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Determinants of Non-Performing Loans in China and the Ownership Effect

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Abstract

This prospectus analyzes the potential determinants of Chinese non-performing loan (NPL) ratio in banking sector and its implications using panel data from different banks in China. By incorporating both bank specific factors and macro variables, it shows domestic credit growth rate, bank profitability measures and bank ownership play important roles in determining NPL ratio. Analysis of proportion of shares of different types of owners shows that increasing percentage of shares controlled by private institutional investors reduces the NPL ratio significantly. In addition, the declining quality of infrastructure loans indicates the side effect of Chinese economic stimulus plan of 2008, and explains the existing performance gap between Chinese state-owned banks and joint-equity banks. This prospectus discovers some evidence of growth disparity in three most prosperous regions in China where varied degrees of economic reform has led to different performance. By measuring IPO and foreign minority ownership event, it also finds the events of IPO and foreign minority ownership alone cannot improve the bank performance. China's weak corporate governance needs an overhaul to deal with the nepotism towards state-owned enterprises (SOE) and state-owned banks (SOB), which fundamentally distorts the banking sector. Finally, the prospectus anticipates several lines of future research, like how SOE and SOB can be deinstitutionalized; what is the effect of the shadow banking system on financial stability and health; and whether a more developed equity market will help reduce the NPLs as firms have more financing tools to fund their business.

Keywords: NPL ratio, GMM estimation, Ownership
JEL Codes: G210

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1. Introduction

China's banking sector is notorious for its huge amount of non-performing loans (Lu, Thangavelu, and Hu (2005)) and has undergone a turbulent period when the whole banking sector was recapitalized in the late 1990s. Despite SOEs' ongoing accumulation of nonperforming loans around the year 2000, most bank lending has flown to state-owned enterprises (SOEs), rather than hybrid sector banks that are better equipped to generate profit due to the country's adherence to 'market socialism with Chinese characteristics.' The scale of the non-performing loan (NPL) problem in China's banking systems was daunting at the time. Some economists estimate that the total loans outstanding were as high as 40%.[1] Dealing with the explosive growth in NPLs was critical for financial stability. Around the year 2000, the Chinese government set up four state-owned asset management corporations (AMCs)[2] to buy bad debts from the top four state-owned commercial banks[3] and disposed off the bad debts over 10 years. As a result, NPLs declined dramatically.

Figure 1 shows that the NPL level and ratio declined sharply from 2003 to 2011, with three distinct drops in the last decade. These drops can be attributed to three large-scale costly strips of toxic assets and recapitalization of state-owned commercial banks by the Chinese authorities. In contrast to European countries, where commercial banks face severe liquidity shortage and high NPL ratio, China's overall NPLs continue to decline since the recession and until 2011. NPL started to rise again from 428 billion RMB in mid 2011to 540 billion RMB in early 2013 with the ratio increasing from 0.94% early 2012 to 0.96% mid 2013. This very recent rise of both NPL and NPL ratio shows the downside trend of the aggregate economic growth and the repercussions of the multi-trillions RMB stimulus package. As many economists predicted, lending too much too quickly seems to have deteriorated banks' balance sheet. One of the major contributions of this research is in explaining why the NPL rises two years after global financial crisis breakout, and the effect of bank ownership on NPL ratios. Table 1 describes three major events of NPL

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1 Allen et al.(2012) explains it in detail.
2 The Ministry of Finance of China has established four financial asset management companies (AMCs), one for each of the four commercial state-owned banks, which are Great Wall, Orient, Huarong and Cinda.
3 Big four are Bank of China, Agriculture Bank of China, China Construction Bank and Industrial and Commercial Bank of China.

write off by state-owned commercial banks. All the transfers occur one or two years before the 'Big four' went public.[4]

Table 1 Three major strips of toxic assets arranged by the authority

| Year	Event
2004	Bank of China, China Construction Bank and others transfer $65 billion NPLs to AMCs.
2005	Industrial and Commercial Bank of China transfers $100 billion NPLs to four AMCs.
2006	Agriculture Bank of China transfers $110 billion NPLs to Ministry of Finance

Source: AMCs' websites

Figure 1 China's bank NPL and NPL ratio trend
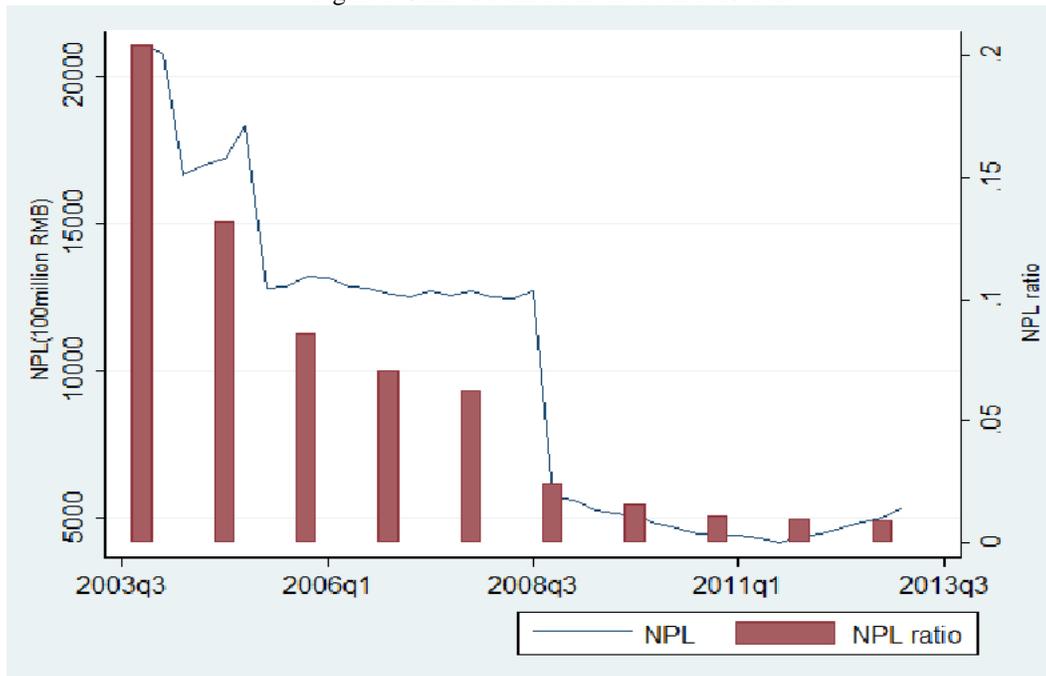
Source: wind info.

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[4] For detailed description about the sale of NPL assets to AMCs, see Paul and Kevin (2010)

Figure 2 NPL ratios of major countries
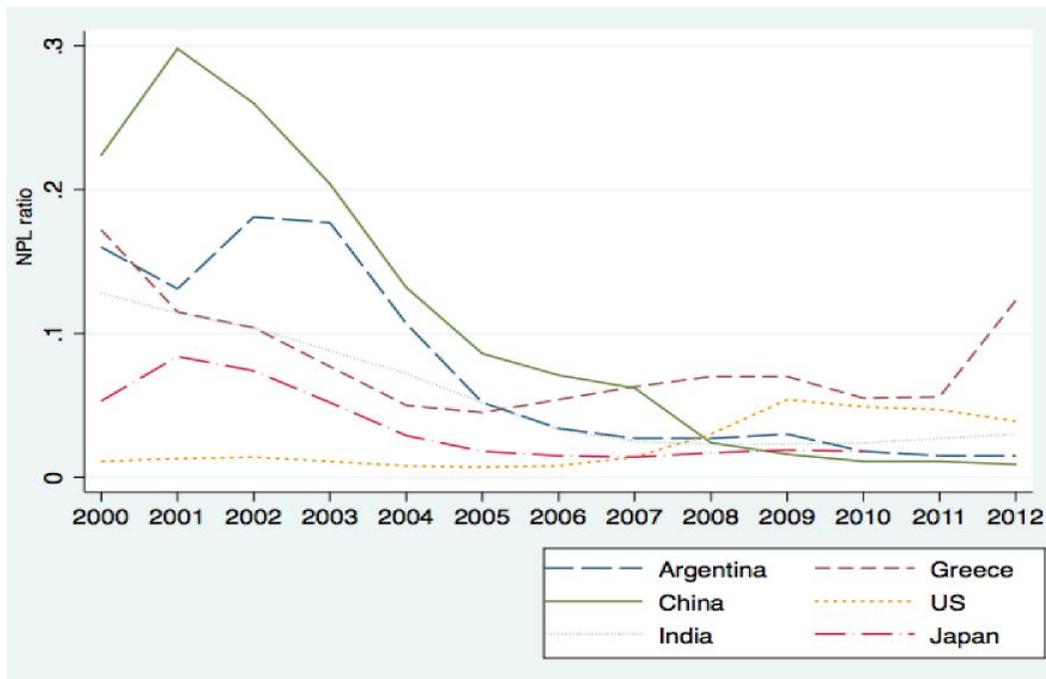
Figure 2 shows that China's NPL ratio is now even lower than some developed countries such as the US and Japan. This figure also shows that the NPL ratio is heavily influenced by the business cycle. The US ratio stays quite flat until 2007 and rises quickly from 0.8% to 5.4% in 2009 before declining when Federal Reserve starts its quantitative easing (QE) program of buying bad assets from commercial banks and other institutions. Argentina's ratio rises sharply in 2001 during its economic depression and one year later the government defaults on the larger part of the public debt. The situation in Greece after 2010 is similar, when sovereign debt crisis depleted Greek banks' liquidity and led to an increase NPLs. Examples of these countries show that the NPL ratio not only reflect the quality of banking assets and health of financial markets, but it is also a good indicator of overall economic performance. However, when interpret NPL data, one should bear in mind that the term "NPL" has many different definitions. Basel II defined NPL as any loan that is past due for more than 90 days, but this definition issubject to national variation.[5]

Since China's banking reforms began in 1978 and accelerated especially in the last decade, China's banking system has evolved with increasing diversity in ownership. State-owned banks inherited most

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[5] China encourages banks to use the supervisory five-category loan classification system according to their inherent risk

of the asset from the People's bank of China (PBOC), the central bank, after they spun off between 1979 and 1984. The four state-owned banks were originally designated to serve four separate business areas but gradually were permitted to engage in businesses that were profit driven. In order to encourage competition, 13 joint-equity banks were established with significant shares held by private institutional investors, though state-owned enterprises were usually the largest shareholders. These banks with broader market vision and advanced management skill were able to capture the profitable part of the market and achieve high growth rate. As of April 2013, state-owned banks account for 42.9% of the total asset in banking sector while joint-equity banks account for 18.5%, down from 52.5% and up from 15.5% in 2005 respectively. City commercial banks (CCBs) also experienced explosive growth, composed of 9.4% of total banking asset, and a 50% growth in eight years.

