ISSN: 2710-0170

Short-term Capital Inflows and Banking Systemic Risk

--Based on Copula-CoVaR method

Shaoheng Zhan

School of Business, East China University of Political Science and Law, Shanghai 201060, China

Abstract

Based on stock data of listed banking companies, this article uses the Copula-CoVaR method to estimate banking systemic risk. Study has found that local and non-state-owned large banks are susceptible by negative impacts and greater the financial market risk spillovers. Research has calculated the scale of short-term cross-border capital inflows per quarter from 2010 to 2020 and found that short-term cross-border capital inflows have a positive impact on the improvement of banking systemic risk, and it will amplify its impact through real estate market fluctuations. The policy implication of the article is to pay attention to the use of macro prudential policy tools, guide cross-border capital inflows, avoid the aggregation of high-risk assets such as the real estate market, prevent risk accumulation, and prevent and resolve major systemic financial risks.

Keywords

Banking Systemic Risk; Capital Inflows; Real Estate Market; Copula-CoVaR.

1. Introduction

1.1. Background

After the impact of economic globalization and financial liberalization, China's economy has gradually opened the regulation of financial markets and capital accounts, shown a positive attitude towards international capital flows and participation in the construction of the world economic and trade system. For one side, implementing the "One Belt and One Road" strategy to further strengthen the economic trade between China and the world; for other sides, in the financial sector and foreign exchange sector, cross-border capital plays an important role in the rapid development of foreign trade and financial market. It can be said that without the injection and guidance of cross-border capital, China's economy is difficult to rise rapidly and occupies an important position in the world economic system today. However, the opening of the capital account will bring about the free flow of financial capital, which will have an unpredictable impact on the economic system.

Short-term cross-border capital has obvious speculative, high liquidity, large-scale capital inflows usually lead to inflows of macro-economic overheating, currency appreciation, asset prices. It is easy to cause the asset bubble burst, currency devaluation, and even further the debt and currency crisis if capital inflows suddenly stop or sharply reduce. For example, QFII and RQFII investment limit to cancel in China 2020, while Europe and the United States and other major economies suffered with the new outbreak around the world. China ushered in the short-term securities investment inflows, its reflected in the interest rate debt market, foreign investors held from the end of 2019 domestic bond balance of 2.19 trillion yuan to 2021 at the end of September 3.84 trillion yuan, which promoted the appreciation of the RMB exchange rate.

ISSN: 2710-0170

However, international capital flows are inevitable through the banking system as China's economic system in the intermediary industry in the domestic financial market. The real economy circulation, thus forming the impact of China's financial system will also be back to the banking industry and produce systemic financial risk. According to the China State Administration of Foreign Exchange, there is a significant debt currency mismatch in China's banking system, and its foreign currency assets were slightly higher than its foreign currency liabilities at the end of 2016. At the same time, the opening of the capital account will increase the internationalization level of banks, and the expansion of banks' overseas assets and liabilities is also an inevitable result[13].

1.2. Properties

An obvious feature of China's economy in recent years is the continuous rise of real estate market prices. The interdependence of bank credit and the real estate market, which can be described as the "capital pool" of the real estate market. There is a large amount of hidden debt. The real estate price change will affect the micro behavior of banks through the credit mortgage constraint channel and the credit mortgage mechanism, so the price change cycle will be directly transmitted to the banking sector [8]. Adrian and Shin based on the data of the US capital flow statement for more than 40 years, demonstrated the active leverage behavior in the banking sector, that is, to actively buy more risky assets to push the price of high-risk assets, with a higher degree of risk taking [6]. In the downside financial cycle, the active leverage of the banking sector leads to the realization of passive risk taking [14], thus affecting the entire financial sector through asset price contagion, liquidity loss and other channels.

The innovation of this paper is to sort out the influence mechanism of capital account opening on the risks of the banking system, connect the real economy sector, and discuss the transmission way for cross-border capital to impact the banking sector and even cause systemic risks. On the other hand, this paper measures the systemic risk of large domestic commercial banks through the Copula function, takes the comprehensive index reflecting the stock market and macro-economic expectations as the benchmark to describe the systemic risk of banks and financial institutions, especially the tail risk. From this basis, the degree of short-term cross-border capital inflow and the level of systemic financial risks of Chinese banks are measured, and the impact mechanism of short-term cross-border capital inflow on systemic financial risks of banks is studied.

2. Literature Review

The existing literatures the driving factors of cross-border capital flows, mainly from the aspects of their driving factors, driving factors and the strength of the two types of factors. The driving factors include driving factors (factors that cause capital inflows outside the inflow country) and driving factors (which cause capital inflows in the inflow country).

In terms, Researchers believes that the interest rate between the two countries is one of the important driving factors of cross-border capital flows. While others believe that the net-inflow of cross-border capital will increase. Bruno and Shin showed that exchange rate movements are the main factor affecting the scale of cross-border capital flows. Cerdeiro et al. research on the relationship between capital account openness and capital flow found that in countries with higher capital account openness, capital flows are more vulnerable to some driving factors [20, 23, 24].

First, for systemic financial risks, the dynamic and temporal expansion research of CAPM model from the time dimension has increasingly become the research hotspot of capital asset pricing theory. CoVaR method, in the condition of VaR based on risk value, used to measure the systemic risk contribution of financial institutions, and introduced state variables to describe

ISSN: 2710-0170

individual differences, using the point regression to measure the risk spillover effect of some financial institutions in trouble. Acharya (2012) proposed the marginal expected loss (MES) method to capture the characteristics of individual institutions, such as scale, leverage ratio, based on the CoVaR method[18]. Adrian and Brunnermeier (2016) based on the CoVaR construction idea[25]. Brownlees and Engle (2017) further proposed the SRISK method consisting of institution size, leverage level and long-term marginal expected loss LRMES[26].

