thus turning the "Big Four" into the "Big Five". During the late 1980s to early 1990s, joint-equity banks, such as CITICS and China Everbright Bank, were founded by raising money from both SOEs and the private sector. They are not completely privately owned, and the government's stakes in them are significantly less than those in the "Big Five". A number of smaller local banks and local microcredit companies have also started to develop around the same time. Since 1996 foreign banks were permitted to make deposits and loans in the local currency. Asian Development Bank's purchase of a 1.9% stake in China Everbright Bank, a major joint-stock bank, in 1996 was the first case of foreign acquisition in China's state-owned commercial banks. In 1999, as a part of government support for the state-owned banks, China established four asset management corporations to take over the non-performing loans (NPLs) (totaling 1.4 trillion RMB) from major state-owned banks at the face value.

China's banking sector reform has accelerated since China joined the WTO in 2001. Foreign banks have been allowed complete entry to the Chinese market in 2006. In the meantime, restrictions on foreign acquisition in Chinese banks have been relaxed. As of 2014, foreign investors can own up to 25% collectively of any domestic bank and up to 20% for any single foreign investor.

China's banking sector is categorized as follows[1]:

1. The Big Five. These are the major players in China's banking sector, providing nationwide wholesale and retail banking services. The central government has controlling ownership in these banks. The total assets (as of end-2013) of the Big Five are RMB 65,600.5 billions (approximately 43.34% of the total assets in the banking sector in 2013).

[1] Data are from China Banking Regulatory Commission (CBRC) 2013 Annual Report.

2. Joint-stock banks. There are 12 nationwide joint-stock banks in China. They are owned jointly by the government, the private sector, and foreign investors. They are mainly different from the Big Five in the following two aspects. First, they are smaller in asset size. Second, the ownership structure of these banks is more diversified when they were established. Most of the joint-stock banks are controlled by state-owned enterprises (SOEs) rather than directly by the central government. The total assets (as of end-2013) of the 12 joint-stock banks were RMB 26,936.1 billions (approximately 17.80% of the total assets in the banking sector in 2013).
3. City and rural commercial banks. Their main business focus is on local economic development and small-and-medium-sized enterprises (SMEs). They are controlled by provincial, municipal, or other local governments, and local SOEs. At the end of 2013, there were 735 city and rural commercial banks with assets totaling RMB 24,931.8 billions (approximately 16.47% of the total assets in the banking sector in 2013).
4. Foreign banks. They provide services to multinational enterprises and increasingly to local clients. At end-2013, there were 42 locally incorporated foreign financial institutions with total assets of RMB 2,562.8 billions (approximately 1.69% of the total assets in the banking sector in 2013).

There are also three policy banks established in 1994 by the State Council to take over the government's policy lending. They each have different focus in their lending, such as promoting and financing the construction of infrastructure, agricultural development, or exports. The total asset size of the three policy banks is RMB 12,527.8 billions (as of end-2013). Due to their strong policy orientation, which are quite different from the commercial banks, policy banks are not included in our study.

China continues its efforts in banking reforms by liberalizing lending and deposit rates, reducing the share of government-directed lending, and opening up the capital account. Since ownership structure is one of the key issues in the reform, the findings of our study provide important references for the ongoing banking reform in China and the rest of the world in general.

3. Theory and hypotheses

Two strands of theories on the relationship between firm ownership and risk-taking guide our analysis of bank risk-taking behavior. The first one includes the theories of *agency cost*, *moral hazard*, and *social lending*. They predict that government ownership leads to higher bank risk-taking. According to the *agency cost* theory, managers/bureaucrats who are running the state-owned firms do not own the assets. They exert less managerial effort and divert more resources for personal career concerns than their private counterparts. Those weak managerial incentives and misallocation of resources caused by the manager–owner conflict imply higher risk-taking and inferior performance of state-owned banks (Barry et al., 2011; Berger et al., 2005; Iannotta et al., 2007; Sapienza, 2004; Shleifer and Vishny, 1986, 1997). According to the *moral hazard* theory, state-owned banks do not fully bear the consequences of the risks they are taking and are, therefore, more likely to engage in higher risk-taking activities. Moral hazard occurs when a party has a higher tendency to involve in risk-taking behavior because the costs that could incur will not be felt by the risk-taking party. The decision maker is thus isolated from the risks and behaves differently from one who is fully exposed to the risks, and this difference usually relates to irresponsible or risky behaviors. From this perspective, one important merit of the state ownership in many countries (both developed and developing) is that the government acts as a protector for the SOEs. This protection includes stripping off non-performing assets, infusing capital, or direct bailout when facing bankruptcy. Hence, the bailout expectation of state-owned banks becomes an incentive for managers to take on excessive risks at the expense of the deposit insurer and ultimately the taxpayer (Merton, 1977). The *social lending* theory, suggests that state-owned banks are not purely profit-driven since they have social welfare objectives as well. Different from private firms, SOEs are created to address market failures whenever the social benefits exceed the costs (Atkinson and Stiglitz, 1980). For the banking sector, the social lending argument states that government-owned banks contribute to economic development and improve general welfare (Stiglitz, 1993). In general, state-owned banks are more likely to take on projects that are "socially" beneficial, such as agricultural development and infrastructure construction, which may generate insufficient cash flows for repayment and have high probability of default. Under this hypothesis, large state-owned banks might have an inferior performance along with higher risks compared with their counterparts in the private sector because of the socially profitable projects that they are involved in.

The second strand of theories, as represented by the *market risk* theory and the *soft budget constraint* theory, suggests that foreign banks tend to have higher risks than domestic state-owned banks. The *market risk* theory argues that foreign banks may have higher risks due to host country market-specific factors (Amihud et al., 2002; Berger et al., 2013; Méon and Weill, 2005; Winton, 1999). Market factors such as language, culture, informal institutions, regulations, legal system as well as the extent of market imperfections and asymmetric information problems in the host countries impose potential challenges on the risk management for foreign banks (Berger et al., 2000, 2013; Buch and DeLong, 2004; Gleason et al., 2006). In addition, to conquer these market differences, foreign banks from a different market environment need to exert more effects in gathering locally-based information and creating lending relationships than domestically-owned banks (Berger et al., 2001). Alternatively, the theory of *soft budget constraint* entails that state-owned banks may exhibit lower risk-taking compared with foreign banks due to the advantages that come with the government ownership. The soft budget constraint syndrome arises when a funding source finds it impossible to keep an enterprise (i.e. a state-owned enterprise) to a fixed budget (Kornai, 1980; Maskin, 1996). These firms are always bailed out with financial subsidies or other instruments and could count on surviving even after chronic losses (Kornai et al., 2003). In the same token, state-owned banks are perceived to enjoy advantages of government support in the forms of direct capital injection, explicit or implicit guarantees, and non-performing loan resolution. As such, we may observe a lower level of measured risks for state-owned banks compared with their foreign competitors. However, the expectation of government support and bail-out may also lead to higher risk-taking behavior due to moral hazard. Nier and Baumann (2006) provide evidence that implicit government support exacerbates banks' risk-taking incentives. Banks that are under government safety net choose lower capital buffers, while those subject to stronger market discipline result in higher capital ratios. Therefore, the prediction for state-owned banks' risk-taking based on the soft budget constraint theory is ambiguous.

In the context of China's banking sector, with the absence of domestic private-owned banks, foreign ownership serves as the alternative to government ownership.[2] We analyze the relationship

[2] The difference in risk-taking behavior between foreign banks and state-owned banks may be viewed from two perspectives: foreign versus domestic banks, and privately owned versus state-owned banks. However, given the ownership structure in China's banking sector, foreign banks represent the private sector as there is only one privately owned domestic bank. Due to the unique nature of China's banking industry, we are unable to distinguish these two differences in our analysis.

between state-ownership and risk-taking by comparing the level of risk-taking of state-owned banks versus foreign banks in China, conditional on bank-level characteristics. Based on the literature, we propose our first set of hypotheses (Hypothesis 1A – 1B) as follows:

Hypothesis 1A. State-owned banks in China have *higher* risks than foreign banks.

Hypothesis 1B. State-owned banks in China have *lower* risks than foreign banks.

We next consider the effect of foreign acquisition (i.e. minority shares held by foreign investors) on state-owned banks' risk-taking in China. State-owned banks with foreign minority shareholder may have lower level of risk-taking due to two effects – the *learning effect* and the *monitoring effect*. According to the *learning effect* argument, foreign acquisition is not only a source of external financing, but also a potential source of advanced knowledge, which is presumably beneficial to the investment recipients (Aggarwal et al., 2011; Blomström, 1986; Buckley et al., 2007; Kokko, 1994; Spencer, 2008; Wei and Liu, 2006; Zhang and Li, 2010). Here, the advanced knowledge can be broadly defined to include assistance with strategic management decision-making, operational practices and financial product innovations. The CBRC recognizes that the partnership with foreign institutional investors has helped Chinese banking institutions to bolster their corporate governance, operational management, risk controls, business performance and product innovation (CBRC Annual Report 2010). Regarding the host/home country institutional environment, Aggarwal et al. (2011) argue that international institutional investors from countries with strong shareholder protection export good corporate governance practices. This effect is especially strong when the investor protection in the institution's home country is stronger than the one in the host country. The *monitoring effect* argument suggests that institutional investors can serve as outside monitors of the target firms and improve firms' management. For instance, monitors may turn down projects that are associated with high risks or low returns, and may reduce moral hazard by preventing the most egregious forms of misbehavior (Tirole, 2001).

Alternatively, one may argue that foreign minority shareholder may not have much influence on the risk-taking of state-owned banks. First, the *learning effect* of the target firm depends on its absorptive capacity (i.e. the ability to assimilate new information), human capital and its technological distance between itself and the investor (Blalock and Gertler, 2009; Cohen and Levinthal, 1990). Second, the *monitoring effect* of foreign investors may not benefit state-owned banks if the monitoring is passive instead of active. The existing literature has distinguished two forms of monitoring, active and passive (or speculative), on the basis of two types of monitoring information, prospective and retrospective (Holmström and Tirole, 1993; Tirole, 2010). Active monitoring is forward looking and analyzes firms' past behavior so as to improve firms' prospects. However, passive (speculative) monitoring is partly backward looking and is less likely to increase firm value. The purpose of the passive monitoring is to maximize portfolio return without any intent to intervene in firms' management.

We test empirically the effect of foreign acquisition on banks' risk measures and try to understand which of the two contrasting views finds more empirical support. Our second set of hypotheses (Hypothesis 2A – 2B) is as follows:

Hypothesis 2A. The foreign minority ownership *improves* the risk management of the state-owned banks in China.

Hypothesis 2B. The foreign minority ownership has *no effect* on risk-taking of the state-owned banks in China.

The predictions of our Hypotheses are summarized in Table 1. Fig. 1 shows the decomposition of banks in our sample by ownership: foreign banks, and state-owned banks with and without foreign investment. Our first set of hypotheses compares the risk-taking behavior between foreign banks (area *a* in Fig. 1) and state-owned banks (areas *b*, *c*, and *d* in Fig. 1). Our second set of hypotheses examines the effect of foreign investment in state-owned banks by comparing their risk-taking level with (area *c* in Fig. 1) and without (areas *b* and *d* in Fig. 1) the foreign investment, conditional on bank-level characteristics. To ensure a proper comparison, we also conduct a validity test to make sure that state-owned banks with foreign investment (area *b* in Fig. 1) are not fundamentally different from those that have never received foreign investment (area *d* in Fig. 1).

4. Data, variables, and summary statistics

4.1. Sample banks

We construct an unbalanced panel of 123 banks in China from the year 2002–2013 with data from the Bureau van Dijk Bankscope, the Thomason Reuters SDC Platinum and the S & P Capital IQ.[3] To ensure the completeness and accuracy of our dataset, we also refer to the annual issues of Almanac of China's Finance and Banking, the annual reports provided by individual banks, and press releases of the banks for some missing data points in the original series acquired from the main data sources mentioned above.

We have state-owned banks and foreign banks in our sample. We follow Volpin (2002) and define banks as state-owned banks if one of the following conditions is met: (1) The Global Ultimate Owner (GUO) information in Bankscope identifies the state (central or local government) or a state-owned enterprise as an ultimate owner of that bank; (2) state and state-owned enterprises jointly own the largest percentage of equity in that bank compared to other private owners (when the GUO information is not available). When the ownership information for a bank is not available, we checked each individual bank's annual report/shareholder information or other publicly available data to obtain ownership of the bank. Similarly, we define banks as foreign banks if the GUO information in Bankscope identifies a foreign entity as an ultimate owner.

In order to study the differences in state-owned banks' risk-taking due to differences in their government ownership, we have grouped the state-owned banks in our sample into different government ownership categories: the Big Five, joint-stock commercial banks, and city and rural commercial banks.[4] We winsorize the top and bottom 5 percentiles in the distributions of the risk-taking measures to eliminate the impact of outliers.[5] We exclude bank-year observations for which information on our main variables is not available. We only include banks with at least 5 years of observations to mitigate potential selection problems associated with our unbalanced panel.[6]

[3] The panel is unbalanced, meaning different banks might have different years of observations. The original data set was from 2000. The first two years of the observations are dropped due to standard deviation calculation for one of our dependent variables.

[4] We exclude three policy banks and one private bank (i.e. China Minsheng Bank) from our estimation sample and focus on the comparison between state-owned banks and foreign banks in China. There are three city commercial banks that were jointly established by foreign and Chinese companies in our sample with more than 50% of foreign ownership (i.e. Xiamen International Bank, and First Sino Bank), and we treat them as foreign banks. We also exclude four foreign state-owned banks in our sample, including Royal Bank of Scotland, Woori Bank, Chinese Mercantile Bank, and Industrial Bank of Korea.

[5] Similar results are obtained if we use different degrees of winsorization or instead trim 5% of the extreme data points.

[6] Our main results are robust to alternative sample restriction criteria. The results are similar if we include the full sample or include banks with at least 6 years or 7 years of observations. Banks are observed for a mean of 8.96 yeas and a median of 9 years in our estimation sample.

Table 1
Hypothesis development.

