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Research on the Impact of Interest Rate Marketization on Risk Bearing of Commercial Banks

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Abstract: ***Based on the elaborating of the interest rate marketization process and the risk influencing factors, this paper empirically studies the impact of interest rate marketization on risk-taking. In this paper, 30 banks including state-owned banks, joint-stock banks and city commercial banks are selected as samples. Using the micro-data of 130 commercial banks in China from 2004 to 2015, the dynamic panel model by System GMM Estimation is analyzed by regression analysis. The study shows that the liberalization of loan interest rate decreases the banks' risk-taking, and the liberalization of deposit interest rate increases the bank's risk-taking. Overall, it shows a downward trend and then a rising trend. Bank risk is negatively related to the size of assets and return on assets; and it negatively related to economic growth and positively related to monetary policy. Finally, from the perspective of banks and regulators, this paper proposes suggestions to copy with the risk of interest rate liberalization.***

Keywords: Interest rate liberalization; Risk-taking; Dynamic panel model; GMM

1. Introduction

With the theory of financial liberalization being proposed, many countries begin financial reform. Interest rate liberalization is the important content of the reform of the financial liberalization. Interest rate is the price of fund, its liberalized can lead source to the most effective sector. With the financial market and policy gradually improved, China also enter into the international trend of interest rate reform, . The liberalization of the interbank lending rate in 1996 marked the beginning of the interest rate liberalization reform. In October 2015, the Central Bank announced the policy that liberalized RMB deposit interest rate regulates, which marked the completion of China's interest rate liberalization reform. The liberalization of interest rate regulate has enabled commercial banks to obtain more independent pricing rights, promoting the effective competition of commercial banks, and greatly improved the efficiency of fund allocation. However, under the background of interest rate liberalization, commercial banks need to deal with such problems as interest margins narrowing, interest rate fluctuations, and intensified industry competition, and banking industry' systemic risk may cause financial risks and even economic crises. Facing with changes in the business environment, commercial banks must adjust their risk-taking behaviors. Hence, this paper aims to study the risk-taking of commercial banks under the marketization of interest rates from theoretical and empirical perspectives, and proposes targeted countermeasures so as to avoid bank risk and refine related policy.

2. Literature Review

Financial liberalization includes interest rate liberalization, financial market liberalization and financial business liberalization (Hu Qiwei, 2015). Interest rate liberalization is an important part of financial liberalization. McKinnon and Shaw (1973) studied the relationship between financial markets and economic development in developing countries. They found that financial regulation, especially the suppression of interest rates, was prevalent in developing countries due to excessive government intervention in financial activities, which resulted in financial markets unable to allocate capital according to market demand. Source, so as to hinder economic growth. Based on this, they put forward the theory of financial restraint and financial deepening, believing that financial restraint will distort the allocation of resources and eventually have a negative impact on economic development; we should promote financial deepening, especially liberalization of interest rate control, strengthen market competition and improve the efficiency of resource allocation to promote economic growth. From the dynamic change of interest rate system, Li She-huan (2000) and Wang Jing (2011) think that the marketization of interest rate is the gradual liberalization of interest rate control by the management authorities, that is, the gradual increase of market forces in the interest rate pricing system.

Scholars at home and abroad have discussed what factors affect the risk-taking of commercial banks. Hellmann et al. (2000) argued that financial liberalization has intensified competition among banks, and fierce market competition will increase the risk-taking of banks. Borio and Zhu (2008) put forward the risk-taking channel theory, which pointed out that monetary policy first acts on the risk tolerance of financial institutions, and then affects the risk level of portfolio and credit decision-making. Haq. M. and Heaney. R. (2012) regression analysis of panel data of 117 banks in 15 European countries shows that bank asset size and off-balance-sheet business activities have a significant impact on bank risk-taking. In terms of the characteristics of micro-banks, Zhang Xuelan and He Dexu (2012) concluded that there was a significant negative correlation between risk-taking level and bank size. Pan Min and Zhang Yiru (2012) based on the empirical research on the heterogeneity of bank equity, the results show that bank size does not have an impact on the level of risk-taking.

