Journal of Applied Finance & Banking, Vol. 10, No. 5, 2020, 181-197
ISSN: 1792-6580 (print version), 1792-6599(online)
Scientific Press International Limited

A Heterogeneity Analysis on SPV Investment of Chinese Banks

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Abstract

In this paper, we study different impacts on Chinese banks' SPV (Special Purpose Vehicle) investment of different impact factors. We employ GMM method to estimate different impacts of above factors by making use of a panel data of 113 Chinese banks' SPV investment in 7 years. Our sample consists of 5 large commercial banks (LCBs), 8 national joint-stock commercial banks (NJSCBs), 45 city commercial banks (CCBs) and 55 rural commercial banks (RCBs). The heterogeneity analysis on different type of banks shows that: RCBs and LCBs are inclined to circumvent capital requirement by SPV investment but NJSCBs and CCBs are not. The credit risk transfer is another important incentive for all types of banks to make SPV investment. NJSCBs and CCBs may count on the profit by the SPV investment in the case of narrowing net interest margin while LCBs and RCBs do not care about it. The deposits and interbank liabilities are the main funding resources to invest SPV for all types of banks despite that LCBs and NJSCBs also use the central bank liabilities as additional funding. The impact of the limiting policy on SPV investment is weak, particularly for NJSCBs with zero effect.

Keywords: Heterogeneity Analysis, Shadow Banking, GMM, SPV Investment.

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Article Info: *Received:* April 21, 2020. *Revised:* May 8, 2020.
Published online: July 1, 2020.

1. Introduction

Special purpose vehicle (SPV) is usually set up by a sponsoring financial institution such as a commercial bank, an investment bank, a fund management company, a trust company, or an insurance asset management company, to purchase and hold financial assets from a variety of asset sellers. It has been gradually the most important form of shadow banking in China since the last global financial crisis in 2008. As a matter of fact, the SPV investment of Chinese banks has been expanded drastically in last 10 years. By the end of 2019, the SPV investment of 13 Chinese listed banks[3] has been up to 6.6 trillion RMB, a growth of 328.13% from the beginning of 2013, over 3 times of the growth of loans during the same period.

Why Chinese banks' SPV investment is so huge and which factors, in what degree, drive them to make SPV investment? Nobody answers this question, particularly for the latter part. This paper aims to answer it. Firs of all, we review the development in terms of economy and finance in past 10 years in a historical view to speculate the reasons that Chinese banks have been allocated so much SPV assets in their balance sheet. Secondly, on the basis of reasons that we think drives banks to invest SPV, we link them to concrete factors as the measurement then propose corresponding hypothesis on these factors. Finally, we employ appropriate specification to test our hypothesis and assess the impacts of different factors.

In the sense of macroeconomy, the Chinese government has been implementing an easy monetary policy to cater for the financial tsunami in 2008, e.g. the well-known 4 trillion RMB stimulus package[4]. As a result, the asset volume of Chinese banks has been rapidly expanding, along with a thirsty demand for capital. Meanwhile, the central bank simultaneously imposes a vigorous limitation on the total loan size of all banks in order to make the inflation controllable. In this period, the regulatory authorities have been noticed the potential risk in the industry of real estate and local government financing vehicle (LGFV) and put forward requirements on loans to them[5]. The consequent story of the SPV investment of banks emerges. On one hand, banks have a lot of money seeking for assets. On the other hand, the real estate industry and the LGFV demand huge money to finance themselves[6]. The SPV plays the ideal role to bridge the supply side and the demand side of money. Meanwhile, the provision and capital requirements on SPV investment are much less than the ones of loans according to the regulatory rules. The market players soon find out that the SPV is a good channel to bypass the regulatory constraint to take regulatory arbitrage. There is another channel effect of SPV which is used to nominally transfer the credit risk of loans when they are securitized and traded in the market. Finally, the SPV investment usually looks like quite profitable, in contrast with traditional

[3] i.e. the 5 large commercial banks and 8 national joint-stock commercial banks in this paper.

[4] Even though the authority claims that the money policy is stable and moderate, but virtually easy.