Hypothesis 1: Risk-taking comparison between state-owned and foreign banks		
	Risk-taking	
	State-owned banks	Foreign banks
Agency cost theory	Higher	Lower
Moral hazard theory	Higher	Lower
Social lending theory	Higher	Lower
Market risk theory	Lower	Higher
Soft budget constraint theory	Unknown	Unknown

Hypothesis 2: Treatment effect of foreign minority ownership		
	Risk-taking	
	State-owned banks without foreign ownership	State-owned banks with foreign ownership
Learning effect	Unknown	Unknown
Monitoring effect (active)	Lower	Higher
Monitoring effect (passive)	Unchanged	Unchanged

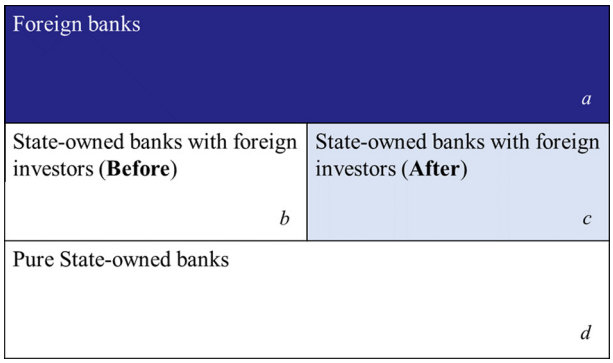

Fig. 1. Comparison groups for empirical testing.

4.2. Bank-level measures

4.2.1. Measures of risk-taking

Different measures of banks' overall risk are discussed extensively in the literature, including credit risk, capital adequacy, return volatility, and liquidity risk. These different measures of risk-taking are the outcome variables that we would like to study in this paper.

The non-performing loan (NPL) ratio is widely used in the literature to measure banks' credit risk (e.g. Salas and Saurina, 2002; Barth et al., 2004; Gonzalez, 2005; Berger et al., 2005; Lin and Zhang, 2009). A higher NPL ratio is presumably a result of more risk-taking of the bank.

We also consider banks' return volatility as another risk measure. Following Saunders et al. (1990), Laeven and Levine (2009) and Pennathur et al. (2012), we measure return volatility as σ(ROE) with a 3-year rolling window. The higher σ(ROE), the higher the return volatility of a bank.

Capital adequacy captures another important aspect of bank risks. It evaluates the extent to which a bank can absorb potential losses (Berger and Roman, 2013). We use the total capital ratio as a measure for banks' capital adequacy, which is the amount of a bank's core capital expressed as a percentage of its risk-weighted assets. A higher capital adequacy ratio indicates lower banks' risks.

The liquidity measure is our fourth bank risk measure. Banks that are more liquid tend to be less risky. The liquidity coverage ratio (LCR) is often used as a measure for banks' liquidity risk. According to the Basel Committee on Banking Supervision (Basel Committee, 2011), a bank's LCR is defined as its ability to use the high quality liquid assets to offset the net cash outflows in a short period of time (e.g. 30 days). Due to data limitation, we adopt a static measure for banks' liquidity using the standard balance sheet data. Our liquidity measure is defined as the liquid assets to deposit and short-term debt ratio. This approach still well-captures the essence of banks' liquidity risk as liquid assets such as reserves and other short-term government debt can be converted easily and quickly into cash to meet the minimum liquidity demand from the demand deposits or short-term debt. In other words, banks' liquidity risk in this case refers to the extent to which the liquidity supply from the readily available funds can meet the liquidity demand (Gorton and Huang, 2002).[7]

4.2.2. Control variables

Bank-level characteristics are included as controls. We include bank size, measured by the logarithm of banks' total assets (*Log assets*) as adopted in McAllister and McManus (1993). This is to control the possibility that larger banks have better risk diversification opportunities and greater capacities to absorb risks (Berger et al., 2013; Berger and Roman, 2013). We also include the return on assets (*ROA*) for each bank to control for the effect of profitability on banks' risks. Following Barry et al. (2011) and Berger et al. (2013), we include the share-listing status of banks as a control variable. Listed banks may have different risk-taking behavior as they are monitored by both the capital market and the securities regulatory commission. We construct *Listed* as a dynamic dummy variable that takes the value of 1 if a bank is listed on a stock exchange in a given year. Our third control is income diversification, following Laeven and Levine (2007) and Berger et al. (2013). Literature has documented that there is a correlation between income diversification and bank risk (e.g. Stiroh, 2004). The variable *Diversification* is constructed as

$$Diversification = 1 - \left| \frac{NetInterestIncome - OtherIncome}{TotalIncome} \right|$$

Finally, we control for revenue growth as a measure of bank performance (Laeven and Levine, 2009). The variable *Revenue growth* is calculated as the first difference of the logarithm for total operating income.

4.3. Summary statistics and mean comparison

Table 2 provides summary statistics for the variables used in our analysis. The data show that about 85% of the observations in the sample are categorized as state-owned commercial banks. Mean comparison t-test results of different risk-taking measures and main control variables between state-owned banks and foreign banks are reported in Table 3. As is shown in the first row, state-owned banks in general have higher risks compared with foreign banks, including higher NPL ratio, higher σ(ROE), lower CAR, and lower LCR. More interestingly, the three types of state-owned banks are not uniformly different in terms of risk-taking measures when compared with foreign banks. For example, while the average NPL ratio for state-owned banks as a whole is only 2.120% higher than that of the foreign banks, the NPL ratio for the Big Five is 4.725% higher than that of the foreign banks. In general, the pattern of the risk measures shows that the Big Five are riskier than the other two types of state-owned banks. The lower panel of Table 3 shows the results for our main control variables. State-owned banks in general have higher ROA, larger asset size, and lower level of income diversification than foreign banks.

[7] Similar liquidity measures, such as current ratio (current assets/current liabilities) or liquid assets/deposit ratio, are also widely used in the corporate finance and banking literature (e.g. Altunbas et al., 2007; Nance et al., 1993).

Table 2
Summary statistics of main regression variables.

Variable	Definition	Mean (SD)	Minimum	Maximum	Number of obs.	Data source
Risk measures						
NPL	Non-performing loan ratio	2.544 (3.563)	0.110	16.97	765	Bankscope
σ(ROE)	Standard deviation of return on equity	4.391 (4.313)	0.279	20.679	870	Bankscope
CAR	Capital adequacy (total capital) ratio	13.260 (6.948)	4.720	54.620	766	Bankscope
LCR	Liquidity coverage ratio (liquid assets to deposits and short-term debt ratio)	32.182 (15.689)	11.848	92.325	1005	Bankscope
Ownership indicators						
Big Five	Dummy equals 1 if the bank is a big-five bank.	0.060 (0.237)	0	1	1005	CBRC
Joint-stock	Dummy equals 1 if the bank is a joint-stock bank.	0.117 (0.322)	0	1	1005	CBRC
City & rural	Dummy equals 1 if the bank is a city or rural commercial bank.	0.667 (0.472)	0	1	1005	CBRC
Foreign	Dummy equals 1 if the bank is a foreign bank (excluded as the reference group).	0.156 (0.363)	0	1	1005	CBRC
Select	Dummy equals 1 if the bank has experienced a foreign acquisition.	0.319 (0.466)	0	1	1005	SDC Platinum
Dynamic Foreign	Dummy equals 0 prior to the bank's foreign acquisition and 1 starting the second year following the change. The bank-year observations are dropped for the years in which foreign acquisitions happened.	0.216 (0.411)	0	1	979	SDC Platinum
Control variables						
ROA	Return on assets	0.980 (0.633)	−3.620	8.580	1005	Bankscope
Log assets	Logarithm of total assets	16.210 (1.930)	8.287	21.855	1005	Bankscope
Listed	Dynamic dummy for banks' publicly traded status	0.111 (0.315)	0	1	1005	Capital IQ
Diversification	$1-\left\lvert\frac{NetInterestIncome-OtherIncome}{TotalIncome}\right\rvert$	0.285 (0.253)	−1.555	1.000	1005	Bankscope
Revenue growth	First difference of logarithm of total operating income	0.266 (0.312)	−1.041	4.736	1005	Bankscope
δ(*Stockprice*)	Standard deviation of stock price calculated from the monthly stock price data	2.220 (2.842)	0.075	14.702	120	CSMAR

Table 3
Mean comparison by bank type.

Mean difference	Risk-taking measures			
	NPL	σ(ROE)	CAR	LCR
State – Foreign	2.120*** (0.385)	1.657*** (0.404)	−8.963*** (0.705)	−16.779*** (1.257)
Big Five – Foreign	4.725*** (0.644)	2.750*** (0.725)	−9.605*** (1.406)	−23.839*** (2.564)
Joint-stock – Foreign	1.912*** (0.359)	1.740*** (0.489)	−11.068*** (0.991)	−18.006*** (2.006)
City & rural – Foreign	1.865*** (0.340)	1.523*** (0.361)	−8.429*** (0.788)	−15.930*** (1.342)
Mean difference	Control variables			
	ROA	Log assets	Diversification	Revenue growth
State – Foreign	0.336*** (0.054)	1.656*** (0.159)	−0.142*** (0.022)	0.021 (0.027)
Big Five – Foreign	0.219** (0.098)	5.701*** (0.269)	−0.060 (0.046)	−0.074 (0.058)
Joint-stock – Foreign	0.051 (0.072)	3.430*** (0.208)	−0.148*** (0.033)	0.049 (0.045)
City & rural – Foreign	0.397*** (0.058)	0.982*** (0.120)	−0.149*** (0.023)	0.024 (0.029)

Note: Results of the two-sample mean comparison t-test are reported in the table. Risk-taking measures: NPL = Non-performing loan ratio, CAR = Capital adequacy (total capital) ratio, σ(ROE) = Standard deviation of return on equity, LCR = Liquidity coverage ratio. Control variables: ROA = Return on assets, Log assets = Logarithm of total assets, Diversification = Income diversification, Revenue growth = First difference of logarithm of total operating income. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 4 lists the earliest foreign acquisition deals that took place in those targeted Chinese state-owned banks during the sample period. It provides the information for each acquisition, including the effective date of each deal, the name of the target bank and its foreign acquirer(s), the country or region of each acquirer, and the percentage of shares acquired. Most of the acquisitions were between 2004 and 2008, and our estimation sample covers most of the target banks (30 out of 34).[8]

5. Empirical results

5.1. State ownership and bank risk-taking

Our first set of hypotheses (Hypothesis 1A and 1B) focuses on the difference of risk-taking between the state-owned and foreign banks. We specify our baseline models as follows in order to test our first set of hypotheses:

$$Risk_{it} = \alpha + \beta State_i + \gamma X_{it} + \eta_t + \epsilon_{it}, \quad (1)$$

$$Risk_{ijt} = \alpha + \sum_{j=1}^{3} \beta_j BankType_{ij} + \gamma X_{it} + \eta_t + \epsilon_{it}, \quad (2)$$

[8] The BvD Bankscope only reports banks' current ownership information. To track the changes of foreign ownership over time, we carefully check the annual reports for all the foreign investor "selected" state-owned banks in each year in our estimation period (2002–2012) for the foreign ownership variable.

Table 4
Summary of the minority foreign shareholders.

Chinese bank (target name)	Acquisition year	Acquiror name	Acquiror nation	Shares of acquisition %
China Everbright Bank	1996	Asian Development Bank	Philippines	1.90
Bank of Shanghai	1999	International Finance Corporation (IFC)	United States	7.00
Bank of Nanjing	2002	International Finance Corporation (IFC)	United States	15.00
Shanghai Pudong Development Bank	2003	Citibank	United States	4.62
Industrial Bank	2003	Government of Singapore Investment Corporation (GIC)	Singapore	5.00
	2003	International Finance Corporation (IFC)	United States	4.00
	2004	Hang Seng Bank	Hong Kong	15.98
Bank of Xi'an	2004	International Finance Corporation (IFC)	United States	2.50
	2004	Bank of Nova Scotia	Canada	2.50
Ping An Bank (Shenzhen Development Bank)	2004	Newbridge Asia AIV III LP	United States	17.89
Bank of Communications	2004	HSBC Holdings	United Kingdom	19.90
Qilu Bank (Jinan City Commercial Bank)	2004	Commonwealth Bank of Australia	Australia	11.00
Bank of Beijing	2005	ING Bank N.V.	Netherlands	19.98
	2005	International Finance Corporation (IFC)	United States	5.00
Bank of Hangzhou	2005	Commonwealth Bank of Australia	Australia	19.90
Harbin Bank	2005	International Finance Corporation (IFC)	United States	Undisclosed
China Construction Bank	2005	Bank of America	United States	8.19
	2005	Temasek Holdings	Singapore	5.81
	2008	Bank of America	United States	2.57
	2008	Bank of America	United States	8.38
Nanchong City Commercial Bank	2005	Federal Ministry for Economic Cooperation and Development (BMZ) via DEG and SIDT	Germany	13.30
Bank of China	2005	Royal Bank of Scotland	United Kingdom	10.00
	2005	UBS	Switzerland	1.61
	2005	Asian Development Bank	Philippines	0.24
	2006	Temasek Holdings	Singapore	5.00
Hua Xia Bank	2005	Pangaea Capital Management	Singapore	6.88
	2006	Deutsche Bank and Sal. Oppenheim	Germany	13.98
Industrial and Commercial Bank of China	2006	Goldman Sachs	United States	4.90
	2006	Allianz	Germany	1.95
	2006	American Express	United States	0.40
Bank of Tianjin	2006	ANZ Banking Group	Australia	19.90
Bank of Ningbo	2006	Oversea-Chinese Banking Corporation	Singapore	12.20
Hangzhou United Rural Commercial Bank	2006	Rabobank	Netherlands	10.00
	2006	International Finance Corporation (IFC)	United States	5.00
Urumqi City Commercial Bank*	2006	Habib Bank	Pakistan	19.90
China Guangfa Bank	2006	Citibank	United States	20.00
	2006	IBM	United States	4.74
Shanghai Rural Commercial Bank	2007	ANZ Banking Group	Australia	19.90
China Citic Bank	2007	Banco Bilbao VizcayaArgentaria, S.A. (BBVA)	Spain	5.00
Bank of Chongqing	2007	Dah Sing Banking Group	Hong Kong	17.00
Bank of Qingdao	2008	Rothschild Merchant Banking	United Kingdom	4.98
	2008	Intesa SanPaolo SpA	Italy	20.00
Bank of Chengdu	2008	Hong Leong Bank	Malaysia	19.99
Evergrowing Bank	2008	United Overseas Bank	Singapore	15.38
Yantai Bank	2009	Hang Seng Bank	Hong Kong	20.00
	2009	Wing Lung Bank	Hong Kong	4.99
Bank of Yingkou	2009	Bumiputra-Commerce Holdings Berhad (BCHB)	Malaysia	18.19
Xiamen Bank*	2009	Fubon Bank	Hong Kong	19.99
Bank of Jilin	2010	Hana Financial Group	South Korea	18.27
Beichuan Fumin Village and Township Bank*	2010	International Finance Corporation (IFC)	United States	10.00
Chongqing Rural Commercial Bank*	2010	Capital Research and Management Corporation	United States	9.12