Research on interest rate marketization and bank risk-taking. Daniel and Jones (2007) set up a dynamic model and took commercial banks in emerging markets as samples. They pointed out that the banking industry would experience a process from low risk in the initial stage to increasing risk with interest rate liberalization. They believed that financial liberalization might increase the risk of banks. Angkinand (2010) pointed out that the risk level of banks showed a U-shaped relationship with financial liberalization. The level of pre-risk will increase with the process of financial liberalization, but will decrease after reaching a certain degree. Wang Daoping (2014), based on data from 73 countries around the world, found that the net effect of interest rate reform determines whether bank risk increases or not. And empirical research shows that the establishment of deposit insurance system can promote the stability of the banking system, and the higher the level of bank risk, the more conducive to restraining the excessive risk-taking of banks. Li Zhonglin (2015) established a bilateral stochastic frontier model to study. The results show that the risk level of domestic commercial banks has decreased significantly under the interest rate reform.

3. Variable Selection, Weight Determination and Data Source

Variable selection

(1) Interpreted variables (bank risk-taking)

According to the existing literature, the variables to measure bank risk-taking include Z value, non-performing loan rate, expected default probability EDF, volatility of capital return and loan loss provision. Based on the availability of data and the rationality of indicators, this paper chooses Z value as the agent variable of bank risk bearing. This paper defines Z value as follows:

$$Z = \frac{ROA + CPA}{\sigma(ROA)}$$

Among them, ROA denotes the return on total assets (net profit/total assets) of banks, CAP denotes the capital adequacy ratio of banks and the standard deviation of the return on total assets. As can be seen from the above formula, the larger the Z value, the lower the probability that the bank will be liquidated, the lower the bankruptcy risk of the bank, and vice versa, the greater the bankruptcy risk of the bank. In this paper, three years are used as interval rolling calculation (sample year and its lag of two years). Because Z value can only represent the characteristics of bank risk when it is positive, the samples with negative Z value are excluded.

(2) Explanatory variables

This paper attempts to use the method of constructing interest rate marketization index to construct explanatory variables to describe the degree of interest rate marketization in China. The basic method is to mark the marketization degree of each single interest rate control measure in China (usually including deposit interest rate, loan interest rate, bond market interest rate, money market interest rate, foreign currency market interest rate and financial product interest rate), and then calculate each according to the relevant market size and its importance in the interest rate system. The weights of interest rates are classified. Finally, the market-oriented index of interest rates in China is obtained by weighted average. Secondly, the micro-characteristics of banks are ownership, capital adequacy ratio (CAP), deposit-loan ratio (LD) and trans-regional operation of city commercial banks. Among them, the property of ownership is expressed by two dummy variables. If a bank is a state-owned bank, the variable national takes 1, otherwise it is 0. If a bank is a joint-stock bank, the variable stock takes 1, otherwise it is 0. Trans-regional operation of local banks is also a fictitious variable. The first provincial branch established by a local bank shall be 1 in the year in which it was established and 0 in the year before.