For a detailed description of China's banking reform, see Jiang, Yao and Zhang (2009), Berger, Hasan, and Zhou (2009), Chang, Jia, and Wang (2010). Due to the diversity and complexity of China's banking sector, various types of banks have different asset quality. Figure 3 shows that at the beginning of 2003, state owned banks have much higher NPL ratio than other types of banks and foreign owned banks have the lowest NPL ratio. Since then, the NPL ratio of state owned banks has converged to that of other banks, falling from 20% to around 1.11%. While 1.11% is still almost twice the NPL ratio of joint-equity banks, it is still well-below 10% and is therefor considered healthy by international standards. The reform of the banking system has improved the incentives for state-owned banks to behave more discretely in their lending (and, att the same time, the three policy banks previously mentioned have gradually taken over the role of policy loans from the 'big four', and thereby reduced their burden to some extent). The original gap in NPL ratio of state-owned banks and other banks and the subsequent convergence are consistent with the hypothesis in Jia (2009) that accountability to shareholders and depositors gives joint-equity banks more incentives than state-owned banks to engage in prudent lending. Another interesting trend is foreign banks' NPL ratio basically remains the same after entering the Chinese market but with some increase after 2008. At the time, most foreign banks focused on currency transaction and international trade and business, and inevitably suffered from the weakness of the Chinese export market and huge currency volatility.

The share of foreign banks in total asset during the crisis also declined from 2.38% in 2007 to 1.82% in late 2012.

Figure 3 NPL ratios per type of bank
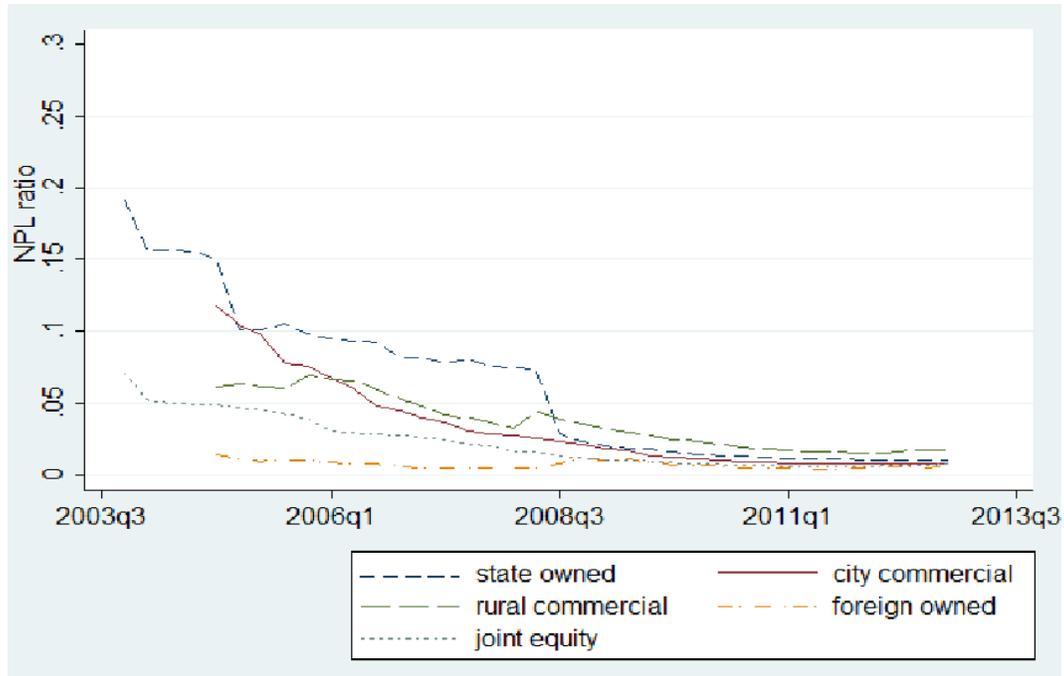
Other important measures of the profitability of financial institutions include return on asset (ROA) and return on equity (ROE). Since banks usually carry a large amount of liability like deposits and debt, the scale of two measures are expected to be different, as in figure 4. Both ROA and ROE are among the highest for joint equity commercial banks. Their ROA performed particularly well with only a small drop in 2008, showing that introducing global strategic partners since 2004 has had a positive effect on profitability. Other ROA and ROE of banks have been rising at the about same pace. For ROE, different banks converge to the same level of around 16% except foreign banks, which achieve merely 6% in 2012. Again, foreign banks' performance lags behind. Besides the global economic slump, it is also driven by the monopoly of the domestic banks in government-related business, heated competition from attracting deposits and loans as well as the still high barrier to entry and expansion in China. With further liberalization in financial sector, foreign banks are expected to catch up as they have advanced management and experience in services. It's also worth noting that with respect to profitability, most domestic banks were not heavily affected by the recent global

recession, if they were affected at all. The explanation for this varies among economists. But, the general consensus is that Chinese financial institutions are largely insulated from developed economies and financially depressed. This kind of underdevelopment and disconnect in financial market enables China to defend itself from the systemic risk of developed countries. In addition, large scale of post-stimulus money from local government in China is still being invested. It was revealed in 2011 that as much as 20% of the loans under the program may be written off.[6] According to 'NPL market investigation report 2013' conducted by China Orient Asset Management Corporation, one of the AMCs, the year 2015 would see a high growth rate of NPLs.

Figure 4 ROE and ROA per type of bank
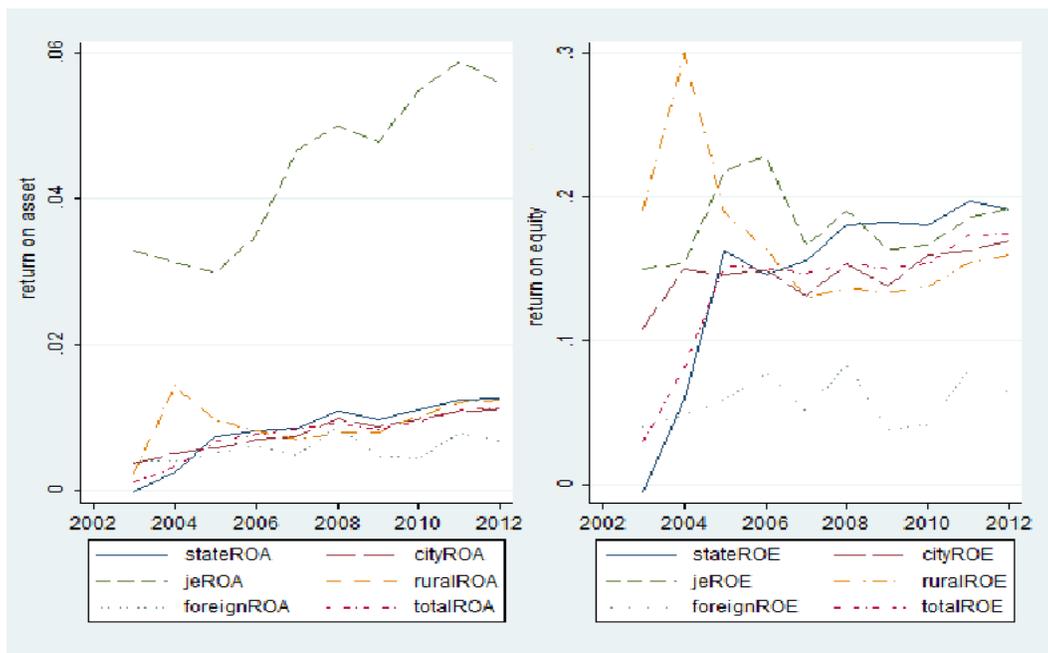
Source: wind info.

Section 2 reviews literature on China's banking sector and cross countries' studies on NPL ratio. Section 3 underlies four hypotheses on the determinants of NPL ratio. The following section discusses data set and GMM estimation method as well as main empirical results. Section 5 makes further analysis of loan portfolio effect on NPL. Section 6 discusses one big impediment to the further

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[6] Schoen, John W. 'China may be next victim of a debt crisis.' MSNBC, 1 July 2011

banking reform in China and its relationship with SOEs. Section 7 presents results of several tests and the final section concludes.

2. Literature Review

Previous literature on NPLs and bank profitability in China mainly focuses on the ownership of Chinese banks and companies. Jia (2009) investigates the relationship between ownership and prudential behavior of banks using excess reserves ratio, loan/asset ratio and deposit/loan ratio as dependent variables in the regression. He uses a bank dummy to capture the difference between state-owned and other banks. He also includes bank fund source measure (short- and long-term deposits), bank assets and GDP growth, showing that joint-equity banks tend to have higher excess reserves, higher deposit/loan ratios, and lower loan/asset ratios, which shows lending by state-owned banks has been less prudent than that by joint-equity banks. Ferri (2009) uses a field survey on 20 city commercial banks from three provinces at different levels of economic development and shows better performance among those in the East where the financial market is more open. Even in the East, commercial banks controlled by state-owned enterprises exhibit worse. Ferri uses the share of CCB board directors appointed by SOEs to capture the ownership effect on NPL and finds the coefficient is positive. Berger, Hasan, and Zhou (2009) categorize bank ownership into majority state-owned, majority private domestic, majority foreign and no majority ownership. They find that minority foreign owners in both private and public bank may increase Chinese bank efficiency. Lin and Zhang (2009) conduct a joint analysis of the static, selection, and dynamic effects of domestic private, foreign and state ownership and find 'Big Four' state-owned banks are less profitable and less efficient, and have worse asset quality than other types of banks. Xu (2011) focuses on the impact of foreign bank entry on domestic banking performance and constructs a spatially disaggregated measure of foreign bank presence called foreign exposure index, showing that foreign bank entry is contributing to a more competitive and efficient banking industry in China.