[5] For instance, the upper limit of the real estate related loans as a share of total loans is 20% and the LGFV financing volume is prohibited to increase.

[6] Actually, those uneconomical enterprises, i.e. unworthy of being financed by banks, also make use of SPV to obtain credit from banks later on.

loan business as the clients are extremely thirsty for money, who is willing to provide payoffs with high return rate.

From above analysis, we could summarize the impact factors influencing banks investment on SPV as follows. First of all, the regulatory constraint in terms of requirements on capital and asset quality, etc. plays an important role in push banks to invest SPV. Secondly, seeking for more profit maybe also another factor that attract banks to carry out this business. The third one is about the funding resources such as deposit, interbank liabilities, as well as the central bank lending and so on. Finally, we should take the special policy such as various bans on SPV investment which have been put forward by authorities which has noticed the potential risk later on. We hypothesize that the regulatory arbitrage and profit-seeking are both important motives for banks to make SPV investment, and the main funding resources should be mainly from deposits and interbank liabilities, the limiting policy issued in 2017 possibly hindered the trend of SPV investment.

The remainder of this paper is organized as follows. The next section introduces an overview of the related literature. Section three contains the model and specification strategy. Section four describes the data and reports empirical results, as well as discusses results. Section five concludes this paper with some policy suggestions.

2. Literature Review

Since the concept of "shadow banking" has been proposed by Gary Cohn, the ex-president and COO of Goldman Sachs in Davos of 2011[7], an extensive body of research has been concentrating on this field[8]. (Meade et al, 2012) discuss the benefits and concerns of shadow banking, put forward some suggestions on regulatory reforms of it as well. (Sherpa, 2013) discuss the causes and consequences of shadow banking in China and India, arguing that the financial liberalization and deregulation are both two important factors in the growth of shadow banking institutions[9]. In his view, strict regulation is indispensable even at the cost of lower economic growth. He also points out limiting policy is better than the Basel III to hinder the rapid growth of shadow banking. (Gennaioli et al, 2013) construct a model of shadow banking, which describes the securitization without any risk transferred. They point out that the shadow banking system is easy to fall in a crisis with liquidity shortage if investors neglect tail risks even though it is stable under

[7] He warned that "greater regulation of banks would push risky activities into the 'shadow banking sector' which is 'less regulated' and 'opaque'", see https://www.cnbc.com/id/41309128/.

[8] As a matter of fact, there is an earlier discussion, see in (Gorton and Metric, 2010), whose work focuses on regulating the shadow banking system, particularly on the repos and securitization. They propose to employ two methods to emphasize the regulation of which one is the strict guidelines on collateral and the other one is the government-guaranteed insurance. In addition, they also make an analysis about the run on the repo market in (Gorton and Metric, 2012).

[9] An earlier work of (Calomiris, 2009), prior to the concept of shadow banking, noticed and argued that it is the government-induced distortions and corporate governance problems that play the important role of causing the propensity of such risk-taking financial sector, i.e. shadow banking system later.

rational expectations. (Chernenko and Sunderam, 2014) demonstrate the frictions in shadow banking lending by study the lending behavior in money market mutual funds (MMMFs). They find out the channel through which the risk-taking leads to the negative spillovers to good firms. Later on, (Sunderam, 2015) proceeds to study on the money creation effect of the shadow banking system, indicating that the money demand is an important cause in the growth of the shadow banking system. (Plantin, 2015) and (Koijen and Yogo, 2016) find the similar the relationship between the shadow finance and the capital requirements in the industry of banking and insurance. (Plantin, 2015) argues that the tightening capital requirements may lead to the increment of shadow banking activity and result in an overall larger risk. On the other hand, (Koijen and Yogo, 2016) model and quantify the effect of the risk-based capital reduction and the expected loss increasing brought by the shadow insurance.