(3) Control variables

This paper chooses bank size, revenue, NII and listing as the characteristics of bank endowment. The larger the scale of bank assets, the more decentralized the investment of banks' assets, and the lower the corresponding bank risk. The higher the proportion of intermediate business income, the lower the dependence of banks on deposit-loan spreads, and the price competition brought by interest rate marketization may not be obvious for such banks. In addition, whether banks are listed or not is also an important factor affecting the level of risk-taking. On the one hand, listing can effectively supplement capital, on the other hand, it will accept strict supervision before listing and adjust its risk level to meet the requirements of listing; after listing, the information disclosure of banks is higher than that of non-listed banks, so investors can vote to some extent to achieve the supervision of listed banks, so listing behavior It may reduce the risk-taking of banks. In the external market environment, we mainly control the real GDP growth rate, real estate price growth rate, financial depth. Among them, financial depth = bank loan size / nominal GDP, which is the proxy variable of financial structure in a region. The biggest flow of bank loans in China is the real estate market. The operational risk of the banking industry is closely related to the development of the real estate industry. The impact of real estate prices in the market may significantly affect the risk-taking level of banks. Therefore, we add the real estate price growth rate into the model. For national banks (state-owned banks and national joint-stock banks), the above three variables use data at the national level, while for local banks (city commercial banks and rural commercial banks), the above three variables use data at the provincial level in the province where the head office of the bank is located. In addition, there are risk-taking channels in the transmission of China's monetary policy, that is, loose monetary policy will lead to higher risk-taking level of banks. In view of this, we also incorporate the growth rate into the bank risk model.

Table 1: Variable Interpretation and Basic Descriptive Statistics

Variable	Definition of variables	mean	standard deviation	minimum	Maximum
risk	Natural logarithm of Z value	4.618	0.946	0.542	7.978
IRLI	Interest Rate Marketization Index	0.765	0.137	0.575	1
national	Virtual variable, state-owned bank = 1, otherwise = 0	0.050	0.218	0	1
stock	Virtual variable, national joint-stock bank = 1, otherwise = 0	0.120	0.325	0	1
CAP	capital adequacy ratio	0.129	0.028	0.037	0.475
LD	Total year-end loans/total year-end assets	0.625	0.109	0.210	0.915
trans-regional	Virtual variable, cross-regional operation of city commercial banks = 1, otherwise = 0	0.411	0.492	0	1
size	Natural logarithm of total assets	11.118	0.721	9.724	13.347
revenue	Increase in business income in the current year/total business income at the end of last year	0.280	0.277	-0.311	4.411
NII	Net Income of Processing Fees and Commissions/Total Operating Income at the End of the Year	0.069	0.063	-0.055	0.382
listed	Virtual variable, listing = 1, otherwise 0	0.171	0.376	0	1
GDPr	Real GDP Growth Rate	0.102	0.028	0.013	0.174
houser	Real Estate Price Growth Rate	0.089	0.079	-0.100	0.567
deep	Total Bank Loans/Total Nominal GDP of the Year	0.112	0.031	0.058	0.220
M2r	M2 growth rate	0.163	0.047	0.110	0.284

Determination of weight

Previous literatures mostly use simple average method to determine the weight, according to the proportion of each market scale or principal component analysis method. Among them, simple average method based on subjective judgment determines the importance of each index roughly. Zhuangxiaojiu uses principal component analysis method to calculate the value. This method relies more on mathematics. The calculation does not reflect the actual information well. In this paper, analytic hierarchy process (AHP) is used to calculate the weights of all levels of indicators from both qualitative and quantitative aspects.

Data sources

This paper takes 130 commercial banks in China from 2004 to 2015 as the research object, including five major state-owned commercial banks, 12 joint-stock commercial banks, 95 urban commercial banks and 18 rural commercial banks, which basically cover all kinds of commercial banks in China. Most of the financial data of banks come from WIND database. The missing part is supplemented by collecting annual reports of public disclosure. The data of cross-regional operation of city commercial banks come from the official websites of city commercial banks. The information of interest rate marketization degree in the interest rate marketization index comes from the official websites of the People's Bank of China, and the other macroeconomic data comes from CEIC data. In the process of sample selection, we have carried out some screening as follows: (1) excluding some samples of missing data; (2) in order to observe the changing trend of bank risk-taking over a long period of time, excluding samples, in which the proportion of urban commercial banks and rural commercial banks reached 71.13% and 11.51%, respectively. The samples are well represented.