Other papers on China's banking sector focus on firm level conditions and political motivation. Lu, Thangavelu, and Hu (2005) use panel data of China's public listing companies to explore the

relationship between banks' lending behavior and NPLs, concluding that state-owned enterprises (SOEs) get more loans with higher default risk and there is a systemic lending bias in favor of SOEs. However, they use borrowing ratio of the firm as dependent variable instead of NPLs and argue a higher ratio may lead to default. Shih (2004) discusses politicization of the NPL problem and policies designed to slow the generation of NPLs and finds that political consideration plays a large role in shaping financial policies in China. Li, Rozelle, and Zhou (2007) use unique survey data to examine bank performance from incentive contracts perspective. They analyze the effect of bank manager's incentive intensity and personal factors such as education level, business experience on deposit growth and proportion of performing loans to show that incentive contracts are important in improving bank performance through attracting deposits and reducing NPLs. Suzuki, Miah, and Yuan (2008) argue the failure to create sufficient economic rents is the chief reason for the current dismal performance of banks.

There are several studies on NPLs that focus on countries other than China. Louzis, Vouldis, and Metaxas (2012) examine the determinants of NPLs in the Greek banking sector, separately for each loan category (consumer loans, business loans and mortgages) and show that NPLs can be explained by macroeconomic variables (GDP growth, the unemployment rate and the lending rates) and management quality (debt, size, leverage ratio, etc.). Barseghyan (2010) develops a general equilibrium model in which the government provides deposit insurance to the financial sector, arguing that the existence of non-performing loans, combined with a delay in the bailout leads to a persistent decline in economic activity between 0.19% and 0.51% per year in Japan. Rajan and Dhal (2003) explore an empirical approach to analyze commercial banks' NPLs in the Indian context. They find that terms of credit variables have a significant effect on banks' NPLs in the presence of bank size induced risk preferences and macroeconomic shocks. Also in India, Ghosh (2005) find a positive relationship between corporate leverage and banks' NPLs. De Lis, Pages, and Saurina (2000) analyze the growth of bank credit and its prudential implications in Spain and show that there is a significant and positive impact of credit growth on problem loans but with a lag of around three years. They conclude that bank managers tend to make overly expansionary credit policy under the market

pressure for higher profits. This increases borrower's debt levels excessively, which results in an increase in problem loans. Cornett, Guo, Khaksari, and Tehranian (2010) examine changing performance differences between state-owned and private-owned banks around the time of the Asian financial crisis and find that state-owned banks operated less profitably, held less core capital, and had greater credit risk than privately-owned ones. Nkusu (2011) investigates the macroeconomic determinants of NPL in panel regressions from 1998 to 2009 for a sample of 26 advanced economies. He includes changes in housing prices and equity price index as explanatory variables in addition to macro- and bank specific variables and confirms that adverse macroeconomic developments are associated with rising NPL.

This research studies Chinese NPLs using both China's banking sector and aggregate economic data and makes several contributions. First, the sample set dates from 2001 to 2012, covering a full period of Chinese business cycle; the expansion from 2001 to 2007, the contraction from 2007 to 2012, and the subsequent upward trend. Thus, this paper is a good illustration of how Chinese banks respond to the business cycle. It also highlights the controversial role of the multi-trillions RMB stimulus package in shaping asset quality. Second, during the same period, many commercial banks, both state-owned or joint-equity, have introduced strategic partners from outside the country and the ownership underwent large scale re-structuring (Lin and Zhang (2009)). During the same period, all the Big Four successfully went public in Shanghai or Hong Kong stock markets. Therefore it is of great significance to look at the change of ownership effect on banking asset quality and profitability. In this research I use more precise variables compared to previous literature to capture this effect. Third, I try to answer why a gap still exists between state-owned banks and joint-equity banks in terms of their attitude towards infrastructure projects, offering another explanation for the ownership effect from a unique angle. Knowing this not only matters for individual bank's survival in increasingly competitive financial markets, but is also critical to whether China should continue its banking reform, and more broadly economic reform.

3. Econometric model

Previous literature indicates that there are both macro factors and bank specific factors that influence NPL ratios.

$$NPL_t = a_t L_t$$

$$a = f(a_{t-1}, Macro_{t-1}, BM_{t-1}, BB_t, Dummy_t)$$

L_t represents total loans on the balance sheet. a_t is NPL ratio, the persistence of which is measured by a function of onece-lagged dependent variable a_{t_1}. The equation also includes previous period macroeconomic factors $Macro_{t\_1}$, bank management skills BM_{t_1}, current period bank balance sheet BB_t are dummy variables that may affect a. Previous literature (García-Herrero, Gavilá, and Santabárbara (2009), Nkusu (2011)) shows that the NPL ratio is highly persistent. NPLs are comprised of loans classified as substandard, doubtful or loss in the five-category loan classification system. banks usually write off the loans using loan loss provision and put great effort into monitoring substandard and doubtful loans, which still stay on the balance sheet.[7] I will identify the other explanatory variables with corresponding hypotheses.

(1) 'Macroeconomics hypothesis': A rapid growing economy will reduce the NPL ratio.

A booming economy will likely improve business condition and hence debtors, such as consumers and firms, have enough capacity to repay the interest and principal from their income, which in turn lowers the NPL and NPL ratio. On the other hand, the value of the collateral increases during expansion periods and firms can borrow more to finance project with higher net present value, whuch further increases revenue income and reduces auditing cost (Bernanke and Gertler (1989)). For banks, a heated economy means plenty of good investment opportunities and larger amount of total loan on its balance sheet, which will increase the denominator, and thus reduce the NPL ratio. Jia (2007) includes GDP growth, credit quota as macro variables. Louzis, Vouldis, Metaxas (2012) include GDP growth and unemployment rate. GDP is the most important, and a commonly used indicator of the overall performance of economy. The unemployment rate, too is a good indicator of the economy. However,

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[7] The movement of loans through the various classifications is called migration rate, accounting for changes in composition of loan portfolio.

which reliability of the data published by the Chinese government is questionable. Hence, I pick domestic credit to measure the overall credit market that is available to commercial banks and other financial institutions. Evidence suggests that rapid expansion of lending by banks often worsens bank's asset quality (Ghosh, 2006). I use once-lagged variables of GDP and domestic credit growth rate among others since NPL ratio is a lagged indicator of credit market. The following is the econometric specification.

$$NPLratio_{it} = a + \beta 1* NPLratio_{it\_1} + \beta 2 * GDP_{t\_1} + \beta 3 * \text{domestic credit}_{t\_1} + \varepsilon_{it}$$

(2) 'Management skill hypothesis': A good management skill will reduce NPL ratio.

An experienced bank manager with a good team can effectively control credit risk by lending to potentially most profitable business. Management quality is measured in different ways. Louzis, Vouldis, and Metaxas (2012) use past performance and cost efficiency as proxies for the quality of management. Educational level is a good measure of how the bank employees perform. In this paper, I collect employee's diploma information. A higher percentage of employees with advanced degrees (masters or Ph.D.) indicate strong research and problem solving ability to handle credit issue challenges. From incentive contract point of view, higher payroll and bonus will make employees work harder and pursue higher net profit with more prudential selection of loan applications (Li, Rozelle, and Zhou (2007)). Besides personal factors that can show management skill, profitability is also a good representative and is negatively associated with NPL ratio in the future. I include the cost income ratio calculated as operating costs divided by operating income to measure bank efficiency. The last variable in this hypothesis is loan deposit ratio, which measures prudential behavior as well as potential liquidity risk (Ariff and Can (2008)). As loan deposit ratio increases, deposit available to hedge bank run decreases.[8] The regression to test this hypothesis is

$$NPLratio_{it} = a + \beta 1* NPLratio_{it\_1} + \beta 2 * GDP_{t\_1} + \beta 3 * \text{Employee Edu}_{t\_1} + \beta 4 * Pay_{t\_1} + \beta 5 * CI_{t\_1}$$
$$+ \beta 6 * \text{LD ratio}_{t\_1} + \varepsilon_{it}$$

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[8] China regulatory banking commission rules the upper limit of loan deposit ratio as 75%.

(3) 'Diversification hypothesis': Bank size, non-interest income (NII) proportion and population of employees are negatively related to NPL ratio. Ratio of loans to Top 1 to 10 clients is supposed to be negative with NPL ratio.

Diversification is a very important tool to spread credit risk. For commercial banks in very small cities, there are limited business customers so that if one firm defaults on its debt, the bank suffers a heavy shock. Humphrey (1990) studies the economies of scale in banking sector. He finds that scale economies exist, but are limited to the relatively smaller banks. Neither constant costs nor some scale diseconomies seem to apply to larger institutions. The larger the bank is, the more monopoly power it has to enjoy the 'quiet life' (Fu and Heffernan (2009)). Traditionally, interest income is unstable due to changes in interest rates, which are highly regulated by the Chinese authority. In contrast, non-interest income consists of commission, account service charges, varieties of fees and etc. is relatively stable and can provide enduring liquidity in the event of increased default rates.[9] In addition, a higher NII indicates that the bank obtained advanced managerial and financial techniques to diversify its sources of revenue, showing its management ability. The third variable is employee population of the bank, whose role is similar to the bank size. Ratio of the ten largest borrowers' loan over equity indicates how well the bank's portfolio spread the risk.

$$NPLratio_{it} = a + \beta1 * NPLratio_{it\_1} + \beta2 * GDP_{t\_1} + \beta3 * Bank\ size_{t\_1} + \beta3 * Employee_{t\_1} + \varepsilon_{it}$$

(4) 'Ownership hypothesis': State-owned banks have higher NPL ratio than other types of banks and going public helps to reduce the ratio.

