

# ***The Impact of Non-Interest Income on Bank Risk in Chinese Commercial Banks***

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**Abstract:** In the rapidly evolving economic landscape of Chinese commercial banks, the diversification of revenue streams beyond traditional interest income has emerged as a critical trend. Traditionally reliant on interest-based revenue, these institutions are increasingly focusing on non-interest income due to intensified market competition and the liberalization of interest rates. This study aims to investigate the impact of non-interest income on the risk profiles of Chinese commercial banks, a relationship that has been subject to both supportive and critical academic perspectives in recent research. This research employs a panel data econometric model analyzing data from thirteen publicly-listed Chinese commercial banks from 2015 to 2022. The paper explored variables such as non-interest income proportion, bank diversification index, and several risk measures like risk-adjusted return and the Z-Score for bankruptcy risk. Key findings indicate a complex relationship where non-interest income generally reduces bankruptcy risk and enhances risk-adjusted returns. Conversely, income diversification shows mixed effects; it appears to reduce risk in some metrics while potentially increasing it in others. The study concludes that while non-interest income plays a beneficial role in mitigating overall banking risk, the effects of diversification are nuanced and call for careful risk management. Banks are advised to balance their income streams and ensure that expansions into new non-interest income avenues align with their risk management capabilities. These insights contribute to strategic financial management within the evolving Chinese banking sector.

**Keywords:** Non-interest Income, Bank Risk, Chinese Commercial Banks, Income Diversification, Panel Data Analysis.

## **1. Introduction**

In recent years, the operational environment for Chinese commercial banks has undergone significant changes. With the continuous opening of financial markets and the acceleration of financial innovation, the revenue structures of these banks have gradually diversified. Traditionally, the basic source of income for commercial banks all over the world was interest income (INI), derived from the interest rate differential between loans and deposits. However, as market competition intensifies and interest rate liberalization progresses, the growth potential of interest income has been constrained. Consequently, non-interest income (NON) has gradually become an important source of revenue for commercial banks.

NON refers to the revenue generated by banks and other financial institutions through non-traditional banking activities, primarily including fees and commissions, investment gains, and trading income.

A significant body of academic research has explored the impact of non-interest income and diversification on bank risk. Early studies commonly believed that engaging in NON-activities could effectively disperse systemic risk. For instance, Gallo's 1996 study found that engaging in both traditional banking and fund businesses could generate risk diversification benefits [1]. Chiorazzo's research in 2008 indicated that NON is negatively correlated with INI, suggesting that a diversified income portfolio could reduce bank risk [2]. Yi's 2012 study found that NON improves risk-adjusted profitability [3].

However, recent research has questioned these previous assertions, suggesting that an increase in NON does not necessarily reduce bank risk. Zhang's 2010 study found that although NON increases equity returns, it also brings higher risk volatility [4]. Zhou's 2011 research indicated that risk reduction is mainly related to the stabilization of INI, while an increase in the proportion of NON leads to higher volatility and contributes to overall risk [5]. Ahmed's 2020 study on South Asian countries like India and Bangladesh found that NON and income concentration significantly affect bank risk [6]. Dang's 2021 study on Vietnamese banks revealed that those more engaged in NON activities had lower credit risk but higher overall bank stability. However, risk-adjusted returns and capital buffers correlated with risk-taking were negatively impacted by NON [7]. Saklain's 2024 study found that NON and a more market-oriented financial structure positively relate to bank profitability, but neither increases risk [8]. Mehmood's 2023 study on the relationship during the COVID-19 pandemic found a positive correlation between the two [9]. Li Bo's 2024 study discovered a non-linear, inverted U-shaped relationship between the proportion of NON and bankruptcy risk Z-score [10]. These studies illustrate that the impact of NON on bank risk is complex and variable. Therefore, further research in this field, especially considering different periods, economic environments, and bank structures, holds significant importance.

This article builds on existing literature by using panel data from Chinese banks over the past decade to establish an econometric model analyzing the relationship between NON growth and bank risk.

## 2. Methods

### 2.1. Sample and Data Sources

Considering the availability, reliability, and standardization of the data, this study selects annual data from 13 commercial banks in China covering the period from 2015 to 2022, amounting to a total of 104 samples. To ensure data reliability and accuracy, this study integrates data from the China Stock Market & Accounting Research Database (CSMAR) and the China Financial Yearbook. Missing and suspicious data were supplemented accordingly.

### 2.2. Variable Selection

#### 2.2.1. Measurement of Non-Interest Income

The most direct measure of NON is its proportion of the total operating income. To eliminate collinearity, this study uses the relative proportion of NON to total operating income, denoted as *SHNON*. The Herfindahl-Hirschman Index (*HHI*) is also adopted to construct the bank's income diversification index *DIV*, defined as:

$$DIV = 1 - (SHNET^2 + SHNON^2) \quad (1)$$

Where *SHNET* represents the relative proportion of the bank's net interest income. The value range of *DIV* is (0, 0.5); a higher *DIV* indicates a higher degree of income diversification.