Based on the existing literature, it is found that CoVaR index is used to measure the externality and spillover of systemic risks in the banking industry, can study the maximum loss caused by a VaR in a certain financial institution at a certain probability level, which can better reflect its tail characteristics. In addition, the Copula function can fit the linkage effect of the individual bank, the real economy, and the stock index, and show the positive and negative impact of the spillover of systemic risk in financial institutions. Therefore, CoVaR index is taken as the main agent variable of systemic risk in this paper.

3. Theoretical Mechanism

3.1. Related Literatures

The financial accelerator theory is that with the transmission mechanism of macroeconomic fluctuations, expounds the non-equilibrium state of credit market caused by information asymmetry, resulting in the transmission mechanism of the initial reverse impact aggravated by the change of credit market state, revealing the role of credit market in the amplification of financial impact. Zhai Yonghui (2019) put forward the financial accelerator theory as systemic risk between the following transmission way: "negative external shocks lead to an entity industry large assets depreciation - asset value shrinking enterprise default on bank loans - higher bad debt rate bank cut credit - credits cuts through financial accelerator feedback to entity industry - entity enterprise cash flow operation more difficult, lead to a larger loan default, amplification impact"[28].

Considering that banks are an important part of the current financial system, Gu Haifeng and Bian Yuchen (2020) found that cross-border capital flows have no significant impact on stock prices, but they will affect the liquidity risk of banks by affecting real estate prices and bond prices[9].

Visible academic research experience, cross-border capital inflow of bank risk and individual risk influence channels, and asset prices, especially the real estate market price is an important part of the risk transmission way, the asset price as the real economy and banking sector, the financial system as a "reservoir", the price fluctuations on the bank risk. In addition, the current research mainly focuses on the cross-border capital flows on individual risk bearing of banks, such as liquidity risk, credit scale, etc., and there are few studies on the risk of the banking sector. This paper further carries out in-depth study on the cross-border capital inflow on the systemic risk of banks.

3.2. Impact Mechanism of short-term cross-border capital inflows

The short-term cross-border capital inflow brought by the opening of the capital account is mainly summarized into two channels: first, the international capital changes the foreign exchange funds to directly affect the domestic money supply, thus affecting the inflation, making the central bank adopt tight monetary policy and affect the international capital assets through the stock market, the securities market and the real estate market, especially the real estate, thus accumulating the risk of asset bubbles.

From the first point of view, capital account opening causes short-term cross-border capital flows, which will affect the risk of bank liabilities from the two aspects of retail deposits and wholesale financing [19], which is also the main source of liabilities for commercial banks. The

ISSN: 2710-0170

opening of the capital account will intensify the competition of domestic banks to "absorb deposits", broaden the overseas investment channels of domestic residents, increase the pressure of banks' retail deposits, and lead to the increased risk of bank debt side. After the outflow of retail deposits, another major capital channel of the bank debt side will bear the pressure of wholesale financing. Due to the large amount of wholesale financing funds, for institutional investors and the short cycle, it is very sensitive to risk. At this time, banks will turn to non-core debt business, one of the important sources of funds is foreign lending. The stage of the financial cycle can be reflected by the scale and composition of bank liabilities, that is, the proportion of retail deposits and wholesale financing. In addition, it also shows that under the condition of capital account opening, the debt structure of banks is unstable, which is easy to fluctuate with the change of economic cycle and international capital flow, which leads to the rise of systemic risk of banks. Therefore, the first hypothesis is proposed as,

H1: Short-term cross-border capital inflows will increase the systemic risk of banks.

The economic development prospects and economic vitality of a country are one of the important driving factors for the inflow of international capital, which in turn can have a significant impact on the real sector of the inflow country. At the same time, countries with higher capital account openness are more vulnerable to pull factors[23], and international capital flows are bidirectional, highly cyclical, spillover and arbitrage [2]. As a result, countries with higher capital account openness are more affected by international capital, and undervalued local currencies, relatively high long-term bond yields and commodity prices are also the main drivers to attract international capital flows into emerging markets.

The global savings surplus hypothesis is a hypothesis for the correlation of capital account opening and the property market, arguing that inflows lead to low interest rates and higher real estate prices. When one country has excess savings, it drives investors to flow out of capital to other countries, especially emerging market economies, to find more suitable investment projects. In recent years, China's economy has developed rapidly and has a good trend, which is increasingly attractive to foreign investment. At the same time, the opening of the capital account has widened the channels of capital inflow. Therefore, on the one hand, the large inflow of international capital makes the supply of domestic capital increase, the interest rate decreases and promotes investment, making the real estate price rise. In this path, investor expectation is an important influencing factor. The high expectation of real estate income will attract capital inflows, make the real estate prices rise and attract more investment, and even cause asset bubbles.

From the other side, China's real estate market is dominated by mortgage loans, and banks, as the main financial institutions, such loans are also the main source of funds for investors. The fluctuation of the real estate market price will lead to the fluctuation of developers and investors, which will affect the bank loan business. As mentioned above, the impact of real estate on the banking sector is mainly carried out through the credit mortgage constraint channel and the credit mortgage mechanism, while the active leverage of banks also makes risks start to accumulate in the upward economic growth cycle [19] What is more, when developers are furious and investors are difficult to repay their loans and default, the non-performing loans of banks will be formed, leading to a decline in the banks' willingness to issue loans, and then impact other real industries and form systemic risks. So, the following assumptions are made:

H2: Real estate price fluctuations will increase the systemic risk of banks.

H3: Real estate price fluctuations play a mechanistic role in the impact of cross-border capital flows and banking systemic risk.

