

A Study of Factors Affecting Banking Operating Risk

Junyi Li*

School of Business and Tourism Management, Yunnan University, Kunming, Yunnan 650504, China

**Corresponding author. Email: 383952637@qq.com*

ABSTRACT

With reforms like interest rate marketization, and during banks' expanding of non-interest income business, size, and lending, it's of vital importance to manage banking operating risk to make their development steadily. Based on the micro-data of 12 listed Banks in China from 2011 to 2019 and the macro-economic data of the same period, this paper studies the correlation between seven variables of related factors and the banking operating risk which is represented by Z-score. Through using an established empirical model, it's finally found that the operating risk decreases with the increase of capital adequacy ratio, growth rate of GDP per person, size of bank, the proportion of non-interest income and net interest margin, while the operating risk increases with the increase of money supply and loan-to-deposit ratio. The results of this paper can provide a reference for the supervision and management of risks.

Keywords: *Operating risk, Z-score, factors*

1. INTRODUCTION

With the rapid development of China's economy, the level of national income is constantly improving. In addition, in this covid-19 outbreak, China adopted a relatively loose monetary policy, which greatly increased the money supply in the market. At the same time, market-oriented interest rate reform, banking reform, the internationalization of the RMB, increasingly strict capital regulation system, and so on, are pushing domestic banks to change their business model, improve their risk management. At present, in China, most banks, especially the listed banks, during expanding their scale of operation, no longer focus only on the traditional deposit and lending business but for the development of diversified businesses. For these banks, proportion of non-interest income is growing rapidly. Under such a background, studying the effect of multiple factors on the operating risk of banks and providing reference for the control of risk indicators for the development of banks, will be conducive to the steady expansion of banks and the supervision of the operating risk of banks.

In consequence, through literature review, several indicators are confirmed to be studied in this paper, and Z-score which is created by American scholar, Altman is adopted to measure the operating risk of banks. Twelve listed banks in China are took as the subjects in this study. Through the establishment of an empirical model, it's expected to find out the impact of these indicators on the operating risk of domestic banks.

2. LITERATURE REVIEW

There are many factors that have an impact on bank risk. At the same time, due to the diverse environment and

characteristics of banks in different countries and regions, factors are of different effect degrees to the risk of different banks. Furthermore, a large number of current studies are about the bank risk-taking behaviour and bank risk for different countries and regions. Some of the study results lead to consistent conclusions, while some show their differences according to different subjects.

On the relationship between bank risk and macroeconomic indicators, the growth rate of GDP per person and broad measure of money supply, M2, are adopted when studying the effect of the expansion of overseas business on bank risk. They are found their different effect on bank risk [1, 2]. Meanwhile, in the study of bank risk-taking under the low interest rate environment in the Euro area from 2001 to 2008, it's discovered that the low interest rate does significantly increase bank risk-taking [3].

On the relationship between bank risk and its financial indicators, in a study of European banks, it's found that the increase of non-interest income enhances the systemic risk banks face for both large and small banks [4]. However, according to a study of banks in Indonesia, it's found that non-interest income is negatively correlated with the risk of small banks and positively correlated with the risk of large banks [5]. For liquidity indicators, loan-to-deposit ratio is used when studying risk-taking behaviour of foreign-funded banks [6, 7]. As for the correlation between bank profitability and bank risk, in the study of commercial banks in Indonesia, the net interest margin is used to represent the profitability of banks and study its correlation with bank risks [8]. The results show that banks with weaker profitability are more exposed to risk [8]. Furthermore, while taking the American and European banks as subjects, most systemic risk indicators show a numerical increase as banks grow in size [9].

On the relationship between policy regulatory indicators and bank risk, according to the Basel Committee on Banking Supervision, the capital adequacy ratio of bank is an important regulatory indicator while managing bank

risk. Meanwhile, by studying commercial banks from the MENA region, it's found that state-owned banks tend to reduce their risk by increasing the capital adequacy ratio [6].

Based on the literature review, some of the results of empirical study on bank risk are likely to differ in different countries and regions. It's of necessity to take Chinese banks as subjects and establish an empirical model to study the correlations between various factors and bank risk. Before doing this, following hypotheses are proposed in this study.