Construction of Empirical Model and Analysis of Result

(1) Establishment and Measurement of Marketization Index of Interest Rate

Through literature review and comparison of various methods, we believe that the process of interest rate marketization can be more accurately and systematically reflected by constructing an index system combined with interest rate reform policies. Therefore, the interest rate marketization index (IRL) is constructed as the explanatory variable of this paper. We set the index of interest rate marketization system according to the existing literature as follows. According to the market, the first-level indicators include: money market interest rate, bond market interest rate, deposit and loan market interest rate and the rate of return on financial products. Secondary indicators: deposit and loan interest rate includes RMB deposit rate, loan interest rate, foreign currency deposit rate and loan interest rate; money market interest rate includes interbank lending rate and bill discount rate; the secondary indicators of the bond market are bond issuance, repurchase rate and cash exchange rate. The financial products market includes bank financing, Monetary Fund and trust fund.

(2) Empirical Model

In order to test the relationship between interest rate marketization and bank micro-characteristics and bank risk-taking, this paper designs three layers of models. Firstly, we construct a dynamic panel model to verify whether there is a significant relationship between interest rate marketization and bank risk-taking.

$$Risk_{i,t} = \alpha + \beta_0 Risk_{i,t-1} + \beta_1 IRLI_{i,t} + \beta_2 IRLI^2_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$Risk_{i,t} = \alpha + \beta_0 Risk_{i,t-1} + \beta_1 IRLI_{i,t} + \beta_2 IRLI^2_{i,t} + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (2)$$

In the above formulas (1), (2), the interpreted variable Risk represents the risk-taking of banks, the core interpretative variable IRLI represents the interest rate marketization, and the square term $IRLI^2$ of the interest rate marketization aims to test whether there is a non-linear relationship between the interest rate marketization and the risk-taking of banks. If β_1 significant but β_2 not significant, it shows that there is a linear relationship between interest rate marketization and bank risk-taking; if β_1 , β_2 significant at the same time and the two symbols are opposite, it shows that there is a U-shaped or inverted U-shaped relationship between interest rate marketization and bank risk-taking. X is the relevant control variable, including bank endowment characteristics and macro market environment. ε is the residual item. Subscription I is the bank, and subscription t is the year. Secondly, on the basis of the above-mentioned bank risk-taking model, in order to verify the relationship between bank micro-characteristics and bank risk-taking, we modify the relevant model as follows:

$$Risk_{i,t} = \alpha + \beta_0 Risk_{i,t-1} + \beta_1 IRLI_{i,t} + \beta_2 IRLI^2_{i,t} + \beta_3 M_{i,t} + \beta_4 X_{i,t} + \varepsilon_{i,t} \quad (3)$$

In formula (3), the variable M represents the corresponding micro-characteristics of banks, including ownership, capital adequacy ratio, deposit-loan ratio and trans-regional operation in local bank samples. If β_3 significant, it shows that the above micro-characteristics of banks will effectively affect the level of risk-taking of banks. Thirdly, to further verify whether the impact of the above-mentioned bank micro-characteristics on risk-taking will change with the deepening of interest rate marketization reform, we add the interaction terms of bank micro-characteristics variables and interest rate marketization in Formula (3):

$$Risk_{i,t} = \alpha + \beta_0 Risk_{i,t-1} + \beta_1 IRLI_{i,t} + \beta_2 IRLI^2_{i,t} + \beta_3 M_{i,t} + \beta_4 M_{i,t} * IRLI_{i,t} + \beta_5 X_{i,t} + \varepsilon_{i,t} \quad (4)$$

Formula (4), if significant but not significant, shows that the impact of bank micro-characteristics on bank risk-taking will not change with the deepening of interest rate marketization reform. If the two symbols are significant at the same time, it shows that the micro-characteristics of banks will affect the risk-taking of banks, but the impact will be weakened with the deepening of interest rate marketization reform.