ISSN: 2710-0170

4. Empirical Study

4.1. Data Selection

Considering that China's financial institutions are generally listed late, most of the representative financial enterprises are listed after 2010, and the market value, business scope and other contents differ greatly, the sample time range selected in this paper is the daily trading data of the stock market from February 22,2010 to December 31, 2020. The sample range includes a series of relatively influential macroeconomic periods, such as European debt crisis, local government debt problems, local bank violence, financial deepening of reform and the decline of economic growth, which is helpful to understand the impact of complex macro-economic background on the systemic risk of China's financial institutions. The measurement software used in this paper is Stata/SE-15.1 and R version-4.2.0 for data processing, and the data source is for CSMAR database and Wind financial database.

Since the absolute value of stock price is easily affected by factors such as equity and stock issue price, it is not easy to observe in the same dimension in many individual samples. Therefore, this paper uses the log yield sequence to analyze each sample. First of all, this paper selects the sample of the overall characteristics of the stock market for the Shanghai and Shenzhen 300 index (hereinafter referred as CSI 300), the index is compiled by the Index co., LTD., not only covers the main board of the Shanghai stock exchange stock market, but also the Shenzhen market of small and medium-sized enterprises, Science and Technology Innovation Board stocks, the representative of listed companies in the Shanghai and Shenzhen 300 index, can better reflect the trend of the stock market as a whole, used as overall effect of systemic risk part has outstanding advantage.

Considering the average market value of listed banks, the nature of shares, and the characteristics of banks, a total of 15 banks are selected as the sample of systemic risk research in this paper. As can be seen from the descriptive statistical results in the table below, under the premise that the maximum and minimum daily logarithmic yield are 10%, the mean is basically 0, and the variance and quantile are small, indicating that the daily logarithmic yield of the sample company fluctuates around the mean, so the mean can be assumed to be 0. At the same time, according to its kurtosis is basically much greater than 3, so sequence shows the characteristics of "spike" peak, which is in line with the thick tail characteristic in financial time series.

1Table 1: Descriptive statistics of the sample time series

Statistic	N	Mean	St.Dev.	Min	Max
CSI 300	2,713	0.0001	0.006	-0.04	0.028
SPDB	2,713	0.0001	0.007	-0.05	0.042
CMBC	2,713	0.0001	0.007	-0.05	0.041
ICBC	2,713	0.0001	0.006	-0.05	0.041
BOC	2,713	0.0001	0.006	-0.05	0.042
HB	2,713	0.0001	0.008	-0.05	0.042
Nbcb	2,713	0.0002	0.009	-0.05	0.042
CCB	2,713	0.0001	0.007	-0.05	0.042
CEB	2,713	0.0001	0.007	-0.05	0.042
Ping An	2,713	0.0002	0.009	-0.05	0.042
CEB	2,713	0.0002	0.008	-0.05	0.042
Bank of Nanjing	2,713	0.0001	0.008	-0.05	0.041
CIB	2,713	0.0002	0.008	-0.05	0.042

ISSN: 2710-0170

BOB	2,713	0.00001	0.007	-0.05	0.042
BCM	2,713	0	0.007	-0.05	0.042
CNCB	2,713	0.00004	0.008	-0.05	0.065

4.2. Systemic Risk Estimation

4.2.1. Marginal Distribution Estimates

Observing the peak thick tail signature shown in the sample data, the Arima-Garden model was used to fit the marginal distribution of each financial company, using the measurement software R (version-4.2.0). From the results of model fitting, the historical information fluctuations can have an obvious impact on the current stock return fluctuations, and the random disturbances and unobserved factors occurring in the past can still affect the current stock return fluctuations and have a great negative impact.

Overall, the maximum likelihood estimation yielded large Loglike statistics and good model fits. However, the result P-value of the ARCH-LM test is very small, and the null hypothesis tested is whether all the regression coefficients in the ARCH model are 0 at the same time, indicating that there is no ARCH effect. A small P-value indicates that the null hypothesis should be rejected, indicating the presence of an ARCH effect in the residuals of the model, and can be fitted using the Garch model. This paper decided to choose the GARCH (1,1) model for marginal distribution estimation.

4.2.2. The Copula-CoVaR Calculation

Through the method described above, this paper uses the Student-t Copula model to fit the marginal distribution of the income sequence of each financial enterprise to the CSI 300 index, and obtains two sets of data: CoVaR at the upper tail and the lower tail of CoVaR. The upper and lower points selected in this paper are 95% and 5%, that is, when the return of a single stock is below the value of 5% of the quantile or above the value of 95% of the quartile, the institution is considered in an extreme situation, and its contribution to the "systemic risk" formed by other stocks or market indexes is judged. Since this paper hopes to study the negative impact of systemic risks of financial enterprises on the financial market and even the real economy, the main object of discussion is the following CoVaR.