H1: The higher the growth rate of GDP per person, the lower operating risk bank has.

Most people and companies are of more ability to repay all loans from banks, which means there will be less non-performing loans, when the economy is developing well. Hence, the bank operating risk will probably reduce with the growth rate of GDP per person increasing.

H2: The more the market money supply, the higher operating risk bank has.

The increase in the market money supply will lead to the fall in market interest rate. This situation will probably push banks to pursue high-risk and high-return business projects to make up for the loss suffered from falling market interest rate.

H3: The greater the proportion of non-interest income, the lower operating risk bank has.

Through expanding sources of non-interest income while widening the scope of business, although the complex business operations bring potential risk, the risk of loss can be hedged or dispersed internally through income diversification. The overall operating risk is of possibility to be reduced by the increase of the proportion of non-interest income.

H4: The higher the loan-to-deposit ratio, the higher operating risk bank has.

Banks with high loan-to-deposit ratio are of more possibility to have non-performing loans and the problem of maturity mismatch between deposits and loans. Therefore, it's considered that banks take higher operating risk when their loan-to-deposit ratios are higher.

H5: The higher the net interest margin, the lower operating risk bank has.

Net interest margin is an important indicator of bank profitability. Even though high risk brings high return, higher net interest margin brings banks more capital to hedge against risk, which overall reduces the bank risk.

H6: The bigger the bank, the lower operating risk it has.

As banks grow in size, the risk management system will get more and more sound, which can effectively help banks control their risk exposure to reduce excessive risk. However, for large banks, they probably seek high-risk and high-return business projects, as there are implicit protection policies which make the banks "too big to fail". As a whole, this study considers that bigger banks take lower operating risk.

H7: The higher the capital adequacy ratio, the lower operating risk bank has.

With the improvement of the bank's capital adequacy ratio, the bank's anti-risk capability also improves, and the risk level of the bank itself also decreases.

3. METHOD

3.1. Variable Selection

3.1.1. Dependent variable

This paper uses Z-score as an indicator to measure the operating risk of banks. Z-score comprehensively considers the operating stability, profitability and financial leverage of commercial banks, and identifies the bankruptcy risk of commercial banks. The value of Z-score is calculated by using formula (1), where i refers to specified bank, j refers to the year, ROA_{ij} refers to the return on assets, EA_{ij} refers to the ratio of capital to assets, and $\sigma(ROA_{ij})$ refers to the standard deviation of the return on assets. A five-year moving average is used to calculate the $\sigma(ROA_{ij})$. In this paper, the dependent variable, Z , is the natural log of Z-score.

$$Z_{ij} = \frac{ROA_{ij} + EA_{ij}}{\sigma(ROA_{ij})} \quad (1)$$

3.1.2. Independent variable

Based on the hypotheses proposed, seven independent variables are included in the empirical model.

(1) The first independent variable, RGP, stands for the growth rate of GDP per person.

(2) The second independent variable, M2, stands for the broad measure of money supply.

(3) The third independent variable, PNI, stands for the proportion of non-interest income, which derives from the ratio of non-interest income to total income.

(4) The fourth independent variable, LDR, stands for the loan-to-deposit ratio.

(5) The fifth independent variable, NIM, stands for the net interest margin, which is calculated by the difference between the average rate of return on interest-bearing assets and the average cost ratio of interest-bearing liabilities.

(6) The sixth independent variable, SIZE, stands for the size of the bank, which is calculated from the natural log of the total assets.

(7) The seventh independent variable, CAR, stands for the capital adequacy ratio, which is the ratio of total capital to risk-weighted assets.

3.2. Data Sources

The data of banks used in this paper derives from the annual reports of 12 listed banks in China. The 12 banks include the big five Chinese state-owned banks and seven listed banks with total assets of more than 2 trillion yuan. In addition, macro data information comes from the website of the National Bureau of Statistics. All the data is from 2011 to 2019. The descriptive statistics of variables in this paper are shown in the following Table 1.