This is the main hypothesis of this paper. Lu, Thangavelu and Hu (2005) show that state-owned companies are more likely to receive loans and the quality of the loan is worse than those held by the private sector. Jia (2007) shows that lending by state-owned banks has been less prudent than lending by joint-equity banks, but he uses loan/asset ratio, deposit/loan ratio as dependent variables. One potential problem is that a higher loan/asset ratio, for example, does not necessarily imply that banks have become less prudent if there are good opportunities for banks to invest. This is particularly relevant given that state-owned banks have an advantage in finding good projects.

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[9] The definition of non-interest income is from Investopedia.

Similarly, a higher deposit/asset ratio may indicate the banks do not know how to invest the deposit, and not necessarily prudential behavior. By using NPL ratios directly, I can get a clear picture of banks' ability to handle credit risk. Berger, Hasan, and Zhou (2009) use several dummies to represent state-owned banks with and without foreign minority, as well as private banks with and without foreign minority to further explore the effect of any foreign shareholding on bank efficiency from 1994 to 2003. They suggest that the 'Big Four' are the least efficient and minority foreign ownership is associated with significantly improved efficiency. Similar to previous dummy method, García-Herrero, Gavilá, and Santabárbara (2009) also find significant and negative impact of transfers of NPLs to AMCs on the ratio and the stock of NPLs, showing that state-owned banks' declining NPLs is partly explained by the recapitalization from the central government. So I also use the recapitalization dummy to control for the government bailout effect. But previous literature on the Chinese banking sector does not use specific shareholder information to study the ownership effect.[10] In this paper, I identify the 5 largest shareholders for each bank over the period and calculate the percentage of shares owned by Ministry of Finance (MOF), state-owned enterprise (SOE), private sectors and foreign investors. I also calculate the degree of control concentration using the concentration index developed by Smith (2011). The equation follows:

$$C = L + \sum_{i=2}^{5} s_i^2$$

where C is the concentration of ownership index and L is the largest proportionate control owner in percentage terms. S is the percentage ownership of ith largest owner in the entity. Smith (2011) believes that highly concentrated ownership carries risks of shareholder inequality, excess leverage, and other private benefits, and the broad degree of ownership dispersion would lower these risks. Prowse (1992) shows that ownership concentration in independent Japanese firms is positively related to returns from exerting greater control over management but is unrelated with accounting profit rate.

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[10] Lu, Thangavelu, and Hu (2005) use state ownership ratio of Chinese public listing companies to study the relationship between banks' lending behavior and NPLs. They show that banks lend biasedly to companies with larger state ownership. But they didn't calculate the private ownership.

Thus I want to test the effect of concentration risk on the prudential behavior of Chinese commercial bank.

$$NPLratio_{it} = a + \beta1 * NPLratio_{it\_1} + \beta2 * GDP_{t\_1} + \beta3 * ownership_{m,t\_1}\% + dummy\_recap_{t\_1} + \varepsilon_{it}$$

where m refers to MOF, SOE, private investors and foreign investors.

4. Empirical analyses

4.1 The data set

Dataset on 16 major commercial banks in China is constructed specifically for this research based on annual reports from 2001 to 2012 and most of the balance sheet data has been cross-checked with Almanac of China's Finance and Banking. The total asset of the sample banks accounts for 62.8% of total asset in China's banking sector. It covers all the 4 state-owned banks and 12 joint-equity commercial banks (84.6% of total asset). The sample set is an unbalanced panel due to data limitations. Most literature on China's bank performance (Fu and Heffernan (2009), Chang, Jia, and Wang (2010), Lin and Zhang (2009), García-Herrero, Gavilá, and Santabárbara (2009)) depend heavily on two data sources: Almanac of China's Finance and Banking published by China's central bank, and Bankscope published by Bureau van Dijk. Since my sample data involves information of shareholders and loan portfolio that neither of these datasets provide, I have used about 200 annual reports to construct a dataset that enables analysis of China's banking reform from a new perspective. Macro data such as GDP, and domestic credit are from IFS. All the original variables are stationary by panel unit root test.[11] Table 2 presents summary of descriptive statistics of joint-equity banks and state-owned banks. State-owned banks have larger total assets, number of employees and non-interest income proportion than joint-equity banks (significant at 1% level) while the ROEs are similar for the two. The NPL ratios for joint-equity banks are decisively lower. Shareholder information of the two types of banks is interesting. State-owned banks are predominately controlled by the central government of China and less so by private investors; on the other hand, state owned enterprises hold

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[11] I take first difference on total asset to make it stationary.

much of the shares of joint-equity banks. T-test of difference in means show that most bank performance variables differ significantly at 1% level for the two types of banks. Percentage of shares owned by MOF is also strongly significant in difference. However, there is no significant difference in SOE and private investors' shareholding, indicating SOEs have comparable influence on both types of banks and private investors' influence is pretty weak overall in China.

Table 2 Summary of descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	t-Test of Difference
	Panel A: 12 Joint-equity bank[a]					Panel B: 4 State-owned bank[h]					
NPL ratio	105	0.021	0.025	0.000	0.114	36	0.088	0.112	0.009	0.344	5.80***
Total asset	106	13.2	1.4	9.3	15.5	36	15.9	0.5	14.9	16.7	11.29***
No. Employee[b]	92	21925	21134	496	96259	27	274287	177203	2297	489425	13,47***
Payroll[c]	92	7.1	1.5	3.5	9.5	29	9.7	1.4	5.2	11.1	8.37***
NII proportion[d]	105	0.100	0.054	0.003	0.221	36	0.173	0.065	0.056	0.3158	6.60***
ROE	104	0.171	0.072	0.009	0.426	31	0.163	0.067	0.012	0.233	0.56
Private%[e]	106	0.189	0.156	0.000	0.624	36	0.156	0.137	0.000	0.373	1.16
SOE%[f]	106	0.322	0.229	0.000	1.000	22	0.017	0.022	0.000	0.089	0.23
MOF%[g]	106	0.070	0.158	0.000	0.709	36	0.809	0.161	0.570	1.000	24.16***

Source: ACFB and annual reports from each commercial bank

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

a include the Bank of Communications, China CITIC Bank, China Everbright Bank, Hua Xia Bank, China Minsheng Bank, Guangdong Development Bank, Shenzhen Development Bank, China Merchants Bank, Shanghia Pudong Development Bank, Industrial Bank, Zheshang Bank and Bohai Bank.

b is number of employees in each bank.

c Defined as Chinese currency yuan per capita.

d is non-interest income.

e percentage of shares held by private investors in top 5.

f percentage of shares held by state owned enterprise in top 5.

g percentage of shares held by Ministry of Finance(MOF) or China Central Huijin, an investment company owned by MOF in top 5.

h include the Big Four, see note 2.

4.2 The GMM technique

The Arellano and Bond (1991) and Arellano-Bover (1995)/Blundell and Bond (1998) dynamic panel estimators are ideal for small T, large N panels (like my sample). Also NPL is highly persistent (Louzis, Vouldis, Metaxas, 2012), which means the dependent variable is dynamic depending on its past realizations and the independent variable is highly endogenous. All of these characteristics indicate that using GMM is a good choice. My basic panel regression is shown as below.

$NPLratio_{it} = \alpha NPLratio_{it-1} + \beta X_{it} + \eta + \varepsilon_{it}, |\alpha| < 1, i = 1, \dots, N, t = 1, \dots, T,$

Where X_{it} vector is the determinants of NPL ratio, ηi is the unobserved bank specific effect and ε_{it} is the error term. The original work by Arellano and Bond (1991) is based on the first difference transformation of the panel regression in the following.

$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \beta \Delta x_{it} + \Delta \varepsilon_{it}$

where Δ is the first difference operator. The lagged dependent variable Δy_{it} is correlated with the error term, leading to a bias in the estimation of the model. In this paper, formation of non-performing loan is complicated in China. There are not only bank specific factors contributing to NPL, but also firm factors, such as the entrepreneurial ability of the CEO or even personal connections with the loan department, play an important role. In order to solve the endogeneity issue, Arellano and Bond (1991) argue y_{it-2}, which is not expected to be correlated with $\Delta \varepsilon_{it}$ for t=3, ... , T, can be used as an instrument in the estimation of the differential equation above. This suggests that lags of order two, and more, of the dependent variable satisfy the following moment condition:

$E[y_{it-s}\Delta \varepsilon_{it}] = 0$ for t=3, . . . ,T and s $\geq$ 2.

Several problems exist in first difference GMM, one of which is that time-invariant regressors (ownership dummy variables in this paper) would disappear in difference GMM. If dependent variable is close to a random walk, the method performs poorly because past levels convey little information about future changes, so that untransformed lags are weak instruments for transformed variables (Blundell and Bond (1998)). Bond, Hoeffler, and Temple (2001) find that the GMM estimator can be poorly behaved when time series are persistent.[12] Introduced by Blundell and Bond (1998), system a estimator differences the instruments, in addition to the first differential equation, to make them exogenous to the fixed effects. This is based on the assumption that changes in any instrumenting variable w is uncorrelated with the fixed effects, that is $E[\Delta w_{it}\mu_{it}] = 0$ for all i and t. Then they argue that $\Delta w_{i,t-1}$ is a valid instrument for the variables in levels as $E[\Delta w_{i,t}\varepsilon_{it}] = 0$. Hence, in system GMM, all instruments for the levels equation are assumed to be orthogonal to fixed effects, and thus to all time-

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[12] The authors use data for a panel of R&D-performing US manufacturing companies and find the system GMM estimator yield much more reasonable parameter estimates.

invariant variables. Arellano and Bover (1995) describe how, if the original equation in levels is added to the system, additional instruments can be brought to increase efficiency.