### 2.2.2. Bank Risk Measurement

According to pertinent economic literature, this study selects two types of indicators to measure bank risk:

Risk-adjusted return on assets (*RAROA*) and equity (*RAROE*), also known as the Sharpe Ratio, are defined as the ratio of return on assets (*ROA*) or equity (*ROE*) to their standard deviations. The formulas are:

$$RAROA_{i,t} = \frac{ROA_{i,t}}{SDROA_i}, RAROE_{i,t} = \frac{ROE_{i,t}}{SDROE_i} \quad (2)$$

Z – Score: Stiroh's 2004 study suggests that Z-score measures the distance to default, which is the reciprocal of the probability of bank failure [11]. A higher Z – Score indicates lower bankruptcy risk. The formula is:

$$Z - Score_{i,t} = \frac{ROA_{i,t} + \frac{E}{A}}{SDROA_i} \quad (3)$$

### 2.2.3. Control Variables

This study primarily selects growth rate of bank assets *GROWTH*, equity ratio *EQUITY*, deposit ratio *DEPOSIT*, and loan ratio *LOAN* as control variables.

The selected variables are justified as follows:

*GROWTH*: Reflects the impact of asset expansion speed.

*EQUITY*: Describes overall financial leverage and reflects risk attitude.

*DEPOSIT*: Measured as the weight of deposits to total assets, reflecting liquidity and the pressure from operating liabilities.

*LOAN*: Banks with higher loan ratios tend to engage in more risk-taking to rapidly expand and generate profits.

## 2.3. Descriptive Statistics of Variables

Table 1: Descriptive statistics of variables

| Variable       | Mean     | SD      | Max      | Min     |
|----------------|----------|---------|----------|---------|
| <i>SHNON</i>   | 0.3022   | 0.0787  | 0.6186   | 0.1399  |
| <i>DIV</i>     | 0.4095   | 0.0541  | 0.4962   | 0.2407  |
| <i>ROA</i>     | 0.8917   | 0.1991  | 1.3300   | 0.4600  |
| <i>RAROA</i>   | 11.2965  | 3.7811  | 20.4013  | 3.8849  |
| <i>ROE</i>     | 12.6688  | 2.6812  | 18.8900  | 6.4000  |
| <i>RAROE</i>   | 9.4927   | 8.5062  | 39.0826  | 2.1601  |
| <i>Z-Score</i> | 196.0525 | 87.7694 | 497.7936 | 79.1392 |
| <i>GROWTH</i>  | 0.1212   | 0.0710  | 0.3681   | -0.0658 |
| <i>EQUITY</i>  | 6.8675   | 0.8674  | 8.6900   | 4.8600  |
| <i>DEPOSIT</i> | 0.7516   | 0.0520  | 0.8544   | 0.6507  |
| <i>LOAN</i>    | 0.7645   | 0.0941  | 0.9510   | 0.5523  |

ROA and RAROA: with mean of 0.8917 and 11.2965.

ROE and RAROE: higher arithmetic mean of 12.6688 and 9.4927, with a significant maximum value.

Z – Score: a mean of 196.0525, maximum 497.7396, represents a low bankruptcy risk.

GROWTH: a mean of 0.1212, minimum -0.0658, reflects the negative growth of a few banks over certain years (Table 1).

## 2.4. Model Construction

Drawing on domestic and international research and literature, this study constructs a panel regression model to analyze the impact of NON, diversification index, and other control variables on bank risk. The basic models are as follows:

$$RAROA_{i,t} = \alpha + \beta_1 DIV_{i,t} + \beta_2 SHNON_{i,t} + \gamma_1 GROWTH_{i,t} + \gamma_2 EQUITY_{i,t} + \gamma_3 DEPOSIT_{i,t} + \gamma_4 LOAN_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$RAROE_{i,t} = \alpha + \beta_1 DIV_{i,t} + \beta_2 SHNON_{i,t} + \gamma_1 GROWTH_{i,t} + \gamma_2 EQUITY_{i,t} + \gamma_3 DEPOSIT_{i,t} + \gamma_4 LOAN_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$Z - Score_{i,t} = \alpha + \beta_1 DIV_{i,t} + \beta_2 SHNON_{i,t} + \gamma_1 GROWTH_{i,t} + \gamma_2 EQUITY_{i,t} + \gamma_3 DEPOSIT_{i,t} + \gamma_4 LOAN_{i,t} + \varepsilon_{i,t} \quad (6)$$

Where the dependent variables are RAROA, RAROE, and Z – Score. SHNON represents the proportion of NON to operating income. GROWTH, EQUITY, DEPOSIT, and LOAN are control variables. Here,  $i \sim (1, N)$   $t \sim (1, T)$ , when N is the number of banks, and T is the period.