(Diamond and Rajan, 2000) have noticed the trend of the decline in bank capital since 1980s twenty years ago. They present a theory of bank capital and point out that the "optimal bank capital structure trades off effects on liquidity creation, costs of bank distress, and the ability to force borrower repayment". (Gordy, 2003) then lay down the foundation for the Basel I capital requirement framework. In fact, the capital requirement has been always almost the strongest constraints for banks business. As pointed out by (Bernanke and Lown, 1991), the tightening capital would result in credit crunch. It is not strange that banks would rather employ other instruments to realize the regulatory arbitrage to circumvent capital requirements. (Acharya et al, 2013) analyze the asset-backed commercial paper conduits, pointing out it is the regulatory arbitrage that drive sponsoring financial institutions to set up them. They hypothesize that commercial banks set up conduits to minimize regulatory capital requirements and more so by banks with more capital-constrained or with guarantees that bypass capital requirements[10]. They test their hypothesis and find that conduits basically don't transfer the risk to the outside investor, instead of leaving it within banks. Our paper, on the basis of existing works, attempts to summarizes possible impact factors on the SPV investment of main types of Chinese banks then explores the heterogeneous impacts of factors on different types of banks.

It is worthy to underline that, unlike the one in U.S. or Eurozone, the Chinese conduit is usually not formed by a process of securitization but with a form of SPV[11]. And the sponsoring institutions are not typically investment banks but mostly are trust companies, insurance asset management companies, as well as commercial banks themselves. our work is probably the first research in this field for Chinese banks, partly because of the unique data resources covering all main types of Chinese commercial banks, particularly containing 100 small and medium banks

[10] As they point out, it is consistent with the arguments of (Karshyap et al, 2002) and (Pennacchi, 2006). On the other hand, guarantees also plays a role of stimulate sponsors to carefully check the conduit's asset, see (Ramakrishnan and Thakor, 1984), (Keys et al, 2010).

[11] It also has another popular and famous name of the 'nonstandard asset'.

(CCBs and RCBs)[12], which has been playing more and more important roles in modern economy and finance of China.

3. The Model

3.1 Impact Factors

As discussed before, we focus on four types of influences: regulatory constraint, earning capability, funding resources and limiting policy, which are demonstrated in 8 impact factors, i.e. explanatory variables as follows.

Capital Adequacy Ratio (CAR): Banks with relatively more stress in capital tend to invest more on SPV, even transfer their loans into non-standard asset being traded in interbank market to save capital. In this paper, we directly use the CAR index as an explanatory variable.

Non-Performing Loan Ratio (NPL Ratio): The rising NPL Ration will push bank to reduce making loans and increase non-loan asset allocation such as SPV investment. As usually the NPL Ration in prior period matters the bank's investment, we take the NPL Ratio in the last period as an explanatory variable in the model.

Net Interest Margin (NIM): A typical projection of interest rate liberalization for a bank is the variation of its net interest margin. The bank with narrowing NIM inclines to expand the SPV investment business to make more profit. We use the difference term of NIM as an explanatory variable in this paper.

Loan-to-Deposit Ratio (LDR): The smaller the LDR of a bank is, the more the money being used to invest SPV is.

Interbank Liability (LL): This item is particularly for those banks with high LDR, which has to borrow money in the interbank market to support their SPV investment. We take the interbank liability as a share of liabilities as the measure of the degree at which the bank borrows in the interbank market.

Central Bank Liability (CBL): Some banks could borrow from the central bank to raise money for their SPV investment. We here use the central bank liability as a share of liabilities to denote this factor.

Interbank Asset (IA): it refers to those traditional interbank assets such as deposit in other banks, lending to other banks and so on, which partially plays a role of substitution of SPV as loans. It means that if the bank reduces the interbank asset or loans, it could increase the proportion of SPV investment in the total asset. We also use the interbank asset as a share of assets as the factor.

Limiting Policy (LP): We notice that the regulatory policy on the SPV investment has been becoming tighter and tighter since the new president of the Chinese regulatory authority has taken his office in Feb. 2017. We then take this dummy variable as 1 after Q1 2017, in comparison with 0 before it.

[12] They are not listed firms and it is relatively hard to collect regarding data as they are distributed in 30 different provinces.