In this paper, I use system GMM method to estimate the coefficients of the independent variables. The most popular tests for dynamic panel data are the Sargan/Hansen specification test and the Arellano-Bond autorcorrelation test. The Sarfan-Hansen test's null hypothesis is that over-identification restrictions are valid. The Arellano-Bond autocorrelation test's hypothesis is that $\Delta\varepsilon_{it}$ are not second order autocorrelated and the $\Delta\varepsilon it$ should be first-order autocorrelated since it derives from the first difference of the equation.

4.3 Results

Table 3 shows the results from GMM estimation. NPL ratio shows strong persistence, as the dependent lagged variable is significant at 1% level in all models. Dummy for recapitalization is strongly negative; showing government effort to reduce the NPL ratio of state-owned banks has been very effective. Macroeconomic GDP growth and domestic credit growth play important role in reducing the NPL ratio. The change in growth rate of domestic credit is negative and significant too, showing there is a cyclical effect of NPL ratio since Chinese domestic credit expands during expansion period (I perform a t-test to test the equality of coefficients on two periods' domestic credit and reject it at 5% level, but fail to reject on two periods' GDP growth). For the management skill hypothesis, the quality and incentive of the employees do not show any effect. However, loan deposit ratio is strongly significant and positive, showing less prudential behavior and more aggressive lending policy would deteriorate the NPL ratio in the long run. The results show management skill is very important in determining the banking asset.

Diversification hypothesis has mixed results. The number of employees is positively correlated with NPL ratio, showing more employees may create low or working efficiency. But both total asset and non-interest income proportion are insignificant. Dummy for Big Four state-owned is only

marginally significant. That is because there is minimal distinction between state-owned and joint-equity commercial banks as all the state-owned banks have gone public and are no longer under full control of central government. The techniques applied in previous literature (Jia (2009), Fu and Heffernan (2009), etc.) become outdated and imprecise and I use more specific shareholder information to capture the ownership effect and IPO effect later.

Table 3 Dynamic GMM panel regression results

Independent variables	Dependent variable: NPL ratio								
	Macroeconomics hypothesis		Management skill hypothesis		Diversification hypothesis			Ownership hypothesis	
NPL$_{t-1}$	.815***	.846***	.818***	.680***	.809***	.813***	.864***	.809***	.812**
	(.057)	(.053)	(.060)	(.049)	(.70)	(.68)	(.067)	(.060)	(.063)
GDP$_{t-1}$	-.158*	-.210***	-.173**	.006	-.204**	-.161**	-.103*	-.162**	-.155*
	(.083)	(.080)	(.085)	(.017)	(.096)	(.078)	(.063)	(.082)	(.081)
DC$_{t-1}$	-.075*	-.008	-.078**	-.005	-.121**	-.071**	-.032	-.076*	-.069*
	(-.041)	(.020)	(.041)	(.013)	(.053)	(.036)	(.032)	(.040)	(.039)
ΔDC$_{t-1}$		-.084***							
		(.030)							
Cost/Income			.0004						
			(.0004)						
EDU				.011					
				(.017)					
Payroll				.00006					
				(.0002)					
Loan/Deposit					.091**				
					(.048)				
Assett						.002			
						(.002)			
Employeet							.002***		
							(.0008)		
NII$_{t-1}$						-.056	-.025		
						(.69)	(.018)		
D_owner								.007*	
								(.002)	
D_public									-.004
									(.004)
D_recap	-.076*	-.087**	-.059***	-.119***	-.071*	-.061***	-.112***	-.062***	-
	(.039)	(.043)	(.019)	(.011)	(.037)	(.018)	(.018)	(.018)	(.019)
Constant	.041*	-0.0006	.043	.0005	-.005	.018***	.008**	.040*	.042*
	(-.023)	(-.001)	(.023)	(.008)	(.029)	(.024)	(.012)	(.021)	(.024)
Hansen p-value	0.969	0.970	0.989	1.000	0.997	0.987	0.999	0.981	0.980
m2 p-value	0.388	0.226	0.352	0.230	0.381	0.282	0.290	0.399	0.389
Observations	125	110	122	50	102	124	107	125	25

Hansen test H0: overidentification is valid

m2 test H0: $\Delta\varepsilon_{it}$ are not second order autocorrelated.

Table 4 shows that the percentage of shares owned by private sectors and foreign investors are negatively correlated with NPL ratio and strongly significant for private shareholders. It indicates that increasing partnership with foreign investors and non-state domestic firms helps improve the banks' prudential behavior (Xu, 2011). Traditional wisdom is that investors from private sectors care more about profitability than state owned investors and thus are more willing to optimize banks' investment policy (Lin and Zhang (2009)). In addition, the sample in this regression covers the period when most banks are already public, an important fact of increasing the percentage of private shares makes market observers and potential investors more confident about the bank's

transparency as banks can learn useful information such as management skill from those other than the board of directors (Berger et al, 2009). Burkart, Panunzi, and Shleifer (2003) documents that when the law of one country is of intermediate quality, outside block ownership is optimal and is a substitute for legal protection. From this point, a higher degree of privatization of banks fulfills the monitoring role as a legal protection. The SOE and MOF owned percentages are not significant, indicating government controls much of the bank ownership and there is little cross-section variation.

Table 4 Dynamic GMM panel regression results for ownership hypothesis models

Independent variables	Dependent variable: NPL ratio					
NPL_{t-1}	.502***	.544***	.542***	.499***	.460***	.578***
	(.113)	(.091)	(.102)	(.096)	(.113)	(.098)
GDP_{t-1}	-.172***	-.174***	-.189***	-.174***	-.162	-.116
	(.056)	(.076)	(.063)	(.056)	(.061)	(.077)
DC_{t-1}	-.103**	-.089***	-.126***	-.108***	-.109**	-.132***
	(.041)	(.058)	(.044)	(.041)	(.046)	(.051)
Private share%	-.062**					
	(.032)					
Foreign share%		-.038				
		(.039)				
SOE share%			-.025			
			(.038)			
MOF share%				-.025		
				(.024)		
Concentration%	-.019	-.031	-.036	-.067		
	(.030)	(.030)	(.035)	(.035)		
Private(MA3)%					-.104**	
					(.042)	
Foreign(MA3)%					-.074	
					(.055)	
SOE(MA3)%						-.086*
						(.048)
MOF(MA3)%						.108**
						(.045)
Constant	.076***	.072***	.079***	.075***	.085***	-.058***
	(.019)	(.019)	(.020)	(.019)	(.021)	(.022)
Hansen p-value	0.974	0.963	0.970	0.973	0.894	0.929
m2 p-value	0.37	0.38	0.38	0.38	0.38	0.33
Observations	83	83	77	69	69	62

Hansen test H_0: overidentification is valid.
m2 test H_0: $\Delta\varepsilon_{it}$ are not second order autocorrelated.

The fundamental result from the last regression is that ownership does have a significant effect on the performance of Chinese banks and introducing investors from the private sector improves that performance in terms of non-performing loans.

5. Further analysis of loan structure

These results are consistent with previous research on the ownership effect on profitability (Jia (2009), Xu (2011)). However, existing literature stops short of explaining fundamentally why more private ownership achieves better performance and its effect on the real economy. Since all the state-owned banks went public after 2005 and are owned by private investors to some extent, will they have more autonomy for lending loans? I take a further step to analyze the component of the loan to find more evidence of divergent NPL ratios. The diversification effect, such as bank asset and non-interest income, is not shown in previous regressions. I use percentage of loans to top one or ten clients to measure how the banks spread the risk when they form the portfolio. Table 5 shows that loans to top 10 clients are positive and significant for total sample and each type of the bank. Among the top 10 borrowers, 57.6% of the largest borrowers in my sample belong to infrastructure companies and most loans are project loans, where the principal will not be repaid for years. For instance, it was widely reported in 2011 that the Yunnan province government announced that it can only pay back the interest on an expressway construction loan and would delay repayment of principal infinitely until sufficient toll fee was collected.[13] Another example of local governments inability to pay back infrastructure loans on time is the one-month delay of the city government in making interest payments.[14] Those projects depend heavily on the revenue capacity of local governments, which have to self-balance the budget balance unlike the central government.[15]

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[13] http://www.sina.com.cn, June 27, 2011
[14] http://finance.qq.com, June 19, 2013
[15] Until late 2013, only Shanghai, Zhejiang, Guangdong, Jiangsu and Shandong are allowed to issue provincial bond

In this analysis, I calculate the proportion of infrastructure loans[16] of each bank and regress NPL ratio on it. While the coefficient is not significant for the whole period, the coefficient is significant in post 2008 period, indicating the quality of infrastructure loan quickly deteriorated when the 4 trillion RMB stimulus package was offered in late 2008, much of which goes to the infrastructure industry like high-speed railway construction.[17] The state-owned banks function back to policy banks again in the latest wave of credit booming, especially supportive of huge infrastructure projects while joint-equity banks focus more on medium and small firms in smaller amount each. The result in table 5 shows infrastructure loans are significant for state-owned banks and not for joint-equity banks. This result further lends ammunition to critics of 2008 stimulus plan who believed the plan would overheat the economy and deteriorate both firms' and banks' balance sheet conditions. Dealing with the big chunk of potentially dangerous assets becomes a heavy task for financial risk management. But why did the state-owned banks want to lend money to huge infrastructure projects in the first place? First, some projects need a large amount of money that small joint-equity banks cannot afford, like railway construction. Only state-owned banks can lead such projects. The second reason lies in the political connection between state-owned banks and SOEs. 113 SOEs which are directly controlled by the central government occupy key industry sectors such as energy, transportation and communication, plenty of projects need financing. Senior bankers, for the purpose of developing long-time relationship with big SOEs, have to sacrifice the short-term profits in order to obtain good projects in the future. Thirdly, those traditional state-owned banks bear more social responsibility than others because of previous recapitalization by central government. Therefore, they show their gratitude to policymakers by supporting the key project like high-speed railway through selfless lending. While this centralization of power can increase welfare of the country, it simultaneously increases financial risk that would be very costly.