2Table 2: Descriptive statistics were fitted to the Copula-CoVaR

Statistic	N	Mean	St.Dev.	Min	Max
SPDB	2,713	-0.099	0.026	-0.215	-0.062
CMBC	2,713	-0.101	0.031	-0.258	-0.067
ICBC	2,713	-0.089	0.022	-0.248	-0.068
BOC	2,713	-0.091	0.026	-0.279	-0.07
HB	2,713	-0.105	0.029	-0.234	-0.068
Ningbo	2,713	-0.116	0.023	-0.221	-0.078
CCB	2,713	-0.053	0.026	-0.23	-0.027
CEB	2,713	-0.08	0.036	-0.268	-0.031
Ping An	2,713	-0.111	0.03	-0.233	-0.059
CMB	2,713	-0.084	0.021	-0.183	-0.052
Bank of Nanjing	2,713	-0.12	0.028	-0.279	-0.081
CIB	2,713	-0.087	0.028	-0.207	-0.046
BOB	2,713	-0.107	0.031	-0.273	-0.071
BCM	2,713	-0.089	0.03	-0.27	-0.06
CNCB	2,713	-0.114	0.035	-0.3	-0.077

ISSN: 2710-0170

According to the descriptive statistical results made in the above table, average value of CoVaR calculated by each joint distribution is basically above -10%, indicating the degree of systemic risk that which banks and financial institutions contribute to the CSI 300 index. Among them, the local commercial banks with relatively small market value, such as Bank of Beijing (hereinafter referred to as BOB), Bank of Ningbo (hereinafter referred to as Nbcb) and Bank of Nanjing, have the largest average absolute value, and the absolute value of the minimum index is also relatively high. It was followed by Industrial and Commercial Bank of China (hereinafter referred to as ICBC), Bank of China (hereinafter referred to as BOC) and China Minsheng Banking (hereinafter referred to as CMBC).

Figure 1 has shown some estimations results of representative samples which draws the upper and lower joint distribution of the bank with the financial enterprise VaR, output the following to the chart. The deviation degree of CoVaR and VaR in the lower tail, which means below Risk-axis equals to 0 in the chart, is significantly higher than that of CoVaR and VaRup (in the risk income), indicating that there is an obvious asymmetry effect in the risk value of financial enterprises, and the systemic risk caused by extreme negative impact and the negative impact on the financial market are significantly greater than the positive impact.

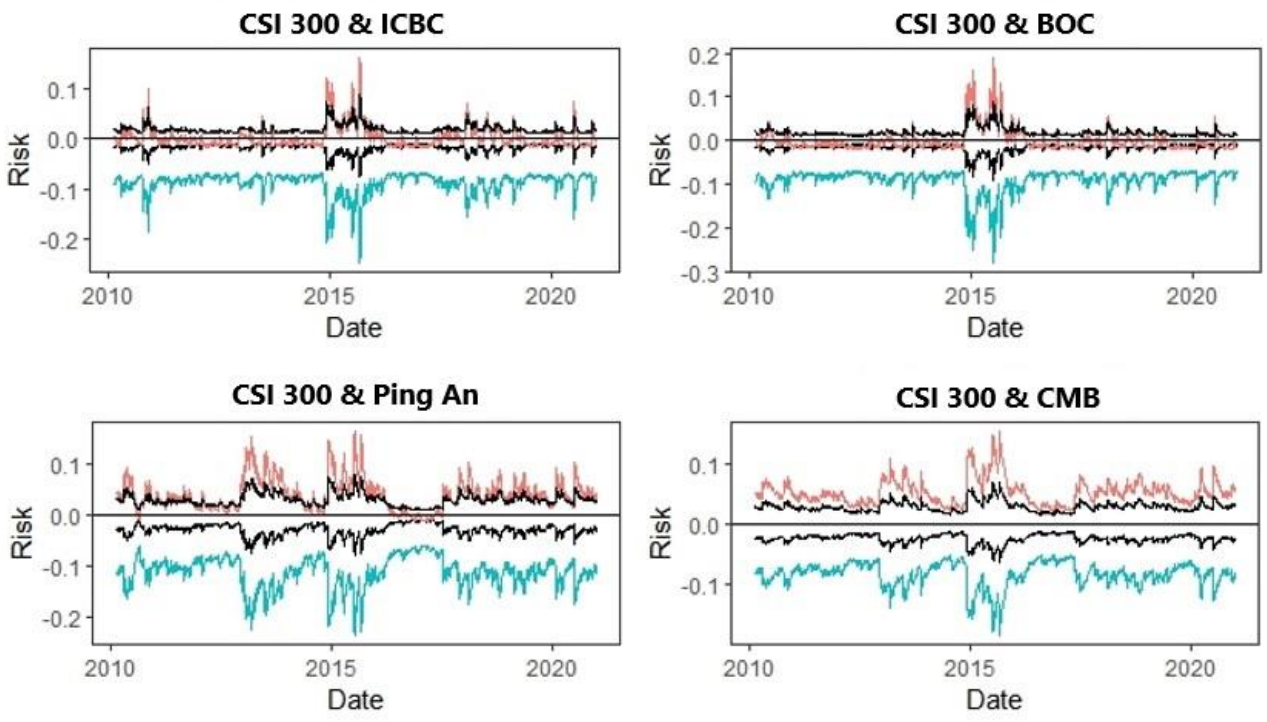

Figure 1: Representative estimation results of Banks

In general, we can conclude from the estimation results that the local commercial Banks, non-traditional comprehensive commercial Banks under the tail and VaR tail deviation degree is more obvious, shows that the financial market negative news impact is relatively bigger, the risk of financial market overflow more than its own losses, the more typical example of BOB, CMBC, Shang Pudong Development Bank (hereinafter referred to as SPDB), China CITIC Bank (hereinafter referred to as CNCB), BOC, Huaxia Bank (hereinafter referred to as HB), Bank of Nanjing and Nbcb.

4.3. Benchmark Regression

4.3.1. Model Specification

First of all, this paper refers to Zhang Ming [7] different methods of short-term cross-border capital inflow, using indirect method of short-term cross-border capital inflow scale estimation, the calculation formula for indirect method 1 (indirect1) = (foreign exchange increment-goods

ISSN: 2710-0170

and services trade surplus-worker remuneration-government departments often transfer-FDI net-foreign equity and long-term bond investment-foreign long-term investment), and to construct the core explanatory variable of this paper namely cross-border capital inflow index.