3.2 The Model

We take the ratio of SPV investment to the total asset as the independent variable $(Y_{i,t})$ with above impact factors as explanatory variables. Moreover, we add the first lag of the variable $(Y_{i,t-1})$ into the explanatory variable vector to reflect dynamic adjustment of SPV investment. The model is then as follows:

$$Y_{i,t} = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + \mu_{i,t} \quad (1)$$

And $Y_{i,t}$, $CAR_{i.t}$, $NPL_{i.t-1}$, $\Delta NIM_{i.t}$, $LDR_{i.t}$, $LL_{i.t}$, $CBL_{i.t}$, $IA_{i.t}$ and LP_t are defined as above.

It is worthy to point out that in above specification, the first lag of the variable $(Y_{i,t-1})$ is not independent with the disturbance term $\mu_{i,t}$. Moreover, there exists mutual influence among $Y_{i,t}$, $LDR_{i.t}$, $LL_{i.t}$, $CBL_{i.t}$ and $IA_{i.t}$. In other words, the endogeneity is unavoidable in our model. To obtain the uniformly asymptotic unbiased estimation of the panel data, we employ the GMM method to estimate model (1).

4. Data and Empirical Results

We collected required quarterly data of 5 large commercial banks (LCBs)[13], 8 national joint-stock commercial banks (NJSCBs)[14], 45 city commercial banks (CCBs) and 55 rural commercial banks (RCBs). The time period is from Q1 of 2013 to Q3 of 2019, i.e. 28 quarters.

[13] They are ICBC (Industrial and Commercial Bank of China), ABC (Agricultural Bank of China), BOC (Bank of China), CCB (China Construction Bank) and BC (Bank of Communications).

[14] They are SPDB (Shanghai Pudong Development Bank), CMBC (China Minsheng Banking Corp.Ltd.), CMBC (China Merchants Bank), HXB(Hua Xia Bank), PAB (PingAn Bank), IB (Industrial Bank), CCB (China Citic Bank) and CEB (China Everbright Bank).

4.1 Descriptive Statistics

Table 1: Descriptive Statistics of Explanatory Variables

	Mean	Maximum	Minimum	Std. Dev.
Y	13.68%	64%	0.00%	10.70%
CAR	13.43%	54.09%	7.51%	2.36%
NPL	1.48%	6.44%	0.00%	0.64%
ΔNIM	2.64%	10.11%	-0.31%	0.94%
LDR	66.25%	107%	25.33%	10.75%
LL	18.55%	61.90%	0.00%	10.91%
CBL	1.45%	41.87%	0.00%	3.28%
IA	12.42%	52.65%	0.08%	7.80%

4.2 SPV Investment Percentage of Different Type of Banks

From Q1 of 2013 to Q4 of 2019, the average SPV investment percentage of RCBs starts from 1.79% on Mar. 31th 2013 to hit its top value of 14.98% on Mar. 31th 2017 then falls to 9.01% on Sept. 30th 2019. Moreover, the average SPV investment percentage of CCBs begins from 11.6% on Mar. 31th 2013 to reach its peak of 28.6% on Mar. 31 2017 then drop to 19.9% on Sept. 30th 2019. On the other hand, the one of LCBs on Mar. 31th 2013 is 1.04%, then climbs to the highest point of 3.11% on Mar. 31 2017 then declines to 2.52% on Sept. 30th 2019. Finally, the average SPV investment percentage of NJSCBs is initially 4.75% on Mar. 31th 2013, then rises to 18.45% on Mar. 31 2017 and ends up with 9.86% on Sept. 30th 2019. It is quite interesting that, no matter what the type of the bank is, the average SPV investment percentage moves in a similar pattern. In particular, the highest average SPV investment percentage of all 4 types of banks appear on the same time, i.e. Mar. 31th 2017. We will elaborate this in the later part of discussion on the empirical results. All trajectories of the average SPV investment percentage of each type of banks are plotted in following figure.