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[16] There is no such item on the balance sheet of commercial bank and I calculate the 'infrastructure loan' by summing all the loans from energy, transportation, storage and communication sectors.

[17] About 1.5 trillion yuan is spent on railway, road, airport and so on. Another 1 trillion yuan is spent on reconstruction after Sichuan earthquake 2008. On high-speed railway construction, China is expected to spend 3.5 trillion yuan from 2011 to 2015 in 'Twelfth Five-Year Guideline'.

Another important trend during recent economic turmoil in China is 'Guo jin min tui', which means 'the state advances, the private sector retreats'. Related to the infrastructure argument above, big state-owned enterprises are being showered with astronomical bank loans subsidies while privately owned small- and medium- sized enterprises are pushed aside during the public spending binge. The small enterprises on the east coast of China are hit especially hard as the comparative advantage of firms has been in small business for export or domestic retail market for decades. It would be of great significance to study how well these small and potentially vulnerable enterprises handled the economic crisis and whether the banking system offers a supportive role. Annual reports from banks do not provide information about NPL ratio for small enterprises, however most small business in China are concentrated in Yangtze River Delta (YRD), Pearl River Delta (PRD) and Bohai Economic Rim(BER), and these three areas combined amount to 7% of Chinese territory but produced 59% of GDP in 2010 (Table 6). Ferri (2009) shows that city commercial banks' performance is systematically and positively related to the level of economic prosperity in their province. And these three regions, while all well developed, are quite different in terms of privatization. YRD and PRD started initial reforms earlier than BER region thus have lower level of state-owned enterprise output; 12% and 23.5% versus 40%. Moreover, the first two regions have always initiated better reform ideas than BER area. So the three regions have had different progress in terms of economic reform. I regress the loan quality on the shares of loans in these three regions to gauge the performance of the most developed regions in China during global crisis.

Table 7 shows that the coefficients on indicators for YRD and PRD provinces are negative and significant, while that on the indicator for BER is positive and significant. Thus, YRF and PRD have performed better than BER from 2008 to 2012. This analysis can be considered a comparison between vibrant private sectors and inert state-owned enterprise sectors. In the BER region where SOEs account for 39.36% of the industry output, structural reform for the diversification of SOE ownership is still ongoing and has been put on hold to some extent since 2008. The quality of the loans to those firms is not as healthy as private enterprise. One important reason for the stronger capability of survival in

24

YRD is that there are multiple financial intermediaries and institutions that small firms can turn to for financing, besides commercial banks.

Table 5 Dynamic GMM panel regression results for component of the loan

Independent variables	Dependent variable: NPL ratio				
NPL_{t-1}	.280***	.276**	.678***	.166***	.262***
	(0.084)	(0.111)	(.127)	(.017)	(.096)
GDP_{t-1}	-.057	-.051	-.377	.045**	-.077
	(.091)	(.097)	(.569)	(.032)	(.105)
DC_{t-1}	-.035*	-.033**	-.110	-.008***	-.040*
	(.018)	(.017)	(.156)	(.003)	(.022)
Top 1 clients%	-.102				
	(.096)				
Top 10 clients%	.063***				
	(.025)				
Top10%*state-owned		-.054*			.059***
		(.034)			(.013)
Top10%*joint-equity		.051***			
		(.015)			
Infrastructure loan%			-.033		
			(.022)		
Infras% post-2008				.016***	
				(.004)	
Infras*state-owned					.015**
					(.008)
infras*joint-equity					.014
					(.010)
Constant	.009	.007	.043	.001	.001
	(.012)	(.014)	(.081)	(.003)	(.003)
Hansen p-value	1.00	1.00	1.00	1.00	1.00
m2 p-value	0.42	0.45	0.18	0.55	0.50
Observations	113	113	104	59	100

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

The capital market is most developed in this region with options for private equity and credit cooperation. This result is robust when I control bank assets and cost income ratio. The next regression is based on loans from different types of banks. There is no effect on state-owned banks but loans issued by joint-equity banks in YRD are healthier than in those issued in the other two areas. However, when I switch loan source in YRD from joint-equity banks to state-owned banks, the coefficient becomes strongly positive, control than joint-equity banks and a higher private ownership in this case helps improve the selection of good firms in need of funding. The ability to find firms with higher NPV is especially important during economic crisis since financing a good firm not only helps the business to survive. This also corroborates my previous conclusion that state-owned banks perform worse in terms of loan quality in the whole economy. PRD is a manufacturing hub for textile, shoes, toys, etc. and has many export-oriented firms. Total export here declined by 11.7% in 2009 from the previous year. The positive coefficient on the interaction term of joint equity bank dummy and PRD, shows that the region has been adversely affected by dampened consumption in developed countries (especially the United States).

Another important change from previous regressions is that the signs of GDP growth all turn positive in post-2008 period. It shows Chinese economic growth is becoming further unsustainable as investment GDP ratio reaches a historical high 47% in 2012.[18] This distorting growth model makes the investment-oriented economy grow at the expense of declining asset quality and there is great uncertainty whether NPLs would suddenly jump up in the near future.

Table 6 Three important economic regions in China, 2010

Region name	Population%	Area%	GDP%	Trade%[a]	SOE%[b]	Major city
Yangtze River Delta (YRD)	8%	1.04%	17.60%	31.30%	12%	Shanghai
Pearl River Delta (PRD)	3.20%	0.40%	11.80%	24.40%	23.50%	Guangzhou
Bohai Economic Rim (BER)	17.50%	5.30%	25.70%	23.44%	39.36%	Beijing
Total	29%	7%	59%	79%		

Source: news reports from people.com.cn and other websites.
a The data of trade volume percentage is in 2012.
b Defined as percentage of state-owned enterprise output to total industry output in each region. The number is estimated in YRD and BER by taking average of the provincial data. National average is 26.7% in 2009.

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[18] http://www.ibtimes.com, March 12, 2013

Table 7 Dynamic GMM panel regression results for three regions in China 2008-2012

Independent variables	Dependent variable: NPL ratio				
NPL_{t-1}	.171***	.156**	.145	.158***	.134***
	(0.024)	(0.054)	(.103)	(.042)	(.045)
GDP_{t-1}	.122***	.136***	.149***	.130***	.148***
	(.046)	(.033)	(.030)	(.032)	(.028)
DC_{t-1}	-.017**	-.010**	-.013***	-.012***	-.012***
	(.007)	(.004)	(.003)	(.003)	(.004)
Yangtzer Delta%	-.010***	-.011*			
	(.003)	(.007)			
Pearl Delta%	-.063***	-.014*			
	(.025)	(.007)			
Bohai Rim%	.023***	.035***			
	(.008)	(.012)			
Yangtzer%*state			.054		.049***
			(.144)		(.014)
Pearl%*state			-.019		
			(.038)		
Bohai%*state			-.041		
			(.211)		
Yangtzer%*joint-equity				-.015***	
				(.005)	
Pearl%*joint-equity				.008	.026***
				(.010)	(.008)
Bohai%*joint-equity				.009	.025**
				(.010)	(.013)
Assett		.0002			
		(.001)			
Cost/Incomet		-.018			
		(.026)			
Constant	-.003	.004	.004	.043	-.012***
	(.003)	(.003)	(.003)	(.081)	(.003)
Hansen p-value	1.00	1.00	1.00	1.00	1.00
m2 p-value	0.27	0.41	0.18	0.33	0.32
Observations	55	45	46	46	46

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

Table 8 Changes in average bank performance after taking IPO or minority foreign ownership in 2006 and 2007

	Obs	NPL ratio	Loan/Deposit	ROE	NII
IPO banks					
Before taking IPO	10	0.065	0.645	0.130	0.110
After taking IPO	12	0.017	0.666	0.174	0.185
Difference of mean		-0.048*	0.021	0.044**	0.075***
t-Test of Difference		1.910	0.675	2.261	3.116
Peer groups					
Before taking IPO	27	0.083	0.663	0.140	0.079
After taking IPO	49	0.019	0.693	0.178	0.095
Difference of mean		-0.064***	0.030*	0.037	0.016
t-Test of Difference		3.541	1.936	1.526	1.303
Difference in difference		0.016	-0.008	0.007	0.059**
t-Test of Difference		0.55	0.26	0.18	2.27
banks with foreign minority ownership					
Before taking on foreign minority	9	0.069	0.661	0.119	0.106
After taking on foreign minority	19	0.015	0.663	0.180	0.099
Difference of mean		-0.054*	0.002	0.061**	0.007
t-Test of Difference		1.945	0.069	2.514	0.336
Peer groups					
Before taking IPO	25	0.085	0.657	0.145	0.073
After taking IPO	47	0.020	0.663	0.177	0.124
Difference of mean		-0.065***	0.026*	0.032	-0.047***
t-Test of Difference		3.501	1.727	1.215	3.303
Difference in difference		0.011	-0.024	0.029	-0.053*
t-Test of Difference		1.43	0.64	0.82	1.90

The table compares 4-year average change in bank performance prior to and after taking IPO and foreign minority ownership in 2006 and 2007 relative to peer groups that do not experience such events. *,** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively.