To examine the impact of cross-border capital flows on banking systemic risk, the paper constructs the following benchmark models:

$$Risk_{i,t} = \beta_0 + \beta_1 Flow_t + \beta_2 X_{i,t} + \beta_3 Z_t + \mu_i + \mu_t + \varepsilon_{i,t} \quad (7)$$

Among them, *Risk* is the variable representing the systemic risk of the bank and the explanatory variable of this paper, *Flow* is the explanatory variable representing the cross-border capital inflow, *X* and *Z* are the control variable at the micro and macro levels of the bank respectively. It should be noted that to make the empirical results readable, the results of CoVaR are treated with opposite numbers, that is, the absolute value is used as the empirical data.

Table 3 shows the control variables selected in this paper from the micro indicators of bank operation and the macro indicators reflecting the macroeconomic situation. At micro level, this paper selects (1) asset size (Size), leverage ratio (Lev) [18], capital adequacy ratio (CAR) to consider the bank asset size and capital factors; (2) non-performing loan ratio (NPL), customer settlement, non-interest income ratio and net profit margin to consider the profitability of bank assets and reflect their operating conditions; (3) Settlement and sales of foreign exchange on behalf of customers (DFES) to consider bank's business abroad; (4)Net interest margin (NIM) to consider the traditional loan business earning ability of bank; (5)Proportion of non-interest income (NII) to consider the multi-business of bank.

3Table 3: Primary Variables Descriptive statistic of Model

Variable	N	mean	min	max
CoVaR	660	0.096	0.033	0.221
indirect1	44	0.017	0.007	0.04
interest	44	3.758	1.614	5.773
Inflation	44	0.695	-15.414	28.376
Lev	660	15.463	11.185	29.576
Economy	44	127.746	113.7	138.314
NPL	660	1.175	0.34	2.350
Size	660	28.949	25.731	31.142
Money	44	-1.874	-14.193	14.107
DFES	660	292.612	-5703.565	3543.366
NIM	660	2.361	1.27	4.977
CAR	660	12.623	6.78	17.52
NII	660	26.45	7.022	57.17

At the macroeconomic level, the driving factors of international capital inflows include high interest rate, high economic growth rate and low inflation [21,23], the role of driving factors in international capital flows faced by developed countries and emerging market economies was significantly higher than the driving factor. Therefore, this paper selects four macro-level indicators (1) Inflation rate (Inflation): taking the consumer price index CPI as the proxy variable; (2) Economic growth rate (Economy): to reflect the overall situation of the macro economy by the logarithm of GDP; (3)Money market interest rate (Interest): choose the three-month money market interest rate as an indicator to reflect China's short-term interest rate level; (4) Monetary growth rate difference (Money): the difference between M1 growth rate minus M2 growth rate, Represents the preference of enterprises and residents to use funds, Positive value indicates that residents and businesses tend to use funds as demand deposits,

ISSN: 2710-0170

More optimistic expectations for the economy; On contrary, it suggests worse expectations, limited investment opportunities, the market faces liquidity pressures.

In this paper, the data frequency of the calculated systemic risk and other control variables is processed by the arithmetic average method, and the quarterly frequency data of the time interval from 2010 to 2020 is uniformly used for panel regression.

4.3.2. Benchmark Regression Results

The benchmark regression results of this paper as shown in Table 4 column (1), cross-border capital inflow as the core research variable its influence coefficient is 6.07, in the bank individual level and macro level control variables, and add time effect, individual effect control, at 1% significance level, indicating that cross-border capital inflow makes bank individual systemic risk contribution. There is a significant positive relationship between, verify the research hypothesis H1.

4Table 4: Benchmark regression & Heterogeneity

	(1) CoVaR	(2) CoVaR	(3) CoVaR	(4) CoVaR	(5) CoVaR
Indirect1	6.07***	4.243**	6.565***	10.86***	5.364***
	(3.772)	(2.062)	(2.953)	(5.717)	(8.153)
SIBs		After	Before		
MPA				Before	After
CVs	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Obs.	660	264	396	300	360
R2	0.802	0.862	0.809	0.647	0.816
N	15	6	9	15	15
Constant	1.44***	1.903***	0.75***	2.371***	1.815***
	(4.769)	(4.003)	(1.642)	(3.405)	(7.599)

Note: The values in parentheses are the t-values at the level of the bank financial institution. * * *, * * and * indicate that the significance levels of the test are 1%, 5% and 10% respectively. The following table is the same.

4.4. Heterogeneity Test

This paper considers the impact of cross-border capital inflows on systemic risk in the banking sector and individuals from the perspectives of systematic importance (SIBs) and macro-prudential policy (MPA).

4.4.1. Systematic Importance

Basel banking supervision committee members, most countries have basically established its list of systemically important financial institutions and regulation, our country in this exploration is slow, until 2020, the people's bank, silver circ jointly issued the systemically important bank evaluation method to clear the basic rules of systemic important Banks in our country. Jintao Wang's (2023) research found that both during the financial crisis or the crash, high business correlation between institutions relatively causes high risk correlation in the same industry. It is more vulnerable to the risk of industries and lead to cross-industry risk spillover, increase the vulnerability of the financial system for high systemic importance of financial institutions which need to focus on [29].

Therefore, according to the evaluation results, this paper takes the third group of BCM, CMB, CIB and the fourth group of ICBC, BOC and CCB as systemically important banks in China, and

ISSN: 2710-0170

returns to this group. Table 4 (2) (3) reports the group regression results of systemically important. The cross-border capital inflows had significant positive effects on systemic risk in both groups of banks, but the impact coefficient for non-systemically important banks was significantly larger. The reason is that the systemically important bank business scope and ability to resist risk compared with systemically important Banks, and our country has not been a real economic crisis, systemic risk, in the financial system as "normal" systemic risk, systemic risk mainly comes from some very low leverage, large assets of the large commercial Banks [19].