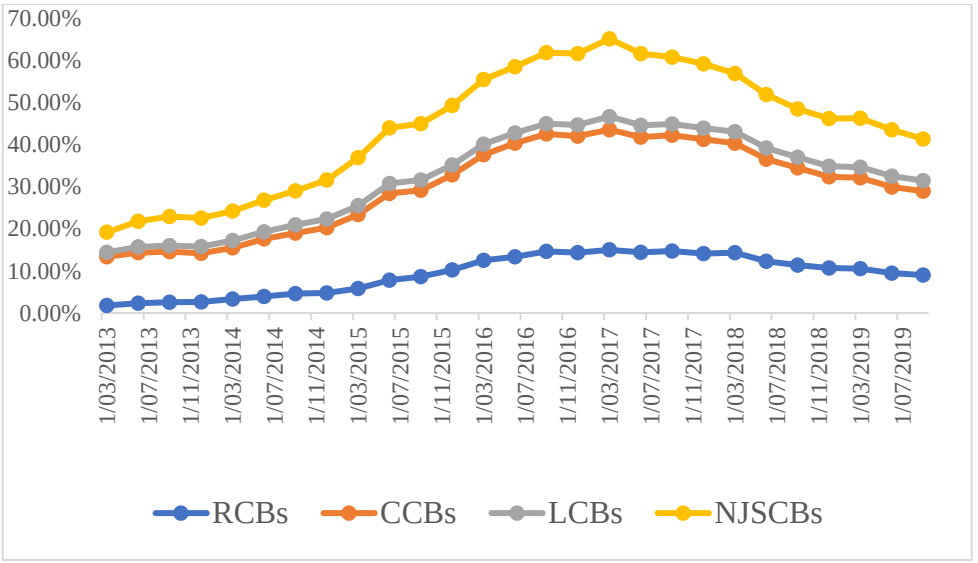

Figure1: Trend of Average SPV Investment percentage of Different Type of Banks

4.3 Empirical Results

4.3.1 Full Sample

In order to avoid the endogeneity, we take the second lag of the independent variable Y and the first lag of explanatory variables of LDR, LL, CBL, IA as instrument variables[15]. The regression results are given out in following table[16].

Table 2: The GMM Regression Results of Full Sample

Variable	Coefficient	Std. Dev	t-Statistics	P-value
Y(-1)	0.3870	0.0021	181.1587	0.0000
CAR	-0.1375	0.0110	-12.49537	0.0000
NPL(-1)	0.9606	0.0355	27.07665	0.0000
ΔNIM	-0.0953	0.0083	-11.47524	0.0000
LDR	-0.4336	0.0037	-115.9466	0.0000
LL	0.5179	0.0017	303.4861	0.0000
CBL	0.1395	0.0042	33.5697	0.0000
IA	-0.7498	0.0025	-305.6890	0.0000
LP	-0.0101	0.0001	-82.4785	0.0000

[15] They are independent with the residual serials by test.

[16] The Sargan Test shows the P-value (0.4247) is much greater than 0, so the instruments variables are effective.

Table 3: Arellano-Bond Serial Correlation Test[17]

AR (1) & AR (2)	Value	P-value
AR (1)	1.025	0.0000
AR (2)	-0.0310	0.1030

=

Table 4: Panel Unit Root Test[18]

Method	Statistics	P-value	Cross-sections	Observation
Levin, Lin & Chu t*[19]	-24.4027	0.0000	113	2599
Im, Pesaran and Shin W-stat[20]	-32.3206	0.0000	113	2599
ADF - Fisher Chi-square	1367.74	0.0000	113	2599
PP - Fisher Chi-square	2593.27	0.0000	113	2712

For the full sample, the first lag of the SPV investment percentage, the NPL of last period, the ratio of the interbank liability to the total liability, as well as the ratio of the central bank liability to the total liability are significantly positive correlated with the independent variable, indicating that the credit risk exposure, the central bank and the interbank funding inflow stimulate the SPV investment. On the other hand, the CAR, the change in NIM, LDR, ratio of the interbank asset to the total asset, and the limiting policy are significantly negative correlated with the SPV investment, telling us that SPV investment is possibly a tool to implement regulatory arbitrage and make more profit by conducting interbank business. The substitution effect of the interbank asset percentage is also significant and the limiting policy since Q1-of-2017 does slow down the SPV investment (Figure 1).