6. More thoughts on China's banking sector reform

In the above analysis, I obtain limited evidence for the ownership effect. This implies that the SOEs' intervention in banks' performance affected NPLs through channels other than privatization alone. This evidence makes it challenging to answer how we can continue the current banking reform and promote market efficiency in the long run. Among others, Xu (2011), Fu and Heffernan (2009) and Ferri (2009) propose continuing reform of China's banking sector, introducing more foreign banks, liberalizing interest rates, developing equity market and so on. However, previous literature (Ferri

(2009), Berger, Hasan, and Zhou (2009)) also shows that neither foreign banks nor stock exchange listing necessarily improves banks' profitability or financial behavior. Table 10 shows changes in average bank performance relative to peer groups after taking IPO or minority foreign ownership in 2006 and 2007. I choose events during these two years because China's banking reform accelerated around this time when the 10th five years transition period expired after China joined WTO in December, 2001.[19] After it was announced that China would join the WTO, foreign banks in China were finally allowed to function without geographical restrictions and to participate in business that was previously restricted to domestic banks. I compute the average bank performance 4 years prior to and after IPO event or foreign ownership change, and test the mean difference.[20] Then, I compare this change with the change in average performance of the peer group, who had no IPO or major ownership recruitment, over the same time period. Thus, by employing this difference-in-differences (DID) strategy, I can capture the effectiveness of banking reform in 2006 and 2007 on specific commercial banks. As table 8 shows, even though both IPO events and introduction of foreign minority ownership improves banks' performance, the peer groups also improve greatly during the same period and the DID strategy fails to show any significant difference between the two groups, except for non-interest income proportion. The 'selection effects' can be a concern if foreign owners could have selected relatively efficient banks to invest (Berger, Hasan, and Zhou (2009)) and the performance of these banks did not improve as a result of their ownership change. IPO for many banks (especially state-owned banks) becomes only a convenient private equity injection to meet capital adequacy requirement. It takes time to actually learn advanced managerial governance from outside investors. Another explanation is that Chinese government selected better banks for privatization, foreign acquisition, and public listing activities in order to attract foreign investors and avoid failure of reform (Xu (2011)).

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[19] More details in http://www.xinhuanet.com/fortune/rushi5/

[20] I use Welch's t-test when two population variances are not assumed to be equal.

Table 9 Panel regressions on the effect of board of directors

Independent variables	Dependent variable					
	NPL ratio		Return on equity		Loan/deposit	
NPL_{t-1}	.251**	.259**				
	(.014)	(.103)				
ROE_{t-1}			.208**	.209**		
			(0.094)	(.095)		
$Loam/Deposit_{t-1}$					.174	.163
					(.104)	(.110)
GDP_{t-1}	.007	.103	.076	.075	.139	.133
	(.019)	(019)	(.094)	(.095)	(.109)	(.104)
$Asset_t$	-.014**	-.016**	.028***	.028***	.011	.011
	(.006)	(.006)	(.008)	(.009)	(.013)	(.013)
Num of Indep BODs	.001		.003		.010	
	(.002)		(.005)		(.008)	
Ratio of indep BODs		.068		.064		.231
		(.055)		(.134)		(.148)
Constant	.206**	.021**	-.278**	-.281**	.329	.329
	(.080)	(.080)	(.098)	(.198)	(.198)	(.198)
R-squared	0.48	0.49	0.28	.028	0.17	0.18
Observations	110	110	108	108	88	88

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively. BODs refers to board of directors   .

To further illustrate weak corporate governance in post-IPO times, I regress key bank performance variables on the number of independent board of directors and its ratio to total number of directors, two important variables in corporate government measurement. Table 9 shows that there is no significant effect of board governance on NPL ratio, return on equity or loan deposit ratio. This indicates weak governance enforcement in China in contrast to strong significant effect in United States. The lack of monitoring effect from board members gives the senior managers more power to chase excessive loans and credits during economic expansion period and sacrifice banks' long-term interest by building personal connections with those SOE managers. Therefore, besides increasing the private ownership, it's necessary to fully realize the function of board of directors who can advice and monitor the senior management.

One of the key fields of reform is to rein in the relationship between state-owned enterprises and state-owned banks. Fundamentally, it is administrative bureaucracy that hinders the efficiency of financial sectors and other SOEs (Perotti, Sun, and Zou (1999)). For the CEOs of any 'Big Four' state-owned banks, their rankings under the China's hierarchy political system is the same as the president of big SUEs - take major utility company China National Petroleum Corporation (CNPC) for example, and even lower than ranking of president of China Railway Corporation (CR)[21]. The hierarchy system greatly increases the non-market factors in the banking sector and senior bankers need to consider the consequences of denying the pseudo-policy loans from SUEs. Even though lenders would no longer be able to count on state support,[22] central government still strongly supports SUEs, most of which are fully controlled in state's hand, thus implicitly guaranteeing all the debt that SUEs hold due from the banks. More than 90% of the lending for fixed investment from 1980 through 1995 by the Industrial and Commercial Bank of China was to SUEs (Cull and Xu (2000)). This I believe is the root cause for low profitability in these gigantic financial institutions as many key reforms are unavoidably interconnected (Prasad and Rajan (2006), Wei and Wang (1997)). Reforming state-owned enterprises is an important goal in moving toward full market economy as China cannot have a market-oriented financial sector unless it reforms the SUE sector and lets the market play the game. Thus, de-institutionalization of SUEs seems more important than partial privatization effort.[23]

7.   Robustness test

Nkusu (2011) estimates panel-corrected standard error (PCSE) models where the parameters are estimated by Prais-Winsten regression, in addition to GMM estimation. Prais-Winsten estimation accounts for serial correlation of type AR(1) in a linear model, which can correct both the heteroskedasticity and contemporaneously correlation across panel. The results using PCSE estimation and fixed-effect panel regression show in table 11. Bank specific factors RUE, cost income ratio and

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[21] Presidents of 'Big Four' rank as vice governor while president from CR is equivalent to governor.
[22] See http://english.peopledaily.com.cn/200408/17/eng20040817_153397.html
[23] The 3rd Plenum of the 18th Central Committee of China's Communist Party in November 2013 vows to accelerate the economic reform and let the market decide. However, state ownership must still play a 'leading role' in the economy.

loan deposit ratio are all significant with the expected sign, and employee quality measures like education level and payroll are also significant and negative, showing the traditional determinants are quite robust. For ownership effect, proportion of shares controlled by Ministry of Finance and state-owned enterprise is positively correlated with NPL ratio while higher private ownership contributes to the improvement of bank loan quality. The top ten clients seem to have a positive effect on the NPL ratio as well as on the loan to infrastructure. Considering results by region, loans from YRD performs better than the other two regions.

Second, I test key results of my sample of banks that have already gone public. It is generally believed that going public would increase transparency of accounting reports and may cause some structural changes the banks' policies. The results in table 12 are essentially unchanged, except banks loan to Pearl River Delta operates better for public banks than nonpublic banks.

Thirdly, I replace the macroeconomic variables with year dummies to control for all other macro factors. Table 13 shows that the general result is still valid, except the significance level is reduced. Ownership type is not significant when year dummies are included, indicating that it might be endogenous in a certain functional form of macroeconomic factors. There is also a mixed effect on the year dummies. The first three regressions reflect a declining influence on the NPL ratio from 2008 to 2012, showing an increasingly adverse macro-environment while the last regression indicates strong effect in later years.

Finally, in this chapter I use NPL ratio as the main measure of bank asset qualify, which is widely used by previous literature (Berger, Hasan, and Zhou (2009)), Louzis, Vouldis, and Metaxas (2012), García-Herrero, Gavilá, and Santabárbara (2009), etc.). However, there are several similar measures such as capital adequacy ratio, migration ratio of normal loans and provision coverage ratio, which I use as dependent variables in robustness tests. Capital adequacy ratios measure the amount of a bank's capital in relation to the amount of its risk weighted credit exposures. The higher the capital adequacy ratios, the greater the level of unexpected losses the bank can absorb before becoming insolvent. Migration ratio of normal loans measures the percentage of normal loans that are rolled to the rest of 4 category loans (special-mention loans and NPLs). Like NPL ratio, the higher the migration ratio, the

Table 10 Robust test with PCSE and fixed effect estimation for key results

Independent variables	Bank specific		Independen hypothesis	Ownership hypothesis	Independent variables	Loan structure	hypothesis
			Dependent variable: NPL ratio				
Panel 1: PCSE estimation							
NPL_{t-1}	.130***	.718**	NPLt-1	.664***	NPLt-1	.232***	.016***
	(.012)	(.021)		(.011)			(.032)
GDP_{t-1}	-.004	-.209*	GDPt-1	-.145***	GDPt-1		-.046
	(.005)	(.109)		(.007)			(.086)
DC_{t-1}	-.008**	-.107*	DCt-1	-.101***	DCt-1	-.036*	-
	(.004)	(.061)		(.006)			(.020)
			MOF%	.003***	Top1 clients%	-.088	
				(.0007)		(.086)	
Cost/Income_{t-1}		.08***	SOE%	.004***	Top10 clients%	.067***	
		(.020)		(.003)		(.004)	
Loan/Deposit_{t-1}		.086***	Private%	-.006**	Infras loan%	.014***	
		(.020)		(.003)		(.004)	
EDU_{t-1}	-.100***		Foreign%	-.004***	Yangtzer Delta%		-.010***
	(.017)			(.001)			(.004)
Payroll_{t-1}	-.0006**				Pearl Delta%		.017**
	(.0003)						(.7)
Asset_t	.0009	.001**			Bohai Rim%		.023***
	(.0009)	(.0005)					(.8)
Constant	.014*	-.015		.046***		.004	-.001
	(.008)	(.016)		(.002)			(.011)
R-squared	0.67	0.80		0.71			0.54
Observations	50	95		77			100
Panel 2: Fixed effect estimation							
NPL_{t-1}	.631***	.741**	NPLt-1	.748***	NPLt-1	.185**	.145***
	(.070)	(.057)		(.089)			(.075)
GDP_{t-1}	.009	-.175	GDPt-1	-.170	GDPt-1		-.021
	(.015)	(.114)		(.133)			(.098)
DC_{t-1}	.003	-.086	DCt-1	-101	DCt-1	-.042*	-.020**
	(.011)	(.053)		(.078)			(.027)
			MOF%	-.004	Top1 clients%	-.006	
				(.0007)		(.196)	
Cost/Income_{t-1}		.0002	SOE%	-.014	Top10 clients%	.063***	
		(.0001)		(.028)		(.033)	
Loan/Deposit_{t-1}		.040	Private%	-.002	Infras loan%	.015***	
		(.028)		(.033)		(.011)	
EDU_{t-1}	.001		Foreign%	-.004	Yangtzer Delta%		.016
	(.042)			(.001)			(.023)
Payroll_{t-1}	.0004				Pearl Delta%		.042
	(.0005)						(.025)
Asset_t	-.002	.003			Bohai Rim%		.043
	(.001)	(.004)					(.039)
Constant	.021*	.069		.053		.0007	-.016
	(.014)	(.067)		(.040)			(.013)
R-squared	0.81	0.81		0.83			0.57
Observations	50	95		77			100