4.4.2. Macro-prudential Assessment System

According to the research of Cheng Xiaoqiang (2020), the system of China's macro-prudential evaluation system was established in 2016, which plays an important role in preventing and defusing financial risks and then maintaining national financial security and promoting financial stability. Zhang et al. (2018) took a sample of 231 Chinese commercial banks as a study and showed that macro-prudential regulation can ease the fragility of the financial system, and strengthening macro-prudential regulation will reduce the risk taking of banks. The empirical study by Song Ke et al. (2019) shows that macro-prudential policies reduce the risk taking of banks by improving the profitability of banks. In addition, in the economic downturn, the effect of macro-prudential policies on curbing the risk taking of banks is more obvious than that in the economic boom.

Otherwise, the author used the macro-prudential policy virtual variable (MPA) to study the heterogeneous impact of the macro environment on the systemic risk of individual banks, and the value was 0 from 2010 to 2015, and the value was 1 from 2016 to 2020. As can be seen from the results reported in column (4) (5) of Table 4., the direction and significance of the variable coefficient are consistent, but the size is MPA and reduced to half of the original value when the value is 1. The results show that since the establishment of China's macro-prudential assessment system, the cross-border capital inflow will have less impact on the systemic risk of banks, the risk resistance of banking departments and individuals is higher than before, and the macro-prudential policies have heterogeneous effects.

4.5. Robustness

Table 5 robustness test reports the results of the substitution of Risk, Flow and other methods to ensure the stability of empirical results. In column (1), the author uses the marginal expected loss MES [11, 18] as the proxy variable for systemic risk. The impact coefficient of cross-border capital inflow of 2.358 was significant at the 1% significance level, and the results were robust.

5Table 5: Robustness Test

	(1) MES	(2) CoVaR	(3) CoVaR	(4) CoVaR
Indirect1	2.36***			
	(3.936)			
Direct2		5.899***		
		(3.933)		
N-reserve			7.099***	
			(5.652)	
Current				9.841***
				(8.936)
CVs	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Obs.	660	660	660	660

ISSN: 2710-0170

R2	0.791	0.795	0.246	0.795
N	15	15	15	15
Constant	6.357***	-0.759	3.461***	-0.726
	(5.883)	(-1.795)	(3.904)	(-0.746)

Second, cross-border capital flow measurement method can be briefly divided into direct and indirect method, the biggest difference is the former will country BOP table several projects as short-term cross-border capital directly added, the mainstream is the Cuddington formula for fitting, the core is the error and omission as the main part of short-term cross-border capital estimates, and indirect law is the foreign exchange as being reduced.

Article (2) - (4) The author lists the measure of cross-border capital inflow in various ways: (1) refer to Zhang Ming [7], Direct method 1 for calculation using the errors and omissions items in the BOP table, Direct method of error and omission items and total short-term investment under financial projects 2, After reducing the ratio of indirect method 1 to GDP, The direction and significance of the coefficient are consistent, Therefore, the empirical conclusion of this paper is robust. Due to space limitations, some results are not listed in the table; (2) Participate in the care methods of Forbes and Warnock [21], Sun Tianqi and Wang Xiaoxiao [27], Using the ratio of BOP table current account balance to GDP and the ratio of non-reserve financial account inflow to GDP by replacing the indirect method 1 as the proxy variable of the explanatory variable Flow, Table 5, column (3) (4), shows a consistent and significant direction, Consistent with the study hypothesis. So, the empirical conclusion of this paper is robust.

5. Research on influence mechanism

To further investigate the intermediary channels and mechanisms of cross-border capital flows affecting the systemic risk of banks, this paper combines the practices and adopts the idea of interactive items to construct the intermediary role test model, as follows:

$$Risk_{i,t} = \beta_0 + \beta_1 Flow_t + \beta_2 M_{i,t} + \beta_3 X_{i,t} + \beta_4 Z_t + \mu_t + \varepsilon_{i,t} \quad (8)$$

$$Risk_{i,t} = \gamma_0 + \gamma_1 Flow_t + \gamma_2 Flow \times M_{i,t} + \gamma_3 M_{i,t} + \gamma_4 X_{i,t} + \gamma_5 Z_t + \mu_i + \varepsilon_{i,t} \quad (9)$$

Where, M is the mediation variable. For this model we focus on the coefficients of M. If its coefficient significant, it means that the intermediary variable will affect the systemic risk of banks; if the interactive and its coefficients both significant, it means that the intermediary role exists, and the intermediary variable will indirectly affect the systemic risk of banks Risk by affecting the cross-border capital inflow variable Flow.

6 Table 6: Influence Mechanism

	(1) CoVaR	(2) CoVaR	(3) CoVaR	(4) CoVaR
Indirect1	1.714***	2.028***	1.685***	6.814***
	(9.761)	(11.779)	(9.836)	(4.163)
Residual	0.003*	-0.002***		
	(1.679)	(-6.382)		
Indirect1 * Residual		0.282***		
		(7.973)		
LDR			-0.005***	-0.0003***
			(-3.454)	(-2.643)
Indirect1 * LDR				-0.004
				(-0.853)
CVs	YES	YES	YES	YES

ISSN: 2710-0170

Bank FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	660	660	660	660
R2	0.343	0.365	0.353	0.805
N	15	15	15	15
Constant	1.921**	2.359**	2.157**	1.66***
	(2.01)	(2.5)	(2.267)	(5.438)

Table 6 column (1) (2) reports the results of the intermediary effect test of the real estate market prices. In this paper, the growth rate of real estate sales is used as the agent variable of real estate price fluctuation. The influence coefficient of residual in column (1) is 0.003, which indicates that the real estate price fluctuation will improve the systemic risk of banks, which is consistent with the research hypothesis H3. Subsequently, under the benchmark model introduced real estate price fluctuations and cross-term cross-border capital inflows, the first (2) report the interaction coefficient of 0.282 at 1% significance level is significant, and significantly greater than the main effect, indicating that the unit of real estate price fluctuations, will significantly increase the effect of short-term cross-border capital inflows on banking systemic risk effect, namely the real estate price fluctuations in the influence mechanism, verify the research hypothesis H4.