(3) Empirical results and analysis

Firstly, a preliminary regression is made according to the model (1) to verify whether the marketization of interest rates affects the risk-taking level of banks. The regression results are shown in the second column of Table 2. The market-oriented interest rate (IRLI) has a significant positive impact on the Z-value of banks at the 1% significant level, while the square term (IRLI*IRLI) has a significant negative impact on the Z-value of banks at the 1% significant level. This shows that in the long run, the market-oriented interest rate has a significant negative impact on the Z-value of banks. The sound is inverted U-shaped. Because the Z value is opposite to the level of risk-taking of banks, this shows that the process of interest rate marketization in China has a U-shaped relationship with bank risk-taking. The first stage is 2004-2012. In this stage, the reform of interest rate marketization is relatively slow. Banks mostly maintain their competitive advantage by strengthening internal risk control and the overall risk status. The situation has been improved. The second stage is from 2013 to 2015. In this stage, the central bank accelerated the pace of interest rate marketization, which is manifested in the rapid promotion of deposit interest rate marketization.

Table 2: Interest Rate Marketization and Bank Risk Bearing

Variable	Model (1)	Model (2)
lrisk	0.420***	0.329***
	(0.110)	(0.125)
IRLI	14.88***	23.31***
	(2.573)	(3.265)
IRLI*IRLI	-9.103***	-13.73***
	(1.535)	(1.857)
Size		0.247***
		(0.088)
Revenue		0.085
		(0.102)
NII		0.511
		(0.623)
Listed		0.008
		(0.095)
Houser		-0.130
		(0.369)
GDPr		4.855***
		(1.524)
M2r		-2.278***
		(0.921)
Deep		2.590***
		(0.899)
Constant	-3.163***	-10.36***
	(0.881)	(1.782)
AR(1)	0.000	0.000
AR(2)	0.714	0.446
Sargan test	0.318	0.372
Observations	830	827
Number of id	132	132

Note: ***, ** and * indicate the significant levels of 1%, 5%, and 10% respectively, and the values in parentheses are standard errors. Among them, AR (1) and AR (2) are first-order and second-order autoregressive results respectively. Sargan test value is the result of over-recognition test, the same below.

Secondly, according to the model (2), on the basis of preliminary regression, the regression is controlled from two aspects: bank endowment characteristics and external market environment, so as to prevent the impact of other factors on the relationship between interest rate marketization and bank risk-taking. The regression results are shown in column 3 of Table 2. On the basis of adding relevant control variables, the coefficients of the square terms of the variable interest rate marketization index and the interest rate marketization index are significant and the symbols remain unchanged at the level of 1%. In addition, the extreme value of the variable IRLI at this time (8.488) is still between 2012 and 2013, which shows the empirical relationship between interest rate marketization and bank risk-taking. The results are robust. In the aspect of bank endowment characteristics, bank size increases Z value at 1% significant level, which indicates that the larger the bank, the lower its risk-taking level. On the one hand, the government implicit guarantee behind large banks is higher, and "big but not fail" reduces the risk level of large banks. On the other hand, large banks in China are generally subject to stricter regulatory requirements, and large banks are subject to more restrictions on investment with higher risks. The other bank endowment variables are not significant. In terms of external market environment, GDP growth rate, M_2 growth rate and financial depth have significant impact on bank risk-taking. Among them, the real GDP growth rate (GDP r) is positively correlated with the Z value at the level of 1%. The better the macro-economy, the lower the probability of default and the lower the risk-taking level of bank credit assets when the external investment environment is better. The growth rate of M_2 is negatively correlated with the Z value at 1%. The faster the growth of M_2, the higher the risk-taking level of banks. This shows that loose monetary policy means higher bankruptcy risk, and there are channels for banks to take risks in monetary policy. Financial depth is positively correlated with Z value at 1% level. The higher the proportion of bank loans/GDP in a region, the higher the participation of banks in the contribution of economic growth in the region, the lower the possibility of bankruptcy.