Note: * indicates that those banks that are not in our estimation sample due to data availability. Data are from the Thomason Reuters SDC Platinum, the annual reports provided by individual banks, and press releases of the banks. This table only includes the first foreign acquisition announced for each bank. Acquisition year is the time (year) when the deal became effective. For banks with multiple acquirers, within each deal that announced at the same or similar time, actual acquisitions were effective at different point of time. The percentage of the foreign ownership is the shareholding percentage of total issued shares (including A-shares that are listed on the Shenzhen or Shanghai Stock Exchanges, and H-shares that are listed on the Hong Kong Stock Exchange).

where $Risk_{ijt}$ is the risk measures for bank i of type j in year t. $State_i$ is a state bank dummy for bank i. $BankType_{ij}$ is a set of state-ownership dummies of bank i of type j state-owned banks (including *Big Five*, *Joint-stock*, and *City* & *rural*). X_{it} is a vector of bank level characteristics for bank i in year t. η_t represents the year fixed effects. The dependent variables in the regressions are the four measures of bank risks, namely the NPL ratio, σ(ROE), CAR, and LCR. The coefficient of the state bank dummy in Eq. (1) is to capture the risk difference between state-owned banks and foreign banks. The three state-ownership type dummies in Eq. (2) are the variables of interest in our baseline models. In order to account for the endogenous features that could have contributed to the risk level

of the bank, bank-level control variables like bank size, profitability, income diversification, indicator for publicly traded bank, and revenue growth are included in the regressions.

Table 5 reports the regression results for the baseline models, which test our first set of hypotheses (Hypothesis 1A and 1B) related to the overall risk-taking level of the state-owned banks compared with foreign banks. All regressions include year fixed effects, as well as bank-level characteristics. Standard errors are clustered at the bank level, and the number of banks in each regression are reported towards the bottom of the table, along with sample size and adjusted R^2. Odd-numbered columns report results for the comparison between state-owned banks and foreign banks in terms of four risk measures (i.e. Eq. (1)), while even-numbered columns report results for differences among different types of state-owned banks in terms of risk-taking compared to foreign banks (i.e. Eq. (2)).

First, we find a significant and robust positive relationship between state-ownership and bank risk-taking. Based on column 1 in Table 5, compared with foreign banks, state-ownership is associated with a statistically significant higher NPL ratio of 2.115%. Results in column 5 suggest that state-owned banks on average have a lower total capital ratio compared to foreign banks by a magnitude of 9.545%. In addition, column 7 shows that state-owned banks tend to have a lower LCR of 13.500% than their foreign counterparts. Our results are consistent with the findings in Nier and Baumann (2006). State-owned banks that are more likely to receive implicit or explicit support from the government tend to operate with lower capital and liquidity buffers compared to foreign banks that are subject to more market discipline. However, results in column 3 indicate that state-owned banks and foreign banks do not differ significantly in their return volatility as measured by the standard deviation of ROE.

Second, we observe different risk-taking patterns across different types of state-owned banks as indicated by the three bank type dummies. The five largest state-owned banks have the highest credit risk (measured by the NPL ratio) among all three types of state-owned banks. The coefficient of the Big Five dummy indicates that those five largest state-owned banks have a 3.105% higher NPL ratio than foreign banks (column 2, Table 5). This finding is consistent with the social lending view in that large state-owned banks are highly involved in policy-oriented and socially beneficial projects. Furthermore, column 2 also shows that city and rural commercial banks have relatively higher NPL ratio (2.331%) compared to foreign banks, while the joint-stock banks are similar to foreign banks in terms of credit risk. Results in column 4 indicate that the Big Five and joint-stock banks exhibit higher return volatility (by a magnitude of 3.323 and 2.547 standard deviation of ROE respectively) compared to foreign banks. The city and rural commercial banks' return volatility is not statistically different from that of the foreign banks. Column 6 shows the results for CAR across different types of state-owned banks. The city and rural commercial banks on average have significantly lower CAR compared to foreign banks (by a magnitude of 9.111%). This can be viewed as supporting evidence for the soft budget constraint view in that large state-owned banks enjoy the most government support in terms of source of financing. Given the differences in their major shareholders (central vs. local government), this result is hardly surprising. In addition, we observe a significantly lower capital adequacy ratio of 8.004% for joint-stock banks. Results in column 8 in Table 5 show that the significance of the lower liquidity level for state-owned banks is mainly driven by the subgroup of city and rural commercial banks as they tend to have lower liquidity coverage ratio (−13.075%) compared to foreign banks.

Taken together, these results provide strong evidence that state-owned banks tend to have higher level of risks when compared to foreign banks. When we look at different types of state-owned banks, city and rural commercial banks exhibit higher levels of risk-taking in all risk measures except the standard deviation of ROE. One possible explanation is that the central government or large SOE controlled banks are subject to more restrictive supervision and capital requirement by the central authorities than those local or regional commercial banks. Interestingly enough, joint-stock banks perform better among three subgroups in terms of these risk-taking measures. Since joint-stock banks are the most similar to private banks in the ownership structure, the results confirm our hypotheses that ownership matters in determining banks' risk-taking behavior.

5.2. Foreign acquisition and state-owned banks' risk-taking

Our second set of hypotheses focuses on the effect of foreign acquisition on state-owned banks' risk-taking. The effect is estimated by comparing the differences in risk measures of state-owned banks with (area c in Fig. 1) and without the foreign acquisition (area $b + d$ in Fig. 1), conditional on our bank-level characteristics. We employ a differences-in-differences methodology to estimate the effect of foreign acquisition in Chinese state-owned banks on their risk-taking. Specifically, we estimate the following equations:

$$Risk_{it} = \alpha + \beta DynamicForeign_{it} + \lambda Select_i + \gamma X_{it} + \eta_t + \epsilon_{it}, \tag{3}$$

$$Risk_{ijt} = \alpha + \sum_{j=1}^{3} \beta_j (BankType_{ij} * DynamicForeign_{ijt}) + \lambda Select_i + \gamma X_{it} + \eta_t + \epsilon_{it}, \tag{4}$$

where $DynamicForeign_{ijt}$ is our focal differences-in-differences (DID) estimator and it is constructed as a dynamic dummy for foreign ownership for bank i with ownership type j in year t. More specifically, $DynamicForeign_{ijt}$ takes on value 1 starting from the year following the foreign acquisition, and takes on value 0 before the acquisition (or if the foreign investors sold out their shares after the acquisition). $Select_i$ is a static indicator for banks being selected by foreign investors. We are interested in examining the effect of the foreign investment in the state-owned banks on their risks (Hypothesis 2A and 2B). In addition, we further examine if the effect is heterogeneous across different types of state ownership (*Big Five*, *Joint-stock*, or *City* & *rural*) by adding in interaction terms between indicators of state ownership and the foreign acquisition dynamic dummy. Our outcome variables are the same risk measures as above.

Regression results for Eqs. (3) and (4) are reported in Table 6. We are interested in the result of the DID estimator and its interactions with bank type dummies for the treatment effect of foreign acquisition on banks' risk-taking. All regressions include year fixed effects and bank-level characteristics as before. Standard errors are clustered at the bank level, and the number of banks in each regression is reported towards the bottom of all tables, along with the estimation sample size and adjusted R^2. Odd-numbered columns report results for the treatment effect of the foreign acquisition (i.e. Eq. (3)), while even-numbered columns present results for differences in this treatment effect across different types of state-owned banks in terms of risk-taking (i.e. Eq. (4)).

First, we find that only the CAR and the LCR are significantly improved for those state-owned banks since the foreign acquisition. Results in column 5 in Table 6 indicate that on average foreign acquisition is associated with a 1.360% increase in the CAR for state-owned banks. The foreign acquisition is also associated with a 4.415% increase in the LCR for those state-owned banks. We do not observe statistically significant treatment effect from foreign

Table 5
State ownership and bank risk-taking: baseline models.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State	2.115***		0.258		−9.545***		−13.500***	
	(0.388)		(0.605)		(2.075)		(3.664)	
Big Five		3.105***		3.323**		−4.301		−7.395
		(1.090)		(1.631)		(4.547)		(9.389)
Joint-stock		0.938		2.547**		−8.004***		−6.766
		(0.608)		(1.216)		(2.828)		(6.160)
City & rural		2.331***		0.547		−9.111***		−13.075***
		(0.370)		(0.604)		(1.923)		(3.758)
ROA	−1.691***	−1.913***	0.777**	0.740*	3.657**	3.444**	4.167**	4.262**
	(0.390)	(0.406)	(0.378)	(0.391)	(1.712)	(1.687)	(2.024)	(1.906)
Log assets	0.215	0.181	0.490**	0.168	−0.802	−1.283	−1.572	−2.273
	(0.150)	(0.125)	(0.193)	(0.184)	(0.607)	(1.098)	(1.034)	(1.796)
Diversification	0.737	0.621	−0.963*	−1.026*	0.768	0.532	2.234	2.362
	(0.550)	(0.515)	(0.567)	(0.573)	(2.516)	(2.390)	(3.017)	(2.893)
Listed	−1.757***	−1.210**	−3.354***	−4.036***	2.004	1.685	2.267	−0.041
	(0.626)	(0.544)	(0.952)	(1.048)	(1.610)	(1.082)	(2.927)	(2.066)
Revenue growth	−0.765**	−0.621*	0.856**	0.817**	2.587**	2.588**	2.024	1.698
	(0.375)	(0.326)	(0.380)	(0.406)	(1.117)	(1.114)	(2.104)	(2.134)
Constant	−0.953	−0.303	−4.132	0.583	29.973***	37.351**	63.534***	73.673***
	(2.301)	(1.895)	(2.870)	(2.786)	(9.368)	(16.981)	(15.513)	(27.040)
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	765	765	870	870	766	766	1,005	1,005
Adjusted R-squared	0.540	0.560	0.177	0.190	0.351	0.362	0.372	0.379
N-cluster (Banks)	103	103	110	110	100	100	123	123

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: State = The state-owned bank dummy, equals 1 if the bank is state-owned, Big Five = The Big Five dummy, equals 1 if the bank is one of the five largest state-owned banks, Joint-stock = The joint-stock dummy, equals 1 if the bank is a joint-stock commercial bank, City & rural = The city and rural dummy, equals 1 if the bank is a city or rural commercial bank, ROA = Return on assets, Log assets = Logarithm of total assets, Listed = The publicly traded indicator, Diversification = Income diversification, Revenue growth = First difference of logarithm of total operating income. Year fixed effects are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 6
The effect of foreign minority ownership on bank risk-taking (differences-in-differences estimation).

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dynamic Foreign	−0.718		−0.858		1.360**		4.415**	
	(0.726)		(1.016)		(0.605)		(1.704)	
Dynamic Foreign*Big Five		−3.868***		−4.291**		2.005***		0.337
		(1.084)		(2.147)		(0.569)		(2.117)
Dynamic Foreign*Joint-stock		0.803		1.254		−0.332		6.649***
		(0.630)		(1.469)		(0.542)		(2.343)
Dynamic Foreign*City & rural		−1.297*		−0.903		2.170***		5.103**
		(0.740)		(0.912)		(0.672)		(2.086)
Select	0.068	0.528	0.432	0.556	−0.994**	−1.169***	−4.653***	−4.965***
	(0.894)	(0.648)	(0.911)	(0.985)	(0.448)	(0.429)	(1.769)	(1.801)
ROA	−1.857***	−2.141***	1.359**	1.292*	1.691***	1.557***	2.170	2.259**
	(0.489)	(0.484)	(0.653)	(0.742)	(0.222)	(0.221)	(1.351)	(1.089)
Log assets	0.328	0.267	0.436*	−0.131	−0.260	−0.354	−1.039	−2.016
	(0.203)	(0.187)	(0.229)	(0.284)	(0.161)	(0.291)	(0.651)	(1.263)
Diversification	0.656	0.563	−0.829	−0.743	0.946	0.959	1.297	1.680
	(0.703)	(0.654)	(0.730)	(0.723)	(0.598)	(0.603)	(2.478)	(2.330)
Listed	−1.733***	−0.665	−2.780**	−2.742**	0.377	0.604	1.511	0.557
	(0.638)	(0.422)	(1.130)	(1.143)	(0.488)	(0.380)	(1.878)	(1.662)
Revenue growth	−0.694	−0.456	0.984**	0.900**	1.324***	1.299***	3.335*	2.821
	(0.456)	(0.325)	(0.397)	(0.434)	(0.299)	(0.306)	(1.932)	(1.976)
Constant	−0.244	1.077	−3.667	5.189	13.573***	15.164***	43.280***	58.186***
	(3.164)	(2.882)	(3.994)	(4.733)	(2.546)	(4.555)	(9.951)	(19.613)
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	650	650	713	713	652	652	822	822
Adjusted R-squared	0.550	0.593	0.170	0.202	0.436	0.468	0.405	0.422
N-cluster (Banks)	87	87	88	88	85	85	99	99

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Dynamic Foreign = The foreign minority ownership dummy, equals 1 if the bank has a foreign investor in a given year, Select = The static foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition, Dynamic Foreign*Big Five = The interaction between the Big Five dummy and foreign minority ownership, Dynamic Foreign*Joint-stock = The interaction between the joint-stock bank dummy and foreign minority ownership, Dynamic Foreign*City & rural = The interaction between the city and rural commercial bank dummy and foreign minority ownership. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

acquisition in terms of credit risk and return volatility, as suggested by results in columns 1 and 3 respectively.