The reason is that the real estate has a significant pro-cyclical process, and the purchase and land purchase links can increase leverage, which will magnify the wealth effect. As the first pillar industry, it plays a leading role on systemic financial risks. When short-term cross-border capital increases the scale of the real estate market, it will have a demonstration effect on domestic funds and attract some domestic market funds to increase the purchase of real estate, making the asset prices rise, which will also make investors' expectations more optimistic, and then the market has a "herd effect", more investors enter the real estate market to further promote the rise of asset prices. Rising asset prices will attract financial institutions to buy assets to obtain price returns. At the same time, rising asset prices will cause the increase of collateral value and capital level, leading to the expansion of credit scale of financial institutions, economic overheating, the expansion of balance sheet of financial institutions and the increase of leverage ratio. When the rise of asset prices leads to the increase of the leverage ratio of financial institutions, which makes the market face a systemic impact, the expected capital shortage deepens, which is the increase of systemic financial risks.

Moreover, to explore the impact of short-term cross-border capital inflow on the traditional business of banks, and whether the traditional business serves as an intermediary channel, this paper introduces the loan-to-deposit ratio of banks as an intermediary variable to further test the transmission mechanism of short-term cross-border capital inflow. Table 6. column (3) shows that after the introduction of variable regression in the benchmark model, the influence coefficient of the loan-to-deposit ratio is -0.005 at the 1% significance level, indicating that the loan-to-deposit ratio increases, that is, the increase in the proportion of total loans issued by banks to their total deposits will reduce the systemic risk of banks. The interaction term is introduced in column (4), and the coefficient is not significant, but the main effect is still significant, and the coefficient increases significantly. This shows that the short-term cross-border capital inflow has less impact on the traditional business of banks, and the interactive relationship between the two is weak.

The reason is that bank loans rise that bank loan business efficiency better, bank business more initiative, its assets and management to resist risk ability stronger, banking systemic risk lower, and short-term cross-border capital inflows mainly by affecting the bank intermediary business, both affect the banking systemic risk way strong mutual independence, it does not directly affect the bank customer structure, deposit preference.

ISSN: 2710-0170

6. Study conclusions and policy recommendations

Starting from the financial industry, this paper first selects the financial industry listed companies through the average market value, and then after the final screening of the length of listing time, a total of 15 banks listed companies. After the calculation of the systemic risk index CoVaR, it is found that when the institution is in a crisis state, the contribution to the systemic risk, that is, the impact on the financial market is more serious than its own losses, indicating that there is obvious risk spillover effect in the financial industry.

On this basis, this paper through the foreign exchange increment as the starting point of indirect method, for short-term cross-border capital inflows, and as the explanatory variable of banking systemic risk, found that can indicate that short-term cross-border capital inflows to banking systemic risk has positive effect, and found that the real estate market prices in the process, the changes will enhance the effect of short-term cross-border capital inflows. At the same time, the increase of the loan-to-deposit ratio will have an inhibitory effect on the systemic risks of banks. It will not play an intermediary role in the influence mechanism of short-term cross-border capital inflow, and the interaction effect of the influence channels is small.

In view of the above research conclusions, this paper puts forward the following policy suggestions: (1) For the problem of cross-border capital inflow, the relevant departments should improve the identification and monitoring capacity under the background of the acceleration of the financial opening-up process. The real estate market is an important "reservoir" in China's financial system, and the large fluctuations of the market price will have a vicious impact on the entire financial system and even the real economy sector. Therefore, after easing the restrictions on cross-border capital flows, Also pay more attention on monitoring price changes in such assets, To keep the housing market stable, To crack down on real estate speculation, Adhere to the general principle and direction of "housing, not speculation", Prevent large inflows of foreign capital to hype up asset prices, Attracting domestic funds into the market, constantly pushing up prices to create a bubble. And to give confidence and support to the real estate industry, beware of excessive falls in asset prices. Leading to increased market liquidity pressure and panic in financial markets, Asset selling, a sharp depreciation, form a systemic risk; (2) Secondly, China's capital account opening degree will continue to improve in the future, And China's economic performance is stable and good, Economic fundamentals are more attractive than other developed countries, regions and emerging market economies, Short-term cross-border capital inflows are bound to increase. In this context, how to properly guide and open the promising industries and guide international capital to "enter" the investment value, to develop the new socialist market economy, cultivate competitive industries and improve the core competitiveness in the international industrial system, not only the financial regulatory authorities, but also the national economic sector; (3) Otherwise, this paper quantified the systemic risk in the state-owned banks and local banks, and the influence of cross-border capital inflow on systemically important banks. So, banking systemic risk monitoring business correlation, business scope and risk asset holdings are Banks systemic risk of internal important drivers, according to the economic cycle and macro-economic conditions of the systemic risk "stage", as the micro financial institutions and the subject regulatory policy and decision basis, not only bank individual size and property properties as a standard. Non-systemically important banks are more likely to cause internal risk contagion during the "normal" systemic financial risk period. (4) Finally, through the heterogeneous analysis of macro-prudential variables, this paper found that the level of macro-prudential risk was significantly reduced after the establishment of macro-prudential assessment system and policies. Therefore, we can further study the targeted use of macro-prudential tools, such as local government debt, local financing platforms, and real estate market supervision, and put forward higher requirements because of micro-prudential

ISSN: 2710-0170

supervision requirements, to improve the ability of the financial system to cope with pro-cyclical fluctuations and prevent the contagion of financial risks.