4.3.2 Heterogenous Models for Different Type of Banks

On the basis of Model (1), we add 3 virtual variables T_1, T_2 and T_3 into it to heterogeneity of the factor impact. Moreover, we notice that the RCBs usually make less SPV investment than the one of the CCBs, the NJSCBs, as well as the LCBs. We consequently take the RCBs as the benchmark type, resulting in the values of virtual variables as follows.

[17] The disturbance term of the difference equation is of first-order autocorrelation but not second-order autocorrelation.
[18] The residual serials have neither common unit root nor individual unit root.
[19] Null: Unit root (assumes common unit root process).
[20] Null: Unit root (assumes individual unit root process).

$$\begin{cases} T_1 = 1 & if \quad CCBs \\ T_2 = 1 & if \quad NJSCBs \\ T_3 = 1 & if \quad LCBs \\ T_i = 0 & if \quad RCBs \ (i = 1,2,3) \end{cases}$$

And we have following 8 heterogeneous specification models:

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) CAR_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{2}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) NPL_{i.t-1} \\ & + \mu_{i,t} \end{aligned} \tag{3}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) \Delta NIM_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{4}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) LDR_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{5}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) LL_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{6}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) CBL_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{7}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) IA_{i.t} \\ & + \mu_{i,t} \end{aligned} \tag{8}$$

$$\begin{aligned} & Y_{i,t} \\ & = \mathrm{c} + \alpha Y_{i,t-1} + \beta_1 CAR_{i.t} + \beta_2 NPL_{i.t-1} + \beta_3 \Delta NIM_{i.t} + \beta_4 LDR_{i.t} + \beta_5 LL_{i.t} \\ & + \beta_6 CBL_{i.t} + \beta_7 IA_{i.t} + \beta_8 LP_t + (\beta_9 T_1 + \beta_{10} T_2 + \beta_{11} T_3) LP_t \\ & + \mu_{i,t} \end{aligned} \tag{9}$$

The GMM estimation for model (2) to (9) is in table 5. Table 6 shows the instruments variables are effective[21].

Table 5: Heterogeneous Analysis[22]

Variables	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	β_i Std. Dev.	β_i Std. Dev	β_i Std. Dev.	β_i Std. Dev	β_i Std. Dev.	β_i Std. Dev.	β_i Std. Dev.	β_i Std. Dev.
Y(-1)	0.20*** 0.0010	0.43*** 0.0022	0.43*** 0.0032	0.19*** 0.0024	0.38*** 0.0028	0.20*** 0.0017	0.44*** 0.0053	0.38*** 0.0027
CAR	-0.23*** 0.0332	-0.21*** 0.0124	-0.16*** 0.0176	-0.16*** 0.0384	-0.14*** 0.0181	-0.12*** 0.0208	-0.16*** 0.0199	-0.17*** 0.0152
NPL(-1)	1.44*** 0.0516	0.67*** 0.0709	0.79*** 0.0361	1.35*** 0.0941	1.14*** 0.0352	1.44*** 0.0730	1.02*** 0.0720	1.04*** 0.0464
ΔNIM	0.01 0.0130	-0.10*** 0.0096	0.00 0.0219	-0.11*** 0.0106	-0.15*** 0.0153	0.08*** 0.0093	-0.18*** 0.0204	-0.11*** 0.0139
LDR	-0.54*** 0.0033	-0.39*** 0.0040	-0.40*** 0.0057	-0.67*** 0.0117	-0.45*** 0.0046	-0.53*** 0.0034	-0.38*** 0.0062	-0.43*** 0.0047
LL	0.61*** 0.0036	0.49*** 0.0022	0.50*** 0.0030	0.62*** 0.0038	0.42*** 0.0067	0.63*** 0.0033	0.50*** 0.0042	0.52*** 0.0025
CBL	0.10*** 0.0081	0.13*** 0.0059	0.16*** 0.0106	0.08*** 0.0107	0.12*** 0.0073	0.51*** 0.0671	0.12*** 0.0106	0.10*** 0.0073
IA	-0.86*** 0.0028	-0.72*** 0.0027	-0.73*** 0.0049	-0.87*** 0.0044	-0.75*** 0.0034	-0.85*** 0.0037	-0.75*** 0.0079	-0.75*** 0.0035
LP	-0.01*** 0.0003	-0.01*** 0.0001	-0.01*** 0.0001	-0.01*** 0.0004	-0.01*** 0.0002	-0.01*** 0.0003	-0.01*** 0.0002	-0.01** 0.0006
CAR*b1	0.38*** 0.0356							
CAR*b2	1.08*** 0.1716							
CAR*b3	0.95 0.8391							
NPL(-1)*b1		-0.13* 0.0770						
NPL(-1)*b2		1.70 1.1491						
NPL(-1)*b3		-0.98 2.1728						
ΔNIM*b1			-0.13*** 0.0199					