Second, we examine the treatment effect on three groups of state-owned banks separately. Overall, the effect of foreign acquisition is more significant for the Big Five and city and rural commercial banks. Specifically, column 2, 4 and 6 in Table 6 show that the foreign acquisitions in the Big Five are on average associated with a decrease of 3.868% in the NPL ratio, a decrease of 4.291 in the standard deviation of ROE, and an increase of 2.005% in the CAR. In addition, there is also a risk improvement in the city and rural commercial banks' NPL ratio, CAR, and LCR (column 2, 6,and 8 in Table 6). The coefficients on *Dynamic Foreign* $*$ *City & rural* are significantly different from zero, showing that the NPL ratio, the CAR, and the LCR are on average improved by 1.297%, 2.170%, and 5.103% respectively in city and rural commercial banks after foreign acquisition. Results in Table 6 also suggest that the joint-stock banks only have a higher liquidity measure after foreign acquisition. Recall our finding in the baseline comparison presented in Table 5 which shows that the Big Five has the highest NPL ratio and city and rural commercial banks have the lowest CAR among different types of state-owned banks. Results in Table 6 suggest that the NPL ratio for the Big Five has been reduced significantly, while the CAR for the city and rural banks has been increased significantly after foreign acquisition. Our findings support the theory about learning effect and active monitoring effect, which indicate that prior knowledge and knowledge gap can be the determinants of the knowledge that banks learn from their foreign minority shareholders. Taken together, our results clearly demonstrate the reduction in state-owned banks' risk-taking behavior after foreign acquisition.

6. Robustness checks

We examine an alternative hypothesis that might explain why state-ownership is associated with high risks. One possible explanation is that difference in risk-taking between state-owned and foreign banks is driven by the level of concentration in the ownership structure. State-owned banks tend to have more concentrated ownership compared to foreign banks. However, when those state-owned banks receive foreign acquisitions, their ownership becomes more dispersed. In this case, one might concern over the possibility that our results are driven by differences in ownership concentration rather than characteristics of the shareholders. In addition, state-ownership indicates higher possibility of receiving government support. A more concentrated ownership leads to higher government involvement in the decision-making process. Literature documents that capital buffers are influenced by market discipline (e.g. Nier and Baumann, 2006). Government safety nets and guarantees result in lower capital ratios, while stronger market discipline resulting from uninsured liabilities and disclosure leads to higher capital ratios. In this case, state-owned banks with higher percentage of state-ownership might benefit more from government explicit and/or implicit guarantees so they can operate with low capital buffers, compared with those banks with less concentrated state-ownership or more private ownership (e.g. foreign banks).

While it is hard to completely rule out the concentration hypothesis, some extensional tests related to this hypothesis are conducted. We use two measures for the state-owned banks' levels of concentration of ownership. The first measure is based on the combined share of the top three shareholders for each state-owned bank.[9] We rank the state-owned banks by the combined shares and separate them into four quartiles. Our baseline model is re-estimated (i.e. Eq. (1)) for the state-owned banks in each quartile, with the comparison group being the foreign banks in our sample. We plot the estimated coefficients on the state ownership indicator for each of our four risk measures. Results are displayed in Fig. 2. The level of ownership concentration of each subsample increases from left to right in each penal. The capped spikes indicate the confidence intervals for each coefficient and the asterisk signs indicate that the estimated coefficients are significantly different from zero at the 10% level (at least). Subsample results with banks of different levels of ownership concentration suggest that state-owned banks with higher levels of concentration in their ownership structure do not necessarily have higher risks. The exception is CAR, where banks with the highest level of ownership concentration exhibit the lowest level of CAR. The second measure is the BvD Independence Indicators obtained from the BvD Bankscope database. The state-owned banks in our sample received the following six ratings, including A, A−, B+, C+, C, and D. We assign scores to the indicators using the following rules: A = 1, A− = 2, B+ = 3, C+ = 4, C = 5, and D = 6. A higher score suggests a more concentrated ownership structure. We group the state-owned banks based on the scores, and the average risk measures for banks at each score level are presented in Fig. 3.[10] As we can see, banks with lower level of concentration (a lower score) tend to have lower risks. The results are partially consistent with the government safety nets hypothesis. State-owned banks that have more access to government support are operating with higher risks, if we compare banks with independence indicators of 4, 5, or 6, with banks with independence indicators of 1, 2, or 3. However, among the more concentrated banks (ones with scores of 4, 5 or 6), the risk-taking pattern is not very clear. The group of banks with scores of 4 or 5 tend to have the highest level of risks, whereas the group of banks with the highest concentration in their ownership (with scores of 6) exhibits lower risks in comparison. Therefore, a clear association between the ownership concentration and banks' risk-taking could not be established.

We also conduct robustness tests for our first sets of hypotheses to check whether or not our results are sensitive to the choice of estimation techniques and samples. First, to rule out the potential confounding effects of foreign ownership on bank risk-taking when we compare state-owned banks with their foreign counterparts, we estimate our baseline models (i.e. Eqs. (1) and (2)) using a restricted sample with only bank-year observations without foreign investment in state-owned banks. The results, as presented in Table 7, show that state-owned banks tend to have higher credit risk, lower capital adequacy ratio, and lower liquidity level compared to foreign banks. These are consistent with our results in the baseline models in terms of the level of significance and the magnitude of the coefficients. In addition, the results for different types of state-owned banks are also consistent with our main estimation results except for the subgroup tests for the standard deviation of ROE. For the state-owned banks without foreign investment, their return volatility tends to be similar to that of their foreign counterparts.

We also conduct a battery of robustness tests for our second sets of hypotheses regarding the treatment effect associated with foreign acquisition in state-owned banks. First, we perform a validity check to see if there is a selection bias in our analysis. In other words, we test whether banks that are selected by foreign investors have different risk-taking levels prior to the acquisition, compared with banks that never received foreign investment. In other words, foreign investors tend to select banks that have lower risks. To address this concern, we perform a validity check for the potential selection bias by comparing state-owned banks with foreign

[9] Results using a measure with only the top one shareholder of each bank are similar.

[10] The red lines indicate the full sample averages for each risk measure.

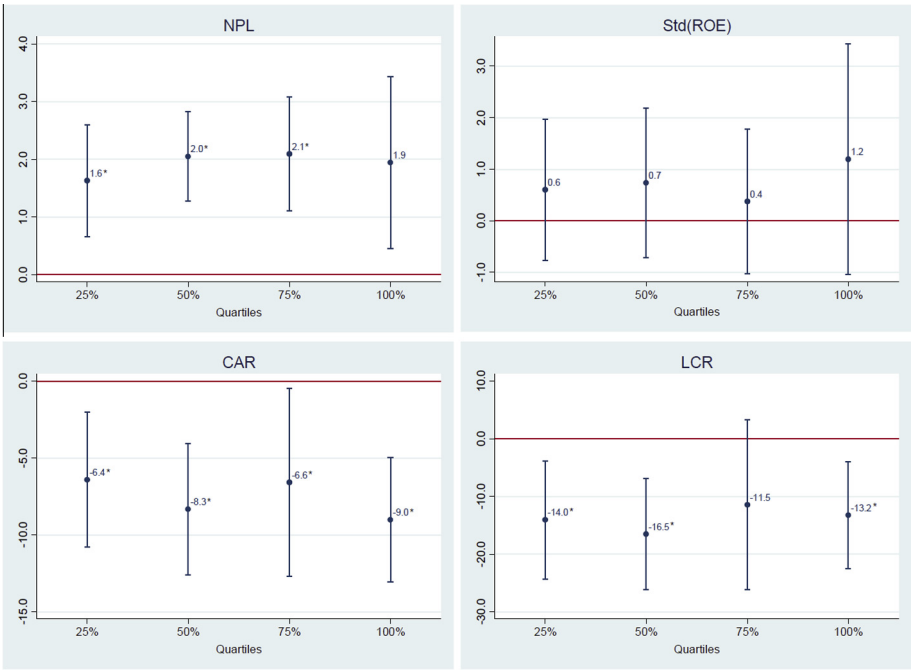

Fig. 2. Tests for the concentration hypothesis: top 3 shareholders. *Note:* Four risk measures are non-performing loan ratio, the standard deviation of ROE, capital adequacy ratio, and liquidity coverage ratio. The state-owned banks are ranked by the combined shares of the top three shareholders and are separated into four quartiles. We estimate the baseline models (i.e. Eq. (1)) for banks in each quartile. The dots are the coefficients for the *State* variable. The capped spikes represent the confidence intervals for each coefficient, and the asterisk signs indicate that the estimated coefficients are significantly different from zero at the 0.1 level.

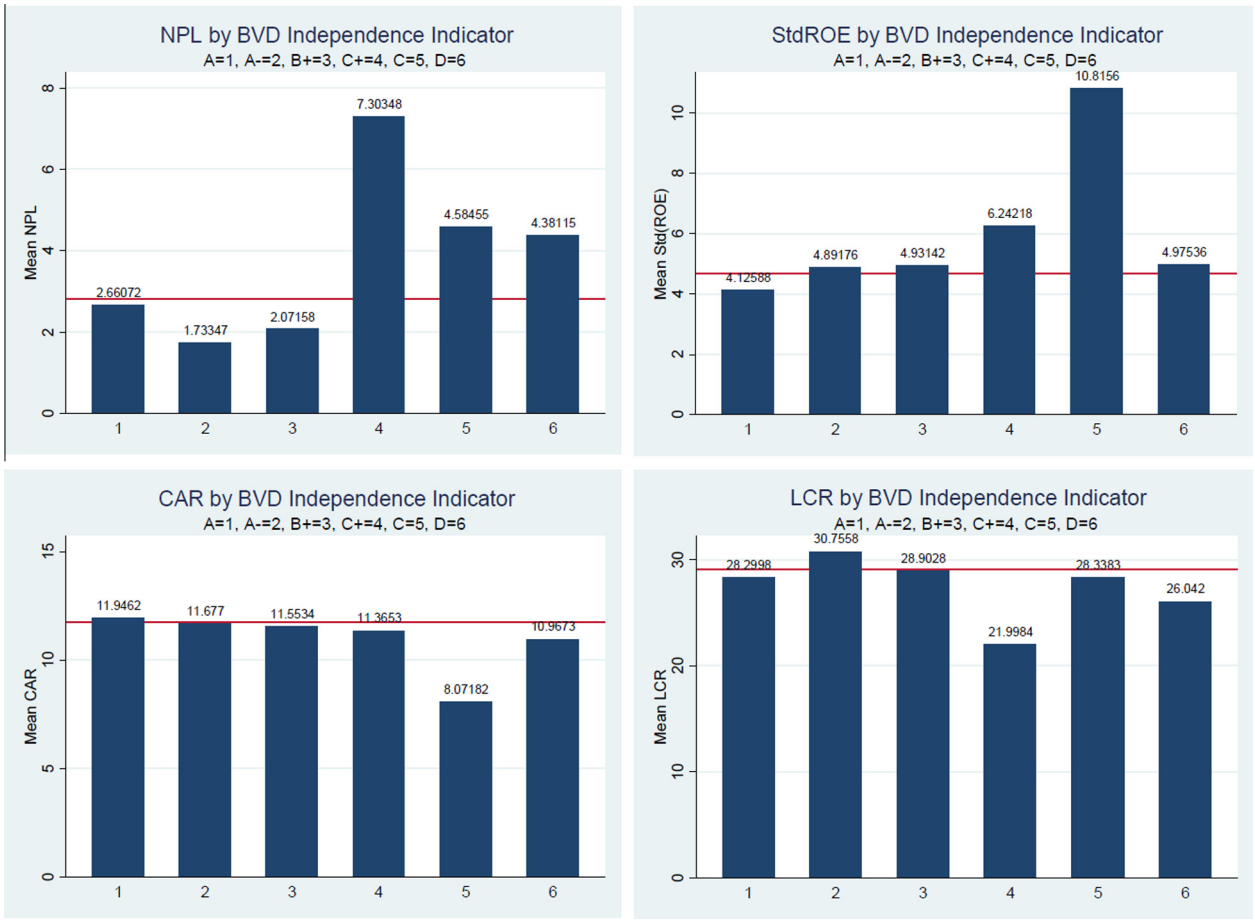

Fig. 3. Tests for the concentration hypothesis: independence indicators. *Note:* Four risk measures are non-performing loan ratio, the standard deviation of ROE, capital adequacy ratio, and liquidity coverage ratio. State-owned banks are grouped based on the BvD Independence Indicators (a higher score suggests a more concentrated ownership), and the average risk measures for banks at each score level are plotted in four panels. The red lines represent the full sample averages for each risk measure. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 7
State ownership and bank risk-taking: State-owned banks without foreign investment.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State	2.081***		0.389		−9.285***		−12.937***	
	(0.440)		(0.615)		(1.933)		(3.729)	
Big Five		4.140***		3.673		−2.569		−2.717
		(1.248)		(2.237)		(6.952)		(12.584)
Joint-stock		−0.310		0.644		−6.516**		−6.451
		(0.724)		(1.009)		(3.104)		(6.778)
City & rural		2.326***		0.642		−9.054***		−12.349***
		(0.404)		(0.602)		(1.800)		(3.824)
ROA	−1.644***	−1.840***	0.779**	0.685*	3.522*	3.430*	4.034*	3.948*
	(0.411)	(0.414)	(0.388)	(0.382)	(1.841)	(1.771)	(2.088)	(2.014)
Log assets	0.403**	0.313**	0.441***	0.217	−1.276	−1.773	−1.970	−2.780
	(0.203)	(0.153)	(0.163)	(0.173)	(0.934)	(1.520)	(1.382)	(2.258)
Diversification	0.512	0.447	−1.226**	−1.213**	1.001	1.167	2.728	3.094
	(0.543)	(0.521)	(0.557)	(0.550)	(2.700)	(2.728)	(3.217)	(3.310)
Listed	−3.226***	−1.062	−2.318**	−1.862	2.722	1.841	2.001	−0.874
	(0.632)	(0.895)	(0.975)	(1.135)	(2.503)	(1.831)	(3.719)	(2.738)
Revenue growth	−1.458**	−1.078**	0.508	0.612	4.197***	3.933**	2.374	2.012
	(0.607)	(0.538)	(0.543)	(0.545)	(1.482)	(1.566)	(2.977)	(3.110)
Constant	−3.465	−2.071	−3.305	−0.020	36.639**	44.077*	69.150***	80.873**
	(3.102)	(2.329)	(2.450)	(2.633)	(14.493)	(23.531)	(20.865)	(33.961)
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Restricted sample	✓	✓	✓	✓	✓	✓	✓	✓
Observations	547	547	634	634	549	549	768	768
Adjusted R-squared	0.574	0.608	0.162	0.172	0.361	0.371	0.347	0.353
N-cluster (Banks)	95	95	104	104	93	93	118	118