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

Table 11 Robust test with PCSE estimation in public bank

Independent variables	Bank specific hypothesis		Independent variables	Ownership hypothesis	Independent variables	Loan structure hypothesis	
			Dependent variable: NPL ratio				
NPL_{t-1}	-.578***	-.406***	$NPLt\_1$	.649***	$NPLt\_1$	.558***	.616***
	(.034)	(.043)		(.010)		(.022)	(.043)
GDP_{t-1}	-.026	-.044*	$GDPt\_1$	-.167***	$GDPt\_1$	-.178***	.070*
	(.011)	(.025)		(.007)		(.017)	(.027)
DC_{t-1}	-.003	-.044***	DCt_1	-.118***	DCt_1	-.048***	-.002*
	(.005)	(.016)		(.005)		(.006)	(.007)
			MOF%	.003***	Top1 clients%	-.428***	
				(.0006)		(.058)	
$Cost/Income_{t-1}$		.098***	SOE%	.004*	Top10clients%	.101***	
		(.020)		(.003)		(.004)	
$Loan/Deposit_{t-1}$		-.076***	Private%	-.002	Infrasloan%	.006***	
		(.018)		(.003)		(.001)	
EDU_{t-1}	-.041***		Foreign%	-.004***	YangtzerDelta%		-.007
	(.016)			(.002)			*(.6)*
$Payroll_{t-1}$	-.0002				Pearl Delta%		.006
	(.0003)						*(.7)*
$Asset_t$	.002***	.003**			Bohai Rim%		.005
	(.0002)	(.001)					(.004)
Constant	.024***	-.094***		.054***		.023***	-.002
	(.006)	(.020)		(.002)		(.003)	(.003)
R-squared	0.93	0.65		0.70		0.74	0.95
Observations	32	63		66		71	33

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

worse the quality will be. Provision coverage ratio is the ratio of loan loss provision to the actual NPL during the period. It measures banks' ability to compensate for loss incurred by writing off NPLs and other risks.[24] Table 14 shows that the significance of key variables is reduced when using migration rate and provision coverage. However, previous results on the diversification effect of loan borrowers and regional differences in effects still hold.

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[24] This measure can be distorted and increased significantly by bankers in order to reduce tax payment as a profit control tool.

Table 12 Robust test in GMM estimation with year dummies

			Dependent variable: NPL ratio			
Independent variables	Bank specific hypothesis	Independent variables	Ownership hypothesis	Independent variables	Loan structure hypothesis	
NPL_{t-1}	.672*** (.026)	NPLt_1	.576*** (.101)	NPLt_1	.239*** (.075)	.150*** (.019)
		MOF%	.001 (.003)	Top1 clients%	-.038 (.075)	
$Cost/Income_{t-1}$	-1.2e-06 (.00003)	SOE%	-.0005 (.003)	Top10 clients%	-.054** (.021)	
$Loan/Deposit_{t-1}$	.024*** (.009)	Private%	-.005 (.006)	Infras loan%	-.009 (.008)	
EDU_{t-1}	-.035* (.019)	Foreign%	-.001 (.003)	Yangtzer Delta%		-.011** (.004)
$Payroll_{t-1}$	-.0001 (.0002)			Pearl Delta%		.015 (.009)
$Asset_t$	.0008*** (.0003)			Bohai Rim%		.045*** (.011)
Dummy08	-.00003 (.0006)	Dummy08	-.011* (.007)	Dummy08	.101* (.009)	-.004 (.004)
Dummy09	-.002* (.0006)	Dummy09	-.011* (.007)	Dummy09	.006 (.009)	-.007 (.004)
Dummy10	.0017 (.001)	Dummy10	-.011* (.006)	Dummy10	-.013* (.006)	-.010** (.004)
Dummy11	-.0004 (.0006)	Dummy11	-.011 (.007)	Dummy11	.011* (.009)	-.012*** (.004)
Dummy12	.001 (.001)	Dummy12	-.009 (.007)	Dummy12	.009 (.7)	-.011** (.005)
Constant	-.008 (.006)		-.014 (.009)		.004 (.8)	-.011*** (.003)
Hansen p-value	1.00		1.00		1.00	1.00
m2 p-value	0.216		0.329		0.411	0.546
Observations	44		77		100	55

*, ** and *** denote significance at 10 percent, 5 percent and 1 percent, respectively

Table 13 Robust test with provision coverage and migration rate as dependent variables

Independent variable	Bank specific hypothesis				Independent variables	Loan structure hypothesis			
	Migration rate		Provision coverage			Migration rate		Provision coverage	
GDP_{t-1}	.116*	.049	-2.112	-7.145	GDPt_1	.236**	.316*	-5.160	-.372
	(.055)	(.078)	(2.242)	(7.578)		(.099)	(.157)	(6.210)	(2.769)
DC_{t-1}	.033	-.088	2.603	-.742	DCt_1	.078	.153*	3.669	4.865
	(.032)	(.051)	(1.921)	(3.893)		(.062)	(.096)	(3.617)	(2.893)
					Top1%	.298***		-21.040	
						(.095)		(23.421)	
C/I_{t-1}		.012		-4.529	Top10%	.062**		1.463	
		(.032)		(3.215)		(.022)		(3.365)	
L/D_{t-1}		-.035		1.106	Infras %	-.002		-1.926	
		(.044)		(1.410)		(.069)		(4.423)	
EDU_{t-1}	.091		19.520*		Yangtzer%		.813		-16.437*
	(.178)		(8.947)				(.433)		(8.156)
$Payroll_{t-1}$	.001		.107**		Pearl%		-.342		-9.676*
	(.001)		(.039)				(.485)		(4.904)
$Asset_t$	-.021*	.012*	.519*	1.529**	Bohai%		-.297		-4.219
	(.010)	(.007)	(.232)	(.562)			(.571)		(8.402)
Constant	.309*	-.250***	-7.602*	-16.991		-.061**	-.166***	4.042**	8.533*
	(.133)	(.070)	(3.356)	(7.922)		(.021)	(.038)	(1.728)	(3.920)
R-squared	0.06	0.002	0.07	0.13		0.25	0.11	0.02	0.14
Observations	25	56	35	74		64	38	84	52

8. Conclusion and Future Work

This proposal studies the potential effect of bank specific factors and macro factors on NPL ratios in China. Empirical results show that macro-variables such as GDP growth, domestic credit growth and ownership of banks are strong determinants of NPL ratios in China's banking sector. Bank specific measures such as number of employees, and loan deposit ratio are also robust in the regressions. It shows that increasing percentage of shares owned by the private sector benefits Chinese banks through more responsible monitoring and transferring good knowledge when bank reform initially starts. The structure of loans in three important economic centers is studied to further analyze why and how the ownership effect mattered during recent global recession. I find that in the post-2008 period the number of infrastructure loans from state-owned banks surges while their quality deteriorates quickly. Many of the top 10 borrowers from commercial banks are concentrated in the infrastructure industry and have a negative effect on NPL ratio. Geographically, loans in Yangtzer River Delta perform better than those in Pearl River Delta and Bohai Economic Rim. I also show that joint-equity commercial banks are more able to control loan quality and identify better loan recipient firms than state-owned banks.

The above results show that non-performing loans are an important indicator for the performance of financial institutions and of great significance to Chinese policymakers who want to further economic reform. In addition to increasing profitability through management skill improvement, more attention should be focused on optimization of banks' shareholder structure. Increasing percentage of private ownership makes bankers more wary of huge infrastructure projects that were traditionally supported by state-owned banks, even at the expense of ever-larger balance sheet size. Social planners must implement efficient Pareto-improving economic reform in a dual-track approach (Lau, Qian, and Roland (2000)) to increase social welfare by mobilizing stronger financial resources while at the same time offering the economic incentives that bankers require. In terms of type of firms, I do not find evidence for the popular argument 'the state advances, the private sector retreats.' Small enterprises in the last five years show considerable flexibility, especially in Zhejiang province. It shows private small

business have exuberant vitality in terms of entrepreneurship despite suffering from biased lending and substantial monopoly rights in SOEs. More importantly, restructuring of the banking sector can be strengthened if state enterprises were reformed beforehand and implicit pressures for state banks to continue providing cheap capital to state enterprises were eliminated (Prasad and Rajan (2006)). As there will be less room to privatize in the banking sector, the politically powerful SOEs should be the next reform target.

History abounds with examples of economic debacles derived from failure to handle NPLs. The prolonged Japanese economic slowdown since 1990s and recent great recession in the US and European countries both involved large quantities of NPLs and other illiquid assets. Thus, the mechanism between non-performing assets and economic activity is worthy of further research. For China, another important issue not discussed in this chapter is shadow banking and other types of financing, which are completely outside the balance sheet and hard to quantify. Investment trusts and other wealth management products have become a vital source of off-balance sheet funding, and now account for almost a third of total credit in the world's second-largest economy, up from less than a quarter in 2012.[25] Total credit shot up from around 120% of GDP in 2008 to 190% in 2013.[26] Several trust loans (Liansheng Resources Group) have defaulted or are on the verge of defaults, which could cause financial instability due to the size of $1.2tn trust market.[27] Local governments are now using sophisticated financial instruments like SPV to avoid auditing and accumulating alarmingly large hidden debts. A method to incorporate the shadow banking system into current studies would be helpful to present whole picture of Chinese financial landscape. This research can be made more comprehensive by incorporating city commercial banks and other types of banks given that China continues to diversify its banking sector. Finally, the Chinese equity market is not very developed and how diversification of financing tools affects the current debt market would be an interesting topic.

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[25] http://www.ft.com, Jan 16, 2014 27 2
[27] http://www.theatlantic.com, Jan 19, 2014
[27] http://www.ft.com, Jan 23, 2014

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