References

[1] He Qing, Qian Zongxin, Liu Wei: Systemic Financial Risk and Real Economic Activity in China, Journal of Financial Research, vol.4 (2018), 53-70.

[2] Wang Hui, Liang Junhao: Measuring Systemic Risk of China's Banking Based on the Time-Varying Factor Copula Model, Journal of Financial Research, vol.11 (2020), 58-75.

[3] Oh. D. H., Patton A. J.: Modeling dependence in high dimensions with factor copulas, Journal of Business & Economic Statistics, vol.35 (2017) No.1, 139-154.

[4] Tobias A, Brunnermeier M K.: CoVaR, The American Economic Review, vol.106 (2016) No.7, 1705.

[5] Girardi G, Ergün A. T.: Systemic risk measurement: Multivariate GARCH estimation of CoVaR, Journal of Banking & Finance, vol.37 (2013) No.8, 3169-3180.

[6] Adrian T, Shin H. S.: Liquidity and leverage, Journal of financial intermediation, vol.19 (2010) No.3, 418-437.

[7] Zhang Ming: Short-term international capital flows facing China: scale measurement of different methods and calibre, The Journal of World Economy, vol.34 (2011) No.2, 39-56

[8] Fang Yi: Analysis of bank risk taking under the impact of monetary policy and real estate prices, The Journal of World Economy, vol.38 (2015) No.7, 73-98.

[9] Gu Haifeng, Zhang Yuanjiao: Monetary Policy and Real Estate Price Regulation: Theory and Chinese Experience, Economic Research Journal, vol.49 (2014) S1, 29-43.

[10] Zhang Ming, Tan Xiaofen. The main drivers of short-term capital flows in China: 2000~2012, The Journal of World Economy, vol.36 (2013) No.11, 93-116.

[11] Gu Haifeng, Bian Yuchen: Cross-Border Capital Flows, Loan Concentration and Banking Systemic Risk: What's the role of Macro-prudential Policies and International Financial Environment, World Economy Studies, vol.10 (2021), 39-54+86+135.

[12] Fang Yi, Yan Ruyun and Zheng Ziwen: Study on the influence mechanism of capital account opening on bank risk, Studies of International Finance, vol.11 (2017), 33-43.

[13] Xiong Qiyue, Zhao Yang, Liao Zezhou: Are net interest margins affected by anks‘ internationlization? Evidence from global major banks, Journal of Financial Research, vol.7 (2016), 64-79.

[14] Brunnermeier M K, Sannikov Y.: A macroeconomic model with a financial sector, American Economic Review, vol.104 (2014) No.2, 379-421.

[15] Greenwood R, Landier A, Thesmar D.: Vulnerable banks, Journal of Financial Economics, vol.115 (2015) No.3, 471-485.

[16] Nguyen J.: The relationship between net interest margin and noninterest income using a system estimation approach, Journal of Banking & Finance, vol.36 (2012) No.9, 2429-2437.

[17] Ongena S, Popov A, Udell G F.: "When the cat's away the mice will play": Does regulation at home affect bank risk-taking abroad, Journal of Financial Economics, vol.108 (2013) No.3, 727-750.

[18] Acharya V. V., Pedersen L. H., Philippon T., et al.: Measuring systemic risk, The review of financial studies, vol.30 (2017) No.1, 2-47.

[19] Fang Yi: Study onthe Transmission Channel and Measure of Systematic Risk: for Macro-Prudential Policy Implementation, Journal of Management World, vol.275 (2016) No.8, 32-57+187.

[20] Cheng Xiaoqiang: Financial openness and bank risk-taking (East China Normal University, China 2020)

[21] Forbes K. J., Warnock F. E.: Capital flow waves: Surges, stops, flight, and retrenchment, Journal of international economics, vol.88 (2012) No.2, 235-251.

[22] SONG Ke, LI Zhen, ZHAO Xuan-kai: Macro-prudential policy, business cycle and bank risk-taking, Economic thoery and Business Management, vol.1 (2019), 43-58.

ISSN: 2710-0170

[23] Cerdeiro D. A., Komaromi A.: Financial openness and capital inflows to emerging markets: in search of robust evidence, International Review of Economics & Finance, vol.73 (2021), 444-458.

[24] Bruno V., Shin H. S.: Capital flows and the risk-taking channel of monetary policy, Journal of monetary economics, vol.71 (2015), 119-132.

[25] Adrian, T., M. K. Brunnermeier, 2016, "CoVaR", American Economic Review, 106(7): 1705-1741.

[26] Brownlees C, Engle R F. SRISK: A conditional capital shortfall measure of systemic risk[J]. The Review of Financial Studies, 2017, 30(1): 48-79.

[27] Sun Tianqi, Wang Xiaoxiao: How does inner and outer financial circle difference influence China's cross-border capital inflow, Journal of Financial Research, vol.3 (2020), 1-20.

[28] Zhai Yonghui, Research on the Risk Spillover Effect between Entity Industry and Banking Industry from the Perspective of Systemic Risk Management, Studies of International Finance, vol.12 (2019) No.392, 74-84.

[29] Wang Jintao, Yue Hua: Foreign Ownership and Systemic Financial Risk, Financial Economics Research, vol.38 (2023) No.2, 66-80.