Table 1 Descriptive statistics

Var.	Mean	Max	Min	Median	Std. Dev.
Z	4.8352	8.5627	3.2872	4.6605	0.9299
RGP	0.0677	0.0901	0.0570	0.0636	0.0094
M2	0.1141	0.1380	0.0810	0.1220	0.0234
PNI	0.2564	0.5115	0.0945	0.2541	0.0794
LDR	0.7664	1.0946	0.5623	0.7397	0.1073
NIM	0.0220	0.0296	0.0132	0.0220	0.0035
SIZE	10.9811	12.6152	9.1659	10.9469	0.9031
CAR	0.1273	0.1752	0.0988	0.1238	0.0158

3.3. Model Specification

In order to analyse the factors affecting the operating risk, which is represented by Z-score, from the growth rate of GDP per person, M2, non-interest income, loan-to-deposit ratio, net interest margin, the size, and capital adequacy ratio. In this study, the OLS regression is used. The regression model established is as follow:

$$Z_{ij} = \alpha + \beta_1 CAR_{ij} + \beta_2 M2_{ij} + \beta_3 PGR_{ij} + \beta_4 SIZE_{ij} + \beta_5 LDR_{ij} + \beta_6 NIS_{ij} + \beta_7 NIP_{ij} + \epsilon \quad (2)$$

In this model, if the coefficient is proved to be valid after hypothesis testing, the degree of influence of each factor on the Z-score can be shown by its coefficient.

4. RESULTS

According to regression statistics show in Table 2, the R-square value of regression equation is 0.3457. It shows that the regression equation fits well.

Based on the result of F-test showed in Table 3, the P-value of the F-test is 0.003, which is less than the 5% significance level and indicates that the data is valid.

From the above results, it's indicated that the regression equation can describe the correlation between dependent variable and independent variables well and efficiently.

Table 2 Regression statistics

Multiple R	0.5879
R-squared	0.3457
Adjusted R-squared	0.3264
Standard Error	0.1207
N	117

Table 3 F-test results

F	3.8441
Significance F	0.0030

Table 4 Regression analysis results

Var.	Coefficient t	Std. Error	t-Statistic	P-value
RGP	9.9873	7.3657	2.6353	0.0096
M2	-3.6288	3.0529	2.9835	0.0035
PNI	27.7736	18.5563	2.4484	0.0159
LDR	-0.7734	1.1494	-1.7482	0.0831
NIM	5.7307	27.2745	1.7181	0.0886
SIZE	0.1231	0.0795	2.0033	0.0476
CAR	5.0232	2.8053	2.3763	0.0192

Table 4 shows the results after doing regression analysis. The results demonstrate that, among these seven P-values of variable's hypothesis testing, there are two less than 1% significance level, five less than 5% significance level, two less than 10% significance level. In consequence, coefficients of the seven independent variables can be considered valid.

The coefficients of variables, CAR, RGP, SIZE, NIM, PNI, are all positive, which means that these variables change in the same direction with the value of Z. The coefficients of variables, M2, LDR, are both negative, which means that these variables change in the opposite direction with the value of Z. As the bigger the value of Z is, the less operating risk the bank has, it can be concluded that the seven hypotheses proposed are acceptable according to these results.

When the growth rate of GDP per person increases faster, the loans made by banks are easier to collect, and the risk of non-performing loans can be reduced. However, when the money supply increases, the market interest rate will fall accordingly, which will stimulate the risk-taking behaviours of banks and make banks carry out high-risk businesses in pursuit of higher returns, thus increasing the operational risks of banks. While banks actively expand

the scale of non-interest income activities, revenues of banks will be spread across multiple businesses so as to alleviate the problem that revenues are too risky as they concentrate on a single business. At the same time this also reduces the operating risk and more business risk can be hedged internally. With the increase of loan-to-deposit ratio, the maturity mismatch of deposits and loans will be intensified, which can increase the risk of capital chain rupture. Meanwhile, the increasing number of loans, will inevitably bring in the potential non-performing loans, which will lead to higher operating risk. When bank's net interest margin rises, it means that the bank's profitability increases, so that it has more capital to protect against the risk encountered in the operation, and it can borrow money more easily from the inter-bank lending market. As the bank grows in size, it will have a more perfect risk management system and technicians, which can effectively control the operating risk and maintain it at a low level. When the bank's capital adequacy ratio rises, it means that the bank can bear more losses and be better able to withstand risks, which can also reduce the operating risk of bankruptcy.