4. Conclusions and Suggestions

For commercial banks, interest rate reform creates both opportunities and challenges. In the market competition environment, the bank's pricing autonomy has been improved, and its enthusiasm has been fully mobilized. However, it is inevitable to face the risks and challenges that follow. The marketization of interest rate makes the bank face the increase of capital cost and the decrease of profit margin, and the intensification of competition in the same industry prompts the bank to actively promote the transformation and innovation of financial business. In the face of market risk, credit risk and operational risk brought by the marketization of interest rate, the bank must improve its risk response ability. This paper discusses whether interest rate marketization has an impact on risk-taking of commercial banks and what kind of impact it has. Firstly, the index system of interest rate marketization is constructed, and the process of interest rate marketization from 1996 to 2016 is measured. Then, the deposit-loan ratio and Z value are used as the alternative variables of risk-taking. The dynamic panel model is constructed by using system moment estimation method to carry out empirical research. The results show that: (1) There is a U-shaped relationship between interest rate marketization and bank risk-taking. The comprehensive index of interest rate marketization is consistent with the result of deposit and loan interest rate market. Because of the path of interest rate reform in China, the risk is generally a downward trend and then an upward trend. Before 2012, interest rate marketization can effectively reduce bank risk-taking. After 2012, interest rate marketization will increase bank risk-taking. (2)Interest rate marketization has a more significant impact on urban commercial banks than large and medium-sized banks. Most of the large and medium-sized banks have been established earlier, their business scope is wider and their operating system is more perfect. When facing the risks arising from interest rate marketization, they are easier to disperse risks through perfect corporate governance and extensive business. (3) From the point of view of bank characteristics, the larger the asset scale, the lower the overall risk, the stronger the risk resistance ability of the larger banks; the higher the net asset interest rate, the lower the risk, the better the internal management of the banks with higher net asset interest rate, and the higher the efficiency of capital operation, thus helping to reduce the risk; the higher the capital adequacy rate, the lower the risk. This is the case. From the macroeconomic point of view, economic growth is negatively related to bank risk, while monetary policy has a positive impact on risk.

The empirical results show that there are still some risks in the whole bank as the interest rate marketization advances. At present, deposit-loan spreads income is still an important source of profit for commercial banks. Commercial banks should first improve their pricing ability from deposit-loan business, accelerate business transformation and financial product innovation to increase their profitability and risk response ability, so as to avoid risks or face risks calmly. (1) Improve the ability of deposit and loan pricing to cope with market competition. Commercial banks have the autonomy of pricing while the competition between the same industry will be more intense. Therefore, banks need to choose a pricing method that is suitable for the market demand and their own, in order to meet the market demand in the fierce competition. (2) Accelerate business transformation and seek new profit points. By expanding the credit scale to cope with the reduction of interest margin, credit risk and interest rate risk may become more prominent. Therefore, it is urgent to get rid of traditional business and realize business transformation. Reasonable development of intermediary business, off-balance-sheet business and financial derivatives business, and explore a diversified

business structure. (3) Accurate market positioning and differential competition. There are great differences in asset scale between large banks and local small and medium-sized banks in China, but at present there is convergence in both management and business structure. Commercial banks should analyze their own characteristics and combine market demand, develop business that suits their own advantages, and reduce homogeneous competition. (4) Improve the construction of market-oriented benchmark interest rate system. Although the central bank deregulates interest rates, which can be decided by financial institutions themselves, it still needs an interest rate that reflects the supply and demand of funds in the current market, i.e. the market benchmark interest rate, which not only provides information for supervisory authorities to monitor the operation of the money market and then formulate corresponding monetary policies, but also determines interest rate water for financial institutions. Ping provides a reference. (5) Establishing risk early warning mechanism and strengthening prudent supervision. The stability of the banking industry plays an important role in the smooth operation of the economy. With the deregulation of interest rate control after the completion of interest rate marketization, banks will be more vulnerable to risks. Therefore, it is necessary to improve the risk early warning mechanism and strengthen the prudent supervision of the financial market.

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