Note: Estimation sample is restricted to bank-year observations without foreign minority ownership for state-owned banks. Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: State = The state-owned bank dummy, equals 1 if the bank is state-owned, Big Five = The Big Five dummy, equals 1 if the bank is one of the five largest state-owned banks, Joint-stock = The joint-stock dummy, equals 1 if the bank is a joint-stock commercial bank, City & rural = The city and rural dummy, equals 1 if the bank is a city or rural commercial bank. Year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

investment before the foreign acquisition (area *b* in Fig. 1) with those never received foreign investment in the sample period (i.e. "pure" state-owned banks, area *d* in Fig. 1). We conduct the validity test using both the OLS and a matching estimator (ME), as implemented by Almeida et al. (2012). Specifically, given foreign acquisition as a treatment, we employ the Abadie and Imbens (2008) matching estimator that minimizes the Mahalanobis distance between a vector of observed covariates across treated banks before the treatment and untreated banks. By minimizing the Mahalanobis distance, treated observations before the treatment are matched with untreated ones based on bank level characteristics, including performance (i.e. ROA), asset size, income diversification, and revenue growth. We use the nearest-neighbor matching method, which matches each state-owned bank with foreign investment before the foreign acquisition with one state-owned bank without foreign investors (i.e. "pure" state-owned banks). Using the matched sample of pre-treatment (area *b* in Fig. 1) and control groups (matched observations in area *d* in Fig. 1), we test for the initial difference in risk-taking measures between those with and without foreign investment. More formally, we estimate the following equations:

$$Risk_{it} = \alpha + \beta Select_i + \gamma X_{it} + \eta_t + \epsilon_{it}, \quad (5)$$

where $Select_i$ is the indicator for banks being selected by foreign investors. We report results using both the matched sample and the full sample (i.e. a direct comparison between area *b* and *d* in Fig. 1). Regression results in Table 8 confirm that the selected banks (before the treatment) do not exhibit lower risk-taking levels than the unselected. If anything, results in columns 5–8 suggest that selected banks before the foreign acquisition had lower CAR and LCR than the unselected banks. These results are due to the fact that the selection is a two-way process. Besides being selected by foreign investors, state-owned banks that have higher demand for capital are more welcoming to "outside" investors. Given the nature of state-owned banks, this decision is likely made by the banks and the government entities that control the banks together. Our results are consistent with the findings in Boubakri et al. (2005) in that banks chosen for privatization have a lower economic efficiency and a lower solvency than banks kept under government ownership.

Second, we look at the effect of foreign acquisition on bank's risk-taking by comparing the risk measures of the state-owned banks with foreign investment before (area *b* in Fig. 1) and after the foreign acquisition (area *c* in Fig. 1), controlling for bank-level characteristics. In other words, we restrict the estimation sample to those selected banks that have or once had foreign acquisition. We use the same four risk measures. Results are reported in Table 9. As suggested by our main results, we observe a higher CAR of 1.420% (column 5) and higher LCR of 1.992% (column 7) after foreign acquisition for state-owned banks as a whole group. For the different types of state-owned banks, the Big Five and city and rural commercial banks have benefited more from the foreign investor as we see a decrease in the NPL ratio, a decrease in the standard deviation of ROE, and an increase in the CAR after foreign acquisition.

Third, to further test the treatment effect of foreign acquisition, we perform a falsification test by randomly assigning foreign acquisition years on those state-owned banks that have received foreign investment. Then, we re-estimate the treatment effect with the same DID framework (Eqs. (3) and (4)). Our key variable here is *Random Foreign*, which is by definition the pseudo *Dynamic Foreign* variable we generate from a random assignment procedure. Most of the coefficients are not statistically significant in Table 10

Table 8
Validity check for potential selection bias.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Select	−0.229	−0.221	0.258	0.617	−0.912*	−1.095**	−4.923***	−3.481*
	(0.954)	(1.073)	(0.975)	(0.809)	(0.466)	(0.422)	(1.848)	(1.819)
ROA	−1.714***	−3.780***	1.458*	6.714***	1.430***	2.273***	1.893	3.055
	(0.536)	(1.231)	(0.760)	(1.393)	(0.254)	(0.715)	(1.430)	(2.126)
Log assets	0.489*	0.388	0.447*	0.807**	−0.345*	−0.102	−1.303	−0.232
	(0.250)	(0.279)	(0.236)	(0.356)	(0.186)	(0.106)	(0.795)	(0.310)
Diversification	0.625	1.241	−1.136	−0.450	1.100*	2.696**	1.501	−2.405
	(0.756)	(2.106)	(0.719)	(1.407)	(0.611)	(1.087)	(2.624)	(1.972)
Listed	−3.429***	−3.600***	−2.274*	−3.556**	0.502	0.056	1.979	1.098
	(0.727)	(0.770)	(1.159)	(1.739)	(0.513)	(0.334)	(2.253)	(1.320)
Revenue growth	−1.726*	−1.364	0.275	−1.884	1.591***	0.846	4.294	4.353***
	(0.942)	(1.515)	(0.635)	(2.392)	(0.485)	(0.694)	(3.427)	(1.365)
Constant	−2.409	2.846	−3.627	−11.484*	15.017***	9.276***	47.156***	24.438***
	(4.015)	(4.778)	(4.272)	(5.869)	(2.833)	(1.784)	(12.480)	(5.284)
Restricted to matched sample		✓		✓		✓		✓
Bank-type fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	453	112	502	127	458	107	611	145
Adjusted R-squared	0.568	0.523	0.154	0.278	0.484	0.453	0.396	0.505
N-cluster (Banks)	79	48	82	50	78	47	94	57

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Select = The static foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition, Log assets = Logarithm of total assets, Listed = The publicly traded indicator, Diversification = Income diversification, Revenue growth = First difference of logarithm of total operating income. Bank-type fixed effects and year fixed effects are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 9
The effect of foreign minority ownership on bank risk-taking: before–after effect.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dynamic Foreign	−0.879		−1.521		1.420**		1.992**	
	(0.730)		(1.058)		(0.670)		(0.809)	
Dynamic Foreign*Big Five		−3.428**		−6.628*		1.653***		−1.486
		(1.528)		(3.501)		(0.574)		(1.865)
Dynamic Foreign*Joint-stock		0.944		0.421		−0.543		3.955***
		(0.632)		(1.582)		(0.513)		(1.109)
Dynamic Foreign*City & rural		−1.561*		−0.810		2.225***		0.864
		(0.842)		(0.933)		(0.718)		(1.290)
ROA	−2.375***	−3.214***	2.643*	4.108***	4.610***	3.532***	4.580*	8.149***
	(0.795)	(0.903)	(1.397)	(1.196)	(1.087)	(1.059)	(2.636)	(2.481)
Log assets	0.023	−0.237	0.639	−0.677	−0.163	0.265	−0.148	0.172
	(0.184)	(0.220)	(0.381)	(0.587)	(0.151)	(0.271)	(0.547)	(1.125)
Diversification	3.159**	2.383*	−0.993	−1.051	0.960	1.837	−4.050	−2.709
	(1.248)	(1.184)	(1.799)	(1.581)	(1.044)	(1.145)	(3.180)	(3.100)
Listed	−1.120*	−0.316	−3.237**	−2.861*	0.288	0.511	0.100	−0.747
	(0.553)	(0.389)	(1.564)	(1.487)	(0.473)	(0.425)	(1.771)	(1.503)
Revenue growth	−0.357	−0.303	1.482***	1.243***	0.936***	1.047***	2.765**	2.262***
	(0.263)	(0.247)	(0.358)	(0.353)	(0.169)	(0.140)	(1.004)	(0.711)
Constant	5.532*	11.408***	−7.238	11.781	8.023***	1.488	23.480**	14.971
	(3.176)	(3.704)	(6.454)	(9.585)	(2.126)	(4.336)	(9.416)	(17.607)
Selected sample	✓	✓	✓	✓	✓	✓	✓	✓
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	260	260	287	287	258	258	295	295
Adjusted R-squared	0.676	0.722	0.186	0.288	0.509	0.570	0.584	0.634
N-cluster (Banks)	30	30	30	30	29	29	30	30

Note: Estimation sample is restricted to state-owned banks that have experienced foreign acquisition (i.e. *Select* = 1). Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Dynamic Foreign = The foreign minority ownership dummy, equals 1 if the bank has a foreign investor in a given year, Dynamic Foreign*Big Five = The interaction between the Big Five dummy and foreign minority ownership, Dynamic Foreign*Joint-stock = The interaction between the joint-stock bank dummy and foreign minority ownership, Dynamic Foreign*City & rural = The interaction between the city and rural commercial bank dummy and foreign minority ownership. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

(except one coefficient for LCR with a counter-intuitive sign). The results further confirm the treatment effect of foreign investment on state-owned banks' risk-taking.

Fourth, we employ Propensity Score Matching (PSM) to test the treatment effect. As in the previous section, the focus of our analysis is the estimated average treatment effect of foreign

Table 10
The effect of foreign minority ownership on bank risk-taking: falsification test.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Random Foreign	−0.390		−1.172		−0.997		1.330	
	(0.585)		(1.385)		(0.725)		(2.009)	
Random Foreign*Big Five		−1.400		0.686		−0.161		−4.667***
		(1.236)		(2.742)		(0.479)		(1.267)
Random Foreign*Joint-stock		0.021		−2.212		−0.670		4.580
		(0.866)		(1.663)		(0.867)		(2.884)
Random Foreign*City & rural		0.060		−1.593		−1.332		1.097
		(0.827)		(1.147)		(0.834)		(2.337)
Select	−0.232	−0.441	0.802	1.339	1.012	1.240	−2.427	−2.301
	(0.740)	(0.785)	(1.343)	(1.177)	(0.796)	(0.842)	(2.095)	(2.196)
ROA	−1.875***	−2.102***	1.388**	1.213*	1.718***	1.540***	2.230	2.373**
	(0.477)	(0.475)	(0.657)	(0.697)	(0.239)	(0.244)	(1.345)	(1.102)
Log assets	0.288	0.273	0.539**	−0.080	−0.148	−0.239	−0.977	−1.765
	(0.204)	(0.202)	(0.265)	(0.265)	(0.171)	(0.296)	(0.648)	(1.214)
Diversification	0.810	0.671	−0.868	−0.868	0.820	0.632	1.355	1.379
	(0.736)	(0.689)	(0.778)	(0.820)	(0.614)	(0.627)	(2.555)	(2.418)
Listed	−1.777***	−0.954*	−3.627***	−4.545***	−0.200	0.049	1.777	0.823
	(0.653)	(0.551)	(1.172)	(1.229)	(0.529)	(0.509)	(2.091)	(1.690)
Revenue growth	−0.661	−0.508	0.838*	0.707	1.241***	1.385***	3.001	2.628
	(0.449)	(0.342)	(0.436)	(0.508)	(0.291)	(0.326)	(1.930)	(1.978)
Constant	0.376	0.906	−5.196	4.593	11.744***	13.462***	42.070***	54.092***
	(3.154)	(3.112)	(4.581)	(4.482)	(2.703)	(4.595)	(9.896)	(18.850)
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	656	656	720	720	660	660	830	830
Adjusted R-squared	0.517	0.538	0.174	0.198	0.412	0.428	0.400	0.417
N-cluster (Banks)	87	87	88	88	85	85	99	99

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Random Foreign = The random assigned foreign acquisition dynamic dummy, Select = The static foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition, Random Foreign*Big Five = The interaction between the Big Five dummy and the random foreign year, Random Foreign*Joint-stock = The interaction between the joint-stock bank dummy and the random foreign year, Random Foreign*City & rural = The interaction between the city and rural commercial bank dummy and the random foreign year. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

acquisition. Our PSM is conducted in two stages: (1) predict the probability of receiving the treatment based on bank characteristics using Logit model,[11] and (2) match observations with similar propensity scores and test the significance in the difference of their outcome variables. In the first stage where we estimate the propensity scores for each observation, the employed explanatory variables are the control variables as in previous regressions: bank's performance (ROA), asset size, income diversification, and revenue growth. The underlying rationale behind choosing these variables in the first stage is that foreign investors are more likely to select banks that have better performance, higher capital capacity, better income diversification, and higher revenue growth to invest in. The estimated propensity score is $pr[D_{it} = 1|X_{it}] = \phi(X_{it})$, where $\phi(X_{it})$ is the probability density function (pdf) for the standard normal distribution.