5. CONCLUSION

The operating risk of a bank can be caused by various factors. At present, China's banking industry is in the stage of improvement and development. Various reform measures and strict supervision system are being implemented, while the scale of banks, non-interest income and loan origination scale are constantly expanding. At the same time, the characteristics of China's economy and market environment are different from those of other countries. China's economy is developing rapidly, and the market money supply is also increasing. Meanwhile, this paper uses the risk indicator, Z-score, which comprehensively considers the operating stability, profitability and financial leverage. Under these conditions, this paper studies the effect of variables of related factors on banking operating risk which is represented by the Z-score. According to the research results of this paper, commercial banks should pay attention to the quality of loans while actively carrying out loan business, and reasonably control the mismatch between the maturity of deposits and loans to prevent the risk of capital chain rupture. Additionally, in the context of implementing loose monetary policy and increasing market money supply, banks should strengthen risk management and take appropriate risk hedging measures while expanding high-yielding and high-risk businesses. Simultaneously, it is effective for banks to develop diversified business and expand income sources for risk hedging and risk management. As banks are growing in size, they should constantly improve and introduce risk control mechanism and technical personnel, and improve the quality and ability of banks' profitability. Besides, it's of importance to reasonably control their capital adequacy ratio, and maintain a considerable amount of their own

capital to cover the possible significant losses and reduce the potential risk of bankruptcy.

REFERENCES

- [1] A. García-Herrero, F. Vázquezb, International Diversification Gains and Home Bias in Banking, *Journal of Banking & Finance*, 37(7) (2013) 2560-2571. DOI: <https://doi.org/10.1016/j.jbankfin.2013.02.024>
- [2] I. Han, H. Liang, K. C. Chan, Locational Concentration and Institutional Diversification: Evidence from Foreign Direct Investments in the Banking Industry, *The North American Journal of Economics and Finance*, 38 (2016) 185-199. DOI: <https://doi.org/10.1016/j.najef.2016.10.013>
- [3] M. D. Delis, G. P. Kouretas, Interest Rates and Bank Risk-taking, *Journal of Banking & Finance*, 35(4) (2011) 840-855. DOI: <https://doi.org/10.1016/j.jbankfin.2010.09.032>
- [4] E. F. Kamani, The Effect of Non-traditional Banking Activities on Systemic Risk: Does Bank Size Matter?, *Finance Research Letters*, 30 (2019) 297-305. DOI: <https://doi.org/10.1016/j.frl.2018.10.013>
- [5] W. Y. Hidayat, M. Kakinaka, H. Miyamoto, Bank Risk and Non-interest Income Activities in the Indonesian Banking Industry, *Journal of Asian Economics*, 23(4) (2012) 335-343. DOI: <https://doi.org/10.1016/j.asieco.2012.03.008>
- [6] N. Lassoued, H. Sassi, M. B. R. Attia, The Impact of State and Foreign Ownership on Banking Risk: Evidence from the MENA countries, *Research in International Business and Finance*, 36 (2016) 167-178. DOI: <https://doi.org/10.1016/j.ribaf.2015.09.014>
- [7] M. Chen, J. Wu, B. N. Jeon, R. Wang, Do Foreign Banks Take More Risk? Evidence from Emerging Economies, *Journal of Banking & Finance*, 82 (2017) 20-39. DOI: <https://doi.org/10.1016/j.jbankfin.2017.05.004>
- [8] M. Shaban, G. A. James, The Effects of Ownership Change on Bank Performance and Risk Exposure: Evidence from Indonesia, *Journal of Banking & Finance*, 88 (2018) 483-497. DOI: <https://doi.org/10.1016/j.jbankfin.2017.02.002>
- [9] S. Varotto, L. Zhao, Systemic Risk and Bank Size, *Journal of International Money and Finance*, 82 (2018) 45-70. DOI: <https://doi.org/10.1016/j.jimonfin.2017.12.002>