[21] As the case of full sample model, the disturbance term of the difference equation is of first-order autocorrelation but not second-order autocorrelation for all heterogenous models. Meanwhile, the residual serials have neither common unit root nor individual unit root. We omit the residual test results.

[22] * means being significant on 10% confidence, ** and *** are for 5% and 1% respectively.

ΔNIM*b2			-2.83*** 0.6643					
ΔNIM*b3			4.96 6.2677					
LDR*b1				0.19*** 0.0127				
LDR*b2				0.36*** 0.0654				
LDR*b3				0.41 0.3762				
LL*b1					0.12*** 0.0067			
LL*b2					-0.04 0.0354			
LL*b3					0.01 0.2653			
CBL*b1						-0.46*** 0.0657		
CBL*b2						0.39*** 0.1200		
CBL*b3						0.10 0.5863		
IA*b1							0.11*** 0.0067	
IA*b2							0.17*** 0.0420	
IA*b3							0.56 0.4439	
LP*b1								-0.01*** 0.0008
LP*b2								0.01* 0.0040
LP*b3								0.03 0.0191

Table 6: Sargan Test of All Heterogeneous Models

Model	J-statistic	P-value
Model 2	105.2808	0.3655
Model 3	105.9557	0.3483
Model 4	98.5553	0.5781
Model 5	97.3247	0.5850
Model 6	104.9179	0.3749
Model 7	98.2826	0.5580
Model 8	103.8569	0.4302
Model 9	105.3683	0.3632

4.3.3 Heterogenous Analysis on Impact Factors

1. **Capital Adequacy Ratio (CAR)**: The capital-constrained effect for RCBs and LCBs is inverse to the one for CCBs and NJSCBs. Specifically, an increase in CAR reduces 0.23 percentage points in SPV investment for RCBs, but brings 0.15, 0.8 and 0.72 percentage points up in SPV investment for CCBs, NJSCBs and LCBs respectively with insignificance for LCBs. It is possibly because of the business structure and the CAR level. In comparison with other types of banks, RCBs' SPV investment percentage is relatively low. They tend to make more loans with more capital[23]. In other words, they are inclined to be influenced by the capital shortage, i.e. have more incentive to implement the regulatory arbitrage to save capital. On the other hand, it is worthy to deploy capital on increasing SPV investment for CCBs and NJSCBs in the sense of economic value added, resulting in a positive correlation. The insignificant of LCBs means the impact of CAR for LCBs is indifferent with RCBs, i.e. negatively correlative.
2. **Non-Performing Loan Ratio (NPL Ratio):** For all 4 types of banks, the credit risk exposure pushes the SPV investment. In particular, an increase in NPL of last period drives 0.67, 0.54 and 2.37 percentage points up in SPV investment for RCBs, CCBs, NJSCBs respectively and insignificantly pulls 0.21 percentage points down for LCBs. This means that the worse of the loan quality is in last period, the more SPV investment the bank will make, being consist with our analysis in previous section. We may guess banks employ SPV as instruments to make risk transfer from credit assets.
3. **Net Interest Margin (NIM):** The NIM effect is quite vague for CCBs. It is the only factor of which the impact on the SPV investment is insignificant and the regression coefficient is almost 0. It is possibly because that the SPV

[23] As a matter of fact, there are other series of regulations for CCBs, requiring them to keep the volume and percentage of loans increasing.

investment percentage of CCBs is too small to response actively to the change in NIM. In other words, CCBs don't adjust its strategy about SPV investment merely by the information from the change in NIM. On the contrary, a decrease in NIM increases 0.13 and 2.83 percentage points in SPV investment for CCBs and NJSCBs respectively. The impact for LCBs is 4.96 percentage points but insignificant. That is, LCBs do not care about this factor when they make SPV investment plan.