The key assumption underlying the PSM procedure is that the matched observations, given that their probability of receiving foreign investment is similar, differ only in the fact that one has foreign shareholders and the other does not. The corresponding Conditional Independence Assumption (CIA) is that $\{Y_{1it}, Y_{0it}\} \perp D_{it}|pr[D_{it} = 1|X_{it}]$, where Y_{1it} and Y_{0it} are respectively the potential risk-level for bank i in year t with and without foreign ownership, $D_{it}(= 1)$ is the indicator for having foreign minority shareholder, and $pr[D_{it} = 1|X_{it}]$ is the probability of receiving foreign investment for bank i in year t. Therefore, the resulted differences in the matched banks' risk measures can be attributed to foreign shareholding. In other words, this CIA condition states that the choice of foreign shareholding between banks with similar propensity score is random.[12]

Based on the estimated propensity scores, observations with similar propensity scores are matched. The estimated Average Treatment Effect for the Treated (ATET) is the average of differences in risk measures for each matched pair, $E[Y_{1it} - Y_{0it}|D_{it} = 1] = E[Y_{1it}|D_{it} = 1] - E[Y_{0it}|D_{it} = 1]$. The risk level of the matched observation without foreign minority shareholder ($E[Y_{0it}|D_{it} = 1]$) can be thought of as the counterfactual outcome for its match without foreign investment. Based on the CIA assumption, the estimated ATET is reported in Table 11.

The PSM estimation is performed using different matching criterion, namely the nearest 1 to 3 neighbors of the treatment observations, with the outcome variable being our four risk-taking measures, *NPL*, *σ(ROE)*, *CAR*, and *LCR*. Overall, our results in Table 11 are consistent with the benchmark results. The treatment is associated with lower NPL ratio and higher CAR, although results are weaker for the return volatility and LCR. Results are robust across different matching criteria.

7. Extensions

Our sample period covers the 2007–2009 global financial crisis, which has a profound impact on the U.S. and global banking system. An in-depth analysis of the crisis is beyond the scope of this

[11] The results are very similar if we use Probit model in the first stage.

[12] We check the comparability of treated and control groups. The differences in the means of the covariates (i.e. matching criteria) for the matched sample are significantly smaller than those for the unmatched sample. For the matched sample, the treated and control groups are not significantly different from each other in terms of those covariates. The results are not reported in this paper.

Table 11
Treatment effect estimation with propensity score matching (PSM).

	Dependent variables			
	NPL	σ(ROE)	CAR	LCR
ATET	−1.681***	−0.724	1.146***	1.637
(One-to-one match)	(0.597)	(0.765)	(0.325)	(1.093)
Observations	650	713	652	822
ATET	−2.067***	−0.872	1.053***	1.289
(Nearest 2 neighbors)	(0.487)	(0.625)	(0.302)	(0.923)
Observations	650	713	652	822
ATET	−2.195***	−0.668	1.080***	1.180
(Nearest 3 neighbors)	(0.517)	(0.583)	(0.290)	(0.914)
Observations	650	713	652	822

Note: Average treatment effect on the treated (ATET) is estimated. Outcome variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Robust Abadie-Imbens standard errors are in parentheses. Propensity scores are computed from a Logit model using all the control variables in our baseline models. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

paper; however, this recent event still gives us an opportunity to investigate the risk-taking behavior of state-owned banks in a different scenario.[13] Literature has also touched upon the risk-taking behavior and performance of state-owned banks during the financial crisis. For example, Cornett et al. (2010) examine the performance and risk-taking of state-owned and private banks during the 1997 Asian financial crisis with a sample of banks in 16 Far East countries. They find that state-owned banks generally operated with higher risks and lower profitability prior to 2001, while they closed the gap with privately owned banks on cash flow returns, core capital, and nonperforming loans in the post-crisis period. Our comparison groups are again the state-owned banks and their foreign (private) counterparts. We split our estimation sample into two parts: the "Crisis" period (2007–2009) and the "Non-Crisis" period (the rest of the sample period). We first present some graphical evidence for the difference in our risk-taking measures between the two groups of banks during different time periods. We plot the average level of our four risk measures in Fig. 4. The navy dots that are connected by short-dashed lines represent the average level of the risk measures in tranquil (non-crisis) period while the maroon dots that are connected by long-dashed lines are the measures during the financial crisis. The dots on the left are for foreign banks and the ones on the right are for state-owned banks. The slopes of the lines reflect differences between state-owned and foreign banks in terms of risk measures (e.g. a flatter slope indicates smaller difference between the two comparison groups in terms of different risk measures). The NPL and the CAR exhibit similar patterns where state-owned banks became closer in the level of risk measures to foreign banks during the crisis period. In addition, we observe a decrease in the average NPL ratio and a small increase in CAR during the crisis for state-owned banks. However, in terms of return volatility, both types of banks experienced a significant increase as measured by the standard deviation of ROE, and the difference between the two groups became larger during the financial crisis. For the LCR, both state-owned and foreign banks tend to have lower liquidity ratio during the crisis and the difference between the two groups is stable over the sample period as the two lines are almost paralleled.

We also re-estimate our baseline model (i.e. Eq. (1)) for the two separated samples and the results are reported in Table 12. Results are very similar to what we observe in Fig. 4. The coefficient of *State* for the "Non-Crisis" sample are larger than that for the "Crisis" sample for the NPL ratio. We find similar results for the CAR as well when we compare the coefficients during crisis and non-crisis periods. The difference is not statistically significant for the standard deviation of ROE. For the LCR, the coefficients of *State* are different in magnitude for the two periods (−15.212% and −13.066% respectively), indicating that the negative liquidity shock on the state-owned banks is slightly larger compared to foreign banks. In general, the results show that state-owned banks are less affected by the 2007–2009 financial and banking crisis compared to the foreign banks. Our results are consistent with the findings in Cornett et al. (2010) as state-owned banks close the gap with foreign banks in terms of risks during the crisis. The reasons can be twofold. First, the Chinese banking and financial market is relatively isolated from the global lending market so the crisis had limited impact on the state-owned banks in China. Second, government support played an important role in stabilizing the banking sector during the crisis. China's economic stimulus package during the financial crisis was quicker, larger in terms of size (share of GDP), as well as planned and implemented for a more concentrated time period compared to the U.S. stimulative policies (Yang, 2011). More importantly, China's stimulus package focused on infrastructure investment. State-owned banks played an important role in the policy transmission and thus benefited from the government support during this period. Therefore, it is not surprising that state-owned banks exhibit relatively lower risk levels during the crisis period.

To further explore the heterogeneous treatment effects of foreign acquisition on Chinese state-owned banks' risk-taking, we perform three extensional tests on the differences of the foreign acquisitions and their effect on risk-taking levels of the target banks.

We first investigate the relationship between the differences in the acquired banks' risk-taking and the differences in the level of intensity or concentration of foreign shares in the acquired banks. More specifically, using the median (16.93%) of the percentage of share purchased by foreign investors as the split point, we group all acquired banks into two groups, "high foreign share" versus "low foreign share".[14] We estimate our DID model for the two groups separately, and report results in Table 13. Odd-numbered columns present results for the subsample with high foreign share, and results for the group with low foreign share are in even-numbered columns. Comparing across the two groups, the results suggest that higher foreign share is associated with larger improvement in the acquired banks' risk measures. For instance, columns 1 and 5 show that only banks that receive foreign investment with percentages of share above the sample median have lower NPL ratio and higher CAR after the foreign acquisition. For the LCR, the effect on banks with foreign investment is positive and significant for both groups, but the coefficient is larger for the group with higher percentage of foreign ownership. The results are suggestive of the possibility that foreign investors that acquire lower percentages of share are more likely to exert passive monitoring and are less likely to involve in the management process than those purchase larger shares.

We then explore the heterogeneous treatment effects along the dimension of the local market involvement of the foreign investors. Foreign investors may have different post-acquisition performances due to the differences in their long-term strategies and plans in the Chinese market. We group target banks based on whether their foreign investors have subsidiaries or branches in China. More specifically, state-owned banks are categorized into the "Local" group if their foreign investors had subsidiaries or branches in China at the time of the acquisition, while those banks with foreign investors that do not have local subsidiaries or

[13] We thank our anonymous referees for the suggestion of this extension.

[14] We leave the bank observations with median level of foreign ownership out of our estimation sample. We obtain similar results by including the bank observations with median level of foreign ownership in either group.

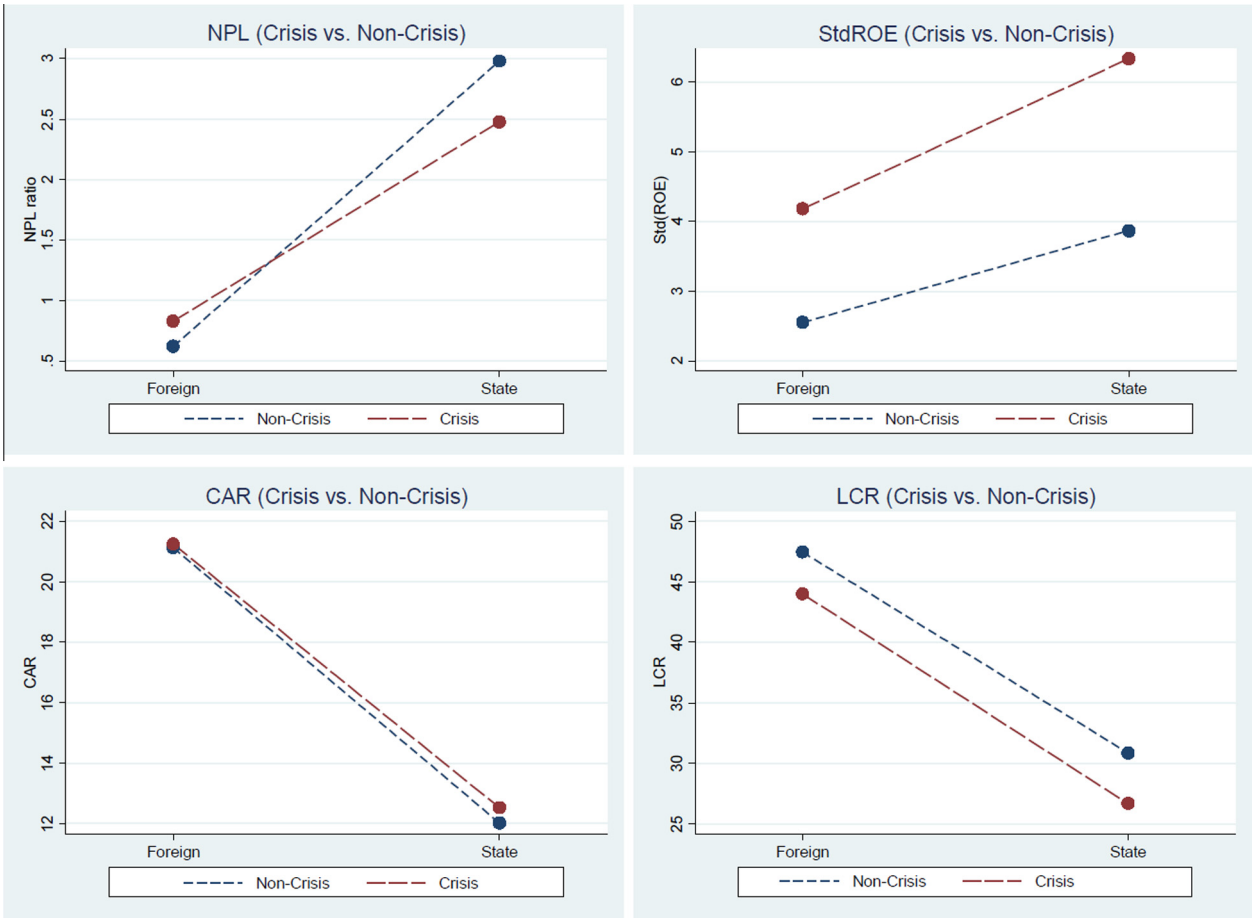

Fig. 4. Mean comparison between the "Crisis" and "Non-Crisis" periods. *Note:* Four risk measures are non-performing loan ratio, the standard deviation of ROE, capital adequacy ratio, and liquidity coverage ratio. The navy dots that are connected by short-dashed lines represent the mean level of the risk measures in tranquil (non-crisis) period while the maroon dots that are connected by long-dashed lines are the measures during the financial crisis. The dots on the left are for foreign banks and the ones on the right are for state-owned banks. The slopes of the lines reflect differences between state-owned and foreign banks in terms of risk measures (e.g. a flatter slope indicates smaller difference between the two comparison groups in terms of risk measures).

Table 12
State-ownership and bank risk-taking: Crisis vs. Non-crisis.

	NPL		σ(ROE)		CAR		LCR	
	Crisis (1)	Non-Crisis (2)	Crisis (3)	Non-Crisis (4)	Crisis (5)	Non-Crisis (6)	Crisis (7)	Non-Crisis (8)
State	1.792***	2.518***	0.973	0.051	−7.828***	−10.869***	−15.212***	−13.066***
	(0.596)	(0.396)	(0.902)	(0.672)	(2.709)	(2.074)	(4.798)	(3.581)
ROA	−1.402**	−1.913***	0.709	1.029**	1.491	4.757***	3.365**	4.684**
	(0.558)	(0.414)	(0.643)	(0.469)	(1.471)	(1.497)	(1.645)	(2.232)
Log assets	0.283*	0.156	0.496	0.499**	−1.082	−0.623	−1.510	−1.549
	(0.153)	(0.159)	(0.323)	(0.221)	(0.829)	(0.457)	(1.368)	(0.944)
Diversification	−0.614	1.725**	−1.646	−0.696	1.455	−0.025	0.795	2.835
	(0.665)	(0.658)	(1.053)	(0.599)	(3.794)	(1.621)	(4.493)	(2.872)
Listed	−1.835***	−1.705**	−3.866**	−3.096***	3.152	1.555	2.076	2.267
	(0.625)	(0.671)	(1.684)	(0.944)	(2.307)	(1.305)	(4.474)	(2.673)
Revenue growth	−0.450	−1.736**	1.517***	0.446	1.696	4.766	0.707	3.563
	(0.312)	(0.829)	(0.418)	(0.496)	(1.636)	(4.013)	(2.060)	(2.761)
Constant	−1.917	−0.069	−2.899	−4.836	35.013***	26.822***	61.985***	63.368***
	(2.283)	(2.518)	(4.747)	(3.331)	(12.582)	(7.869)	(20.661)	(14.359)
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	260	505	266	676	249	517	313	692
Adjusted R-squared	0.165	0.640	0.0797	0.174	0.209	0.444	0.239	0.408
N-cluster (Banks)	103	102	108	110	100	99	122	122

Note: The sample is separated into the "Crisis" (2007–2009) and the "Non-Crisis" (2002–2006 & 20010–2013) periods. Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: State = The state-owned bank dummy, equals 1 if the bank is state-owned (equals 0 for foreign banks). Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 13
The effect of foreign minority ownership on bank risk-taking: percentage of foreign ownership.

	NPL		σ(ROE)		CAR		LCR	
	High (1)	Low (2)	High (3)	Low (4)	High (5)	Low (6)	High (7)	Low (8)
Dynamic Foreign	−2.162***	1.393	−0.900	0.127	2.279***	−0.006	6.678***	5.494**
	(0.804)	(1.234)	(1.047)	(1.683)	(0.729)	(0.759)	(2.452)	(2.408)
Select	1.074	−1.606	0.247	0.210	−1.606***	0.325	−5.155**	−5.907**
	(0.752)	(1.249)	(1.034)	(1.542)	(0.513)	(0.673)	(2.033)	(2.565)
ROA	−1.737***	−1.733***	0.981	1.339*	1.335***	1.443***	1.967*	1.801
	(0.492)	(0.486)	(0.627)	(0.712)	(0.261)	(0.226)	(1.171)	(1.158)
Log assets	0.411*	0.776***	−0.148	0.278	−0.421	−0.555*	−2.246	−2.514*
	(0.215)	(0.227)	(0.252)	(0.314)	(0.312)	(0.318)	(1.380)	(1.427)
Diversification	0.402	−0.011	−1.077	−0.894	0.895	0.967	1.757	2.657
	(0.671)	(0.598)	(0.736)	(0.757)	(0.608)	(0.612)	(2.535)	(2.603)
Listed	−1.408*	−2.244***	−1.878	−4.404***	0.363	1.090**	0.152	−0.003
	(0.786)	(0.584)	(1.446)	(1.454)	(0.596)	(0.453)	(2.476)	(1.687)
Revenue growth	−1.270*	−0.535*	0.420	0.728	1.824***	0.943***	4.281	2.248
	(0.730)	(0.314)	(0.690)	(0.481)	(0.506)	(0.336)	(3.807)	(1.934)
Constant	−1.591	−7.295**	6.035	−1.162	16.519***	18.629***	62.022***	66.590***
	(3.381)	(3.495)	(4.300)	(5.374)	(4.820)	(4.952)	(21.787)	(21.998)
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	519	560	565	611	521	570	670	679
Adjusted R-squared	0.573	0.523	0.179	0.179	0.445	0.407	0.375	0.387
N-cluster (Banks)	72	84	73	83	71	83	84	84

Note: The sample is split by the median level (16.93%) of the percentage of foreign ownership. "High" ("Low") indicates that the foreign ownership is higher (lower) than the sample median level. Bank observations with median level of foreign ownership are left out of the estimation sample. Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Dynamic Foreign = The foreign minority ownership dummy, equals 1 if the bank has a foreign investor in a given year, Select = The foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 14
The effect of foreign minority ownership on bank risk-taking: Local vs. Non-Local.

	NPL		σ(ROE)		CAR		LCR	
	Local (1)	Non-Local (2)	Local (3)	Non-Local (4)	Local (5)	Non-Local (6)	Local (7)	Non-Local (8)
Dynamic Foreign	−1.339	−0.269	0.037	−0.503	1.724**	0.842	5.583**	5.740***
	(0.994)	(0.881)	(1.027)	(1.332)	(0.766)	(0.697)	(2.609)	(2.038)
Select	0.387	−0.020	−1.159	1.305	−0.677	−1.033	−5.168**	−5.321**
	(0.979)	(0.961)	(1.069)	(1.184)	(0.619)	(0.628)	(2.266)	(2.224)
ROA	−1.860***	−2.085***	1.028*	1.262	1.426***	1.348***	1.855	1.940*
	(0.501)	(0.523)	(0.610)	(0.770)	(0.233)	(0.242)	(1.203)	(1.115)
Log assets	0.497**	0.470**	−0.004	0.059	−0.468	−0.575*	−2.224	−2.468*
	(0.216)	(0.232)	(0.239)	(0.330)	(0.297)	(0.336)	(1.352)	(1.445)
Diversification	0.165	0.132	−1.237	−0.726	1.013	0.844	2.237	2.206
	(0.678)	(0.672)	(0.749)	(0.781)	(0.644)	(0.596)	(2.551)	(2.606)
Listed	−1.411**	−1.397*	−2.572***	−3.869**	0.600	0.861*	2.160	−3.210**
	(0.668)	(0.778)	(0.783)	(1.752)	(0.467)	(0.477)	(1.728)	(1.311)
Revenue growth	−0.439	−0.942	1.157***	−0.246	1.436***	1.572***	2.733	3.148
	(0.397)	(0.610)	(0.431)	(0.645)	(0.391)	(0.490)	(2.236)	(3.111)
Constant	−2.910	−2.099	3.659	2.495	17.187***	18.923***	61.958***	65.741***
	(3.355)	(3.598)	(4.138)	(5.616)	(4.628)	(5.197)	(20.940)	(22.602)
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	532	508	580	559	541	505	683	666
Adjusted R-squared	0.543	0.536	0.184	0.187	0.417	0.463	0.372	0.396
N-cluster (Banks)	73	71	74	72	72	69	85	83

Note: The sample is split by the degree of localization of foreign investors. "Local" ("Non-Local") indicates that the state-owned banks with foreign investors that have (do not have) subsidiaries or branches in China. Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Dynamic Foreign = The foreign minority ownership dummy, equals 1 if the bank has a foreign investor in a given year, Select = The foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

branches are included in the "Non-Local" group.[15] We then estimate our DID model for these two groups separately. Results are presented in Table 14. Odd-numbered columns present results for the group with investors with local business, and results for the group with investors without local business are in even-numbered columns.

Comparison between the two groups suggests that, in terms of the CAR, state-owned banks acquired by foreign investors with local business exhibit significantly lower risk-taking level after the acquisition. While those have investors without local sub-

[15] For target banks with multiple acquirers (i.e. a group of acquirers), we group them as "Non-Local" if none of the acquirers has local subsidiaries or branches.

Table 15
The effect of foreign minority ownership on bank risk-taking: foreign directors serving on boards.

	NPL		σ(ROE)		CAR		LCR	
	High (1)	Low (2)	High (3)	Low (4)	High (5)	Low (6)	High (7)	Low (8)
Dynamic Foreign	−1.368	−0.203	−1.597	0.320	1.424*	1.374*	6.775**	5.109**
	(1.061)	(0.749)	(1.172)	(1.175)	(0.775)	(0.693)	(2.659)	(1.973)
Select	0.153	0.036	−0.042	0.604	−0.646	−1.164*	−5.495**	−5.123**
	(1.176)	(0.833)	(1.225)	(1.147)	(0.642)	(0.618)	(2.479)	(2.003)
ROA	−1.672***	−1.936***	1.044*	1.343*	1.429***	1.378***	1.564	2.141*
	(0.487)	(0.507)	(0.590)	(0.770)	(0.213)	(0.260)	(1.214)	(1.123)
Log assets	0.533**	0.527**	0.036	0.141	−0.518*	−0.439	−2.674*	−2.098
	(0.236)	(0.214)	(0.256)	(0.285)	(0.293)	(0.341)	(1.481)	(1.343)
Diversification	0.745	−0.236	−1.230*	−0.848	1.072*	0.785	1.936	2.549
	(0.713)	(0.602)	(0.681)	(0.812)	(0.591)	(0.659)	(2.507)	(2.677)
Listed	−0.908	−1.932***	−2.197**	−3.792***	0.651	0.639	0.369	−1.082
	(0.841)	(0.613)	(0.921)	(1.343)	(0.475)	(0.513)	(1.360)	(1.862)
Revenue growth	−1.008	−0.581*	0.721	0.547	1.197*	1.273***	3.134	2.826
	(0.723)	(0.329)	(0.640)	(0.497)	(0.616)	(0.315)	(4.117)	(1.892)
Constant	−3.639	−3.187	3.060	0.969	18.022***	16.877***	69.239***	59.792***
	(3.693)	(3.314)	(4.375)	(4.959)	(4.538)	(5.277)	(23.266)	(20.799)
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	559	520	601	575	563	528	667	682
Adjusted R-squared	0.529	0.549	0.190	0.181	0.406	0.430	0.391	0.375
N-cluster (Banks)	82	74	81	75	81	73	82	86

Note: The sample is split by the number of of foreign directors serving on boards. "High" ("Low") indicates that the number of foreign board members is larger than (smaller than) the median level (=2). Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: Dynamic Foreign = The foreign minority ownership dummy, equals 1 if the bank has a foreign investor in a given year. Select = The foreign acquisition dummy, equals 1 if the bank has experienced a foreign acquisition. Year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A1
The balance sheet transparency and the risk-taking of state-owned banks.

Variable	*No_Missing*	*Missing*	Diff	p-value
NPL	2.816	2.797	0.019	0.946
σ(ROE)	4.800	4.554	0.246	0.470
CAR	11.869	11.631	0.237	0.332
Variable	*Year_N > median*	*Year_N < median*	Diff	p-value
NPL	3.289	2.188	1.101***	0.003
σ(ROE)	4.597	4.800	−0.203	0.593
CAR	11.539	12.257	−0.718**	0.035
LCR	26.093	32.134	−6.041***	0.000

Note: Banks in the subgroup of *Missing* (*No_Missing*) have at least one (have no) missing value in our sample for corresponding risk measures. Banks in the subgroup of *Year_N < median* (*Year_N > median*) have lower than (higher than) the median number of year observations. NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A2
State-ownership and bank risk-taking: the stock price.

	NPL (1)	σ(ROE) (2)	CAR (3)	LCR (4)
σ(Stock price)	−0.017	0.040	−0.110**	0.209
	(0.011)	(0.091)	(0.042)	(0.260)
ROA	−0.959*	−1.677	6.437**	−0.709
	(0.461)	(2.297)	(2.185)	(3.066)
Log assets	−0.681	−0.098	−0.688	4.110*
	(0.583)	(1.403)	(0.889)	(1.960)
Diversification	−0.009	−8.522**	−3.671*	−16.276***
	(1.467)	(3.967)	(1.934)	(5.158)
Revenue growth	−2.506	−0.438	−4.299	16.409**
	(1.551)	(3.006)	(4.269)	(7.173)
Constant	15.380	7.289	23.296	−43.326
	(10.529)	(23.220)	(15.112)	(37.188)
Bank-type fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Observations	119	120	119	120
Adjusted R-squared	0.604	0.114	0.643	0.587
N-cluster (Banks)	15	15	15	15

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: σ(Stock price) = The standard deviation of stock price calculated from monthly data. Year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

sidiaries do not behave very differently in terms of our other risk measure after the acquisition. From the behavioral perspective, one possible explanation is that investors with local business are more likely to involve in the management process as they tend to keep their business in the local market for a longer period of time. As they may become more familiar with the Chinese market through the acquisition, the shareholder position may also help them develop their own business in China. On the other hand, "pure" foreign institutional investors tend to hold the investment position temporarily as they face higher level of foreignness in China and are less likely to enhance their involvement in their own business in the local market.[16] However, the coefficients for the LCR are significant for both sub-groups and are similar in magnitude.

In our next extension, we test the monitoring and learning effect of foreign acquisition by looking at the assignment of representatives on the boards of the banks.[17] Data with detailed information of the boards of directors are from the BvD BankScope Directors dataset and banks' annual reports. We retrieve individual characteristics for each director at each bank including the institution, name, and nationality. We then count the number of foreign directors for

[16] We also check the correlation between the foreign ownership percentage and the local business indicator to see if foreign banks with local business tend to invest in the state-owned banks with higher shares. A modest correlation of 0.1820 indicates that the above two factors (i.e. foreign investors' ownership percentage and their local market involvement) are different mediators that affect the treatment effect of foreign acquisitions.

[17] We thank our anonymous referees for the suggestion of this extension.

Table A3
The effect of foreign minority ownership on bank risk-taking: percentage ownership.

	NPL		σ(ROE)		CAR		LCR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ForeignP	−0.039		−0.093*		0.085***		0.193**	
	−0.032		−0.051		−0.031		−0.093	
ForeignP*BigFive		−0.172***		−0.232***		0.100***		0.053
		−0.058		−0.077		−0.036		−0.1
ForeignP*Joint-stock		0.044		−0.047		−0.006		0.300**
		−0.034		−0.077		−0.027		−0.13
ForeignP*City & rural		−0.068*		−0.06		0.129***		0.237**
		−0.036		−0.05		−0.035		−0.116
Select	0.006	0.336	0.916	0.752	−1.035**	−1.183***	−3.693**	−4.094**
	−0.782	−0.586	−0.965	−0.933	−0.425	−0.408	−1.635	−1.569
Bank-level controls	✓	✓	✓	✓	✓	✓	✓	✓
Bank-type fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	650	650	713	713	652	652	822	822
Adjusted R-squared	0.551	0.587	0.178	0.195	0.444	0.473	0.404	0.419
N-cluster (Banks)	87	87	88	88	85	85	99	99

Note: Dependent variables: NPL = Non-performing loan ratio, σ(ROE) = Standard deviation of return on equity, CAR = Capital adequacy (total capital) ratio, LCR = Liquidity coverage ratio. Independent variables: ForeignP = The foreign ownership percentages, ForeignP*Big Five = The interaction between the Big Five dummy and the foreign ownership percentages, ForeignP*Joint-stock = The interaction between the joint-stock bank dummy and the foreign ownership percentages, ForeignP*City & rural = The interaction between the city and rural commercial bank dummy and the foreign ownership percentages. Bank-type fixed effects, year fixed effects and bank-level control variables are included in the regressions. Standard errors are clustered at bank level. Standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

each state-owned bank.[18] There are 21 state-owned banks that have at least one foreign director serving on the boards of directors in our sample (all of which had foreign acquisition in our sample period). The mean and median numbers of foreign directors are 2 and 2.76 for the 21 banks respectively. We separate our estimation sample into two subgroups using the median number of foreign directors. Banks that have at least two foreign members on the boards of directors are categorized as "High", while those with below median number of foreign directors are in the "Low" group. Results are reported in Table 15. We find that those selected banks with more than two foreign members on their boards show lower level of risks after the foreign acquisition compared to banks with fewer or no foreign members on the boards. The finding that state-owned banks with higher number of foreign directors on boards have better improvement of their risk-taking can be viewed as a supporting evidence for the learning and monitoring channel for the effect of foreign acquisition.