4. **Loan-to-Deposit Ratio (LDR):** All 4 types of banks take deposit as an important funding resource to make SPV investment, particularly for RCBs and CCBs. Specifically, an increase in LDR reduces 0.67, 0.48, 0.31 and 0.27 percentage points in SPV investment for RCBs, CCBs, NJSCBs and LCBs respectively with significance. It is consistent with our intuition that the more the loan is, the less the money could be invested on SPV.
5. **Interbank Liability (LL):** The interbank liability is another important funding resource for all types of banks to conduct SPV investment. RCBs and CCBs love this kind of money more. An increase in LL pushes 0.42, 0.54, 0.38 and 0.43 percentage points in SPV investment for RCBs, CCBs, NJSCBs and LCBs respectively but it is not significant for latter 2 types of banks. It tells that RCBs and CCBs tend to absorb money in the interbank market then deploy them on SPV investment.
6. **Central Bank Liability (CBL):** NJSCBs and RCBs tends to make use of CBL to invest SPV while CCBs seldom do this. An increase in CBL bring 0.90 and 0.51 percentage points in SPV investment for NJSCBs and RCBs[24], but only drives 0.05 percentage points up for CCBs. The impact for LCBs is insignificantly positive 0.61 percentage points so we think it is no difference from the one for RCBs.
7. **Interbank Asset (IA):** The substitution effect is quite obvious for the traditional interbank asset to SPV investment. After SPV investment appears on the market, banks are incline to deploy their asset on it as the SPV investment is more economically valuable. From our specification, a decrease in IA significantly increases 0.75, 0.86 and 0.92 percentage points in SPV investment for RCBs, CCBs and NJSCBs respectively. The relatively effect for LCBs is not significant, meaning it is indifferent with RCBs.
8. **Limiting Policy (LP):** Finally, we find that the limiting policy effect is little negative for RCBs and CCBs and almost zero for NJSCBs, which is consistent with the result of the all-factors analysis model. The impose of the limiting policy on SPV investment suppress this business of RCBs and CCBs by 0.01 and 0.02 percentage points respectively. It is weird that the limiting policy push the SPV investment of LCBs 0.02 percentage points up and fortunately this result is not significant.

[24] Although the CBL effect is significant for RCBs, we still omit this funding channel for RCBs as the CBL as a share of liabilities of RCBs is too small to be meaningful. Most RCBs are disqualified to lend from the central banks and would not count on CBL.

5. Concluding Remarks

This paper examines the heterogeneity of different factors' influence on different types of Chinese banks. We find that regulatory constraints on capital and asset quality, the funding resource, as well as the limiting policy, to different degree, matter in the active-ness of SPV investment of Chinese banks. To be specific, LCBs and RCBs, being vulnerable to the capital constraining would turn to SPV investment in the case of capital shortage while CCBs and NJSCBs don't. ALL banks are sensitive to their loan quality and would cope with the rising NPL ratio by increasing the SPV investment, particularly for RCBs. The main funding resource for SPV investment for all banks are deposits and interbank liability, which are particularly important for those medium and small banks, i.e. CCBs and RCBs while LCBs and NJSCBs would consider to lend from the central bank to support their SPV investment. The limiting policy since Q1 of 2017, although weakly, works in curbing the dramatic surge of SPV investment.

The heterogeneous analysis provides inspirations in issuing appropriate policies for Chinese regulatory authorities. First of all, the authorities may propose the corresponding capital requirement for SPV investment in accordance with the same criteria for the loan, which aims to block the hole of arbitrage. Secondly, it is possibly effective to set up a floor of loans as a share of assets and an upper limit of interbank liabilities as a share of total liabilities in view of the funding resource analysis results. Finally, the authorities should continue to implement the limiting policy and equip it with rigorous punishments to strengthen the effect of the limiting policy.

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