8. Conclusion and implication

The objective of this study is to analyze how ownership affects banks' risk-taking behavior with a sample of banks in China. We compare the risk-taking level of state-owned banks with foreign banks and further explore the differences across three types of state ownership. The estimation results demonstrate that state-owned banks exhibit higher risk-taking behavior compared with foreign banks in China. We also find different risk-taking patterns among different types of state-owned banks. More specifically, banks controlled by the central or local government have higher risks than those controlled by large SOEs.

Our second series of hypotheses concern the effect of foreign acquisition on the risk management of the state-owned banks through the learning and monitoring effect channels. We find that the overall effects of foreign acquisition differ across different types of state-owned banks. The Big Five and city and rural commercial banks benefited more from the foreign acquisition compared with joint-stock banks. In addition, we also show that foreign acquisitions with high percentage of shareholding tend to have more significant effect in term of banks' risk-taking compared to those with low percentage of shareholding. Meanwhile, foreign investors that have subsidiaries or branches in China are more likely to exert positive monitoring effect on banks' risks management compared to investors without local business. Moreover, the monitoring effect of foreign investors is also positively associated with the number of foreign representatives serving on the boards of directors of the target state-owned banks.

This paper has important policy implications for the banking sector reform in China and the emerging market economies in general. Our finding that foreign acquisition helps lower risks of state-owned banks offers reference for ownership reform in the banking sector. State-owned banks that received foreign investment are subject to additional monitoring from their foreign shareholders. Therefore, private ownership, to some extent, may be one of many potential venues to improve corporate governance in state-owned banks. The results in our paper suggest that monitoring and supervision play crucial roles in reducing banks' risks, which is especially relevant in the context of state-owned banks.

Appendix A

In this section we present the results of three analyses that are not presented in the main text for brevity.[19] We explore the link between the level of transparency of the banks' financial reporting and their risk-taking levels. We restrict our analysis to state-owned banks in our sample only and identify two features of the data as proxies for the state-owned banks' reporting transparency. The first proxy is based on the existence of missing values for each of our four dependent variables in the baseline regressions (i.e. $NPL, \delta(ROE), CAR$, and LCR). We conduct a mean comparison t-test for the banks with missing values and those without missing values for each dependent variable.[20] Our second proxy represents the numbers of year observations for each bank in our sample. We use

[18] Due to data limitation, we do not have cross-sectional time series dataset of the number of foreign shareholders or board members. We use the current number of foreign directors for each bank and assume relative stability in the composition of the boards of directors.

[19] We thank our anonymous referees for the suggestion of these extensions.

[20] Bank observations with missing values for independent variables (i.e. bank-level controls) are eliminated from our estimation sample. *LCR* has no missing value for all banks in the sample so it is not included in this analysis.

the median number of year observations for each dependent variable as the split point for our subsamples and conduct a t-test for mean comparison between the two groups. Results are reported in Table A1. Banks in the "*No_Missing*" and "*Year_N* > *median*" groups tend to be more transparent than those in the "*Missing*" and "*Year_N* < *median*" groups. For results using our first measure reported in the upper penal of Table A1, state-owned banks that have missing balance sheet data are not different from those that do not have missing values in terms different risk measures. However, results in the lower penal show that banks with balance sheet information for a larger number of years tend to have higher risks (in terms of *NPL* and *CAR*) compared to those release less balance sheet data. Overall, we do not find strong evidence that transparency in banks' financial reporting indicates lower risk-taking of the state-owned banks. Our second test is related to the volatility in stock prices and the risk-taking of the listed state-owned banks. We construct a subsample of 15 listed state-owned banks in China.[21] The focal variable is the standard deviation of the stock price, calculated from the stock prices in a monthly frequency. The results are presented in Table A2. We only observe a negative relationship between the volatility of stock price and the CAR (Column (3)) for the listed state-owned banks. State-owned banks that have more volatile stock prices tend to have lower level of capital adequacy ratio. Our third analysis is a robustness check for the effect of the change in foreign ownership on banks' risk-taking. We replace our dynamic dummy variable for foreign investment with a variable that shows percentage of foreign ownership (at the bank level) in each year of the sample period. We re-estimate our main DID regressions and the results are reported in Table A3. The results are almost identical to the results in Table 6.

References

Abadie, A., Imbens, G.W., 2008. On the failure of the bootstrap for matching estimators. Econometrica 76, 1537–1557.

Aggarwal, R., Erel, I., Ferreira, M., Matos, P., 2011. Does governance travel around the world? Evidence from institutional investors. Journal of Financial Economics 100, 154–181.

Almeida, H., Campello, M., Laranjeira, B., Weisbenner, S., 2012. Corporate debt maturity and the real effects of the 2007 credit crisis. Critical Finance Review 1, 3–58.

Altunbas, Y., Carbo, S., Gardener, E.P., Molyneux, P., 2007. Examining the relationships between capital, risk and efficiency in European banking. European Financial Management 13, 49–70.

Amihud, Y., DeLong, G.L., Saunders, A., 2002. The effects of cross-border bank mergers on bank risk and value. Journal of International Money and Finance 21, 857–877.

Atkinson, A.B., Stiglitz, J.E., 1980. Lectures on Public Economics.

Barry, T.A., Lepetit, L., Tarazi, A., 2011. Ownership structure and risk in publicly held and privately owned banks. Journal of Banking & Finance 35, 1327–1340.

Barth, J.R., Caprio, G., Levine, R., 2004. Bank supervision and regulation: what works best. Journal of Financial Intermediation 13, 205–248.

Basel Committee, 2011. Basel III: a global regulatory framework for more resilient banks and banking systems. Basel Committee on Banking Supervision.

Berger, A.N., Clarke, G.R., Cull, R., Klapper, L., Udell, G.F., 2005. Corporate governance and bank performance: a joint analysis of the static, selection, and dynamic effects of domestic, foreign, and state ownership. Journal of Banking & Finance 29, 2179–2221.

Berger, A.N., DeYoung, R., Genay, H., Udell, G.F., 2000. Globalization of financial institutions: evidence from cross-border banking performance. Brookings–Wharton Papers on Financial Services 2000, pp. 23–120.

Berger, A.N., El Ghoul, S., Guedhami, O., Roman, R.A., 2013. Internationalization and bank risk. Tech. rep., Working paper, University of South Carolina.

Berger, A.N., Hasan, I., Zhou, M., 2009. Bank ownership and efficiency in china: what will happen in the world's largest nation? Journal of Banking & Finance 33, 113–130.

Berger, A.N., Klapper, L.F., Udell, G.F., 2001. The ability of banks to lend to informationally opaque small businesses. Journal of Banking & Finance 25, 2127–2167.

Berger, A.N., Roman, R.A., 2013. Did TARP banks get competitive advantages? Journal of Financial and Quantitative Analysis, Forthcoming.

Blalock, G., Gertler, P.J., 2009. How firm capabilities affect who benefits from foreign technology. Journal of Development Economics 90, 192–199.

Blomström, M., 1986. Foreign investment and productive efficiency: the case of Mexico. The Journal of Industrial Economics, 97–110.

Bonin, J.P., Hasan, I., Wachtel, P., 2005a. Bank performance, efficiency and ownership in transition countries. Journal of Banking & Finance 29, 31–53.

Bonin, J.P., Hasan, I., Wachtel, P., 2005b. Privatization matters: bank efficiency in transition countries. Journal of Banking & Finance 29, 2155–2178.

Boubakri, N., Cosset, J.-C., Fischer, K., Guedhami, O., 2005. Privatization and bank performance in developing countries. Journal of Banking & Finance 29, 2015–2041.

Buch, C.M., DeLong, G., 2004. Cross-border bank mergers: what lures the rare animal? Journal of Banking & Finance 28, 2077–2102.

Buckley, P.J., Clegg, J., Wang, C., 2007. Is the relationship between inward fdi and spillover effects linear? An empirical examination of the case of china. Journal of International Business Studies 38, 447–459.

Cohen, W.M., Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. Administrative Science Quarterly, 128–152.

Cornett, M.M., Guo, L., Khaksari, S., Tehranian, H., 2010. The impact of state ownership on performance differences in privately-owned versus state-owned banks: an international comparison. Journal of Financial Intermediation 19, 74–94.

Gleason, K.C., Mathur, I., Wiggins III, R.A., 2006. The evidence on product-market diversifying acquisitions and joint ventures by us banks. Journal of Financial Services Research 29, 237–254.

Gonzalez, F., 2005. Bank regulation and risk-taking incentives: an international comparison of bank risk. Journal of Banking & Finance 29, 1153–1184.

Gonzalez-Garcia, J., Grigoli, F., 2013. State-owned banks and fiscal discipline. No. 13-206, International Monetary Fund.

Gorton, G., Huang, L., 2002. Liquidity, efficiency and bank bailouts Tech. rep.. National Bureau of Economic Research.

Holmström, B., Tirole, J., 1993. Market liquidity and performance monitoring. Journal of Political Economy, 678–709.

Iannotta, G., Nocera, G., Sironi, A., 2007. Ownership structure, risk and performance in the European banking industry. Journal of Banking & Finance 31, 2127–2149.

Iannotta, G., Nocera, G., Sironi, A., 2013. The impact of government ownership on bank risk. Journal of Financial Intermediation 22, 152–176.

Kokko, A., 1994. Technology, market characteristics, and spillovers. Journal of Development Economics 43, 279–293.

Kornai, J., 1980. The dilemmas of a socialist economy: the hungarian experience. Cambridge Journal of Economics, 147–157.

Kornai, J., Maskin, E., Roland, G., 2003. Understanding the soft budget constraint. Journal of Economic Literature, 1095–1136.

La Porta, R., Lopez-de Silanes, F., Shleifer, A., 2002. Government ownership of banks. Journal of Finance 57, 265–301.

Laeven, L., Levine, R., 2007. Is there a diversification discount in financial conglomerates? Journal of Financial Economics 85, 331–367.

Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. Journal of Financial Economics 93, 259–275.

Lin, X., Zhang, Y., 2009. Bank ownership reform and bank performance in china. Journal of Banking & Finance 33, 20–29.

Maskin, E.S., 1996. Theories of the soft budget-constraint. Japan and the World Economy 8, 125–133.

McAllister, P.H., McManus, D., 1993. Resolving the scale efficiency puzzle in banking. Journal of Banking & Finance 17, 389–405.

Méon, P.-G., Weill, L., 2005. Can mergers in Europe help banks hedge against macroeconomic risk? Applied Financial Economics 15, 315–326.

Merton, R.C., 1977. An analytic derivation of the cost of deposit insurance and loan guarantees an application of modern option pricing theory. Journal of Banking & Finance 1, 3–11.

Nance, D.R., Smith Jr, C.W., Smithson, C.W., 1993. On the determinants of corporate hedging. Journal of Finance, 267–284.

Nier, E., Baumann, U., 2006. Market discipline, disclosure and moral hazard in banking. Journal of Financial Intermediation 15, 332–361.

Otchere, I., 2005. Do privatized banks in middle-and low-income countries perform better than rival banks? an intra-industry analysis of bank privatization. Journal of Banking & Finance 29, 2067–2093.

Pennathur, A.K., Subrahmanyam, V., Vishwasrao, S., 2012. Income diversification and risk: does ownership matter? an empirical examination of indian banks. Journal of Banking & Finance 36, 2203–2215.

Salas, V., Saurina, J., 2002. Credit risk in two institutional regimes: Spanish commercial and savings banks. Journal of Financial Services Research 22, 203–224.

Sapienza, P., 2004. The effects of government ownership on bank lending. Journal of Financial Economics 72, 357–384.

Saunders, A., Strock, E., Travlos, N.G., 1990. Ownership structure, deregulation, and bank risk taking. Journal of Finance, 643–654.

Shleifer, A., Vishny, R.W., 1986. Large shareholders and corporate control. Journal of Political Economy, 461–488.

Shleifer, A., Vishny, R.W., 1997. A survey of corporate governance. Journal of Finance 52, 737–783.

Spencer, J.W., 2008. The impact of multinational enterprise strategy on indigenous enterprises: horizontal spillovers and crowding out in developing countries. Academy of Management Review 33, 341–361.

Stiglitz, J. E., 1993. The role of the state in financial markets. vol. 21, Institute of Economics, Academia Sinica.

[21] There are in total 16 listed domestic banks in our sample. We exclude China Minsheng Bank from our sample.

Stiroh, K.J., 2004. Diversification in banking: is noninterest income the answer? Journal of Money, Credit and Banking, 853–882.
Tirole, J., 2001. Corporate governance. Econometrica 69, 1–35.
Tirole, J., 2010. The Theory of Corporate Finance. Princeton University Press.
Unite, A.A., Sullivan, M.J., 2003. The effect of foreign entry and ownership structure on the philippine domestic banking market. Journal of Banking & Finance 27, 2323–2345.
Volpin, P.F., 2002. Governance with poor investor protection: evidence from top executive turnover in Italy. Journal of Financial Economics 64, 61–90.
Wei, Y., Liu, X., 2006. Productivity spillovers from r&d, exports and fdi in china's manufacturing sector. Journal of International Business Studies 37, 544–557.
Winton, A., 1999. Don't put all your eggs in one basket? Diversification and specialization in lending. Tech. rep.
Yang, J., 2011. China's international coordination in policy response to the 2008 financial crisis. Journal of Diplomacy and International Relations 12, 73.
Zhang, Y., Li, H., 2010. Innovation search of new ventures in a technology cluster: the role of ties with service intermediaries. Strategic Management Journal 31, 88–109.