## 3. Data Analysis

This study first performs regression estimations on the three panel data equations (4), (5), and (6).

### 3.1. Model RAROA

Table 2: Regression results of Model RAROA

|                                | Coefficient | Std Error | t-Statistic |
|--------------------------------|-------------|-----------|-------------|
| <i>C</i>                       | 15.1354     | 9.9634    | 1.5191      |
| <i>SHNON</i>                   | 26.9410***  | 5.0442    | 5.3418      |
| <i>DIV</i>                     | -12.1835    | 10.9630   | -2.0876     |
| <i>GROWTH</i>                  | -1.3590     | 4.7320    | -0.2871     |
| <i>EQUITY</i>                  | 0.9266*     | 0.4816    | 1.9239      |
| <i>DEPOSIT</i>                 | 1.4877      | 5.9858    | 0.1564      |
| <i>LOAN</i>                    | -1.9787***  | 5.1612    | -3.7348     |
| <i>R</i> <sup>2</sup>          | 0.3909      |           |             |
| Adjusted <i>R</i> <sup>2</sup> | 0.3532      |           |             |
| F-Statistic                    | 10.3765     |           |             |
| Prob                           | 0           |           |             |

(\* Note: The asterisks denote the significance levels: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

Table 2 estimation results indicate that the F-statistic of the RAROA model is highly significant, with a p – value less than 1%, confirming the model's overall significance. RAROA is significantly positively correlated (PC) with SHNON, significant at the 1% confidence level. In contrast, it is negatively correlated (NC) with DIV, but this result is not significant. This suggests that an increase in NON can reduce bank risk.

Among the control variables, only LOAN is significantly NC with RAROA, indicating that the larger the loan scale, the higher the bank risk. Conversely, the leverage ratio EQUITY shows a significant PC, suggesting that a higher capital-to-asset ratio can reduce bank risk.

### 3.2. Model RAROE

Table 3: Regression results of Model RAROE

|                         | Coefficient | Std Error | t-Statistic |
|-------------------------|-------------|-----------|-------------|
| <i>C</i>                | -94.5737*** | 25.4400   | -3.7175     |
| <i>SHNON</i>            | -31.0856    | 24.2684   | -1.2809     |
| <i>DIV</i>              | 107.5728*** | 34.7309   | 3.0973      |
| <i>GROWTH</i>           | 6.4612      | 12.0826   | 0.5347      |
| <i>EQUITY</i>           | -1.6907     | 1.2297    | -1.3748     |
| <i>DEPOSIT</i>          | 77.1232***  | 24.4072   | 3.1598      |
| <i>LOAN</i>             | 30.2742**   | 13.1785   | 2.2972      |
| R <sup>2</sup>          | 0.2153      |           |             |
| Adjusted R <sup>2</sup> | 0.1668      |           |             |
| F-Statistic             | 4.4373      |           |             |
| Prob                    | 0.0005      |           |             |

Table 3 estimation results show that the RAROE model is significant at the 1% level, confirming the model's overall effectiveness. RAROE is significantly PC with the income diversification index DIV, significant at the 1% confidence level. In contrast, it is NC with SHNON, but this result is not significant. This suggests that NON does not increase the bank's risk-adjusted returns, whereas income diversification effectively reduces risk.

Among the control variables, the deposit ratio DEPOSIT is significantly PC with RAROE at the 1% confidence level. This indicates that a higher proportion of deposits to total assets enhances the bank's ability to resist risk.

### 3.3. Model Z-Score

Table 4: Regression results of Model Z-Score

|                         | Coefficient   | Std Error | t-Statistic |
|-------------------------|---------------|-----------|-------------|
| <i>C</i>                | 248.1926      | 223.5062  | 1.1104      |
| <i>SHNON</i>            | 1136.7290***  | 213.2127  | 5.3314      |
| <i>DIV</i>              | -1080.3940*** | 305.1324  | -3.5407     |
| <i>GROWTH</i>           | -113.8740     | 106.1532  | -1.0727     |
| <i>EQUITY</i>           | 36.3075***    | 10.8044   | 3.3604      |
| <i>DEPOSIT</i>          | -4.2151       | 214.4325  | -0.0196     |
| <i>LOAN</i>             | -252.4020**   | 115.7814  | -2.1799     |
| R <sup>2</sup>          | 0.4311        |           |             |
| Adjusted R <sup>2</sup> | 0.3959        |           |             |
| F-Statistic             | 12.2532       |           |             |
| Prob                    | 0             |           |             |

Table 4 estimation results indicate that the Z-Score model is significant at the 0.1% level, confirming the model's overall validity. The proportion of SHNON is significantly PC with the bankruptcy risk indicator Z – Score, while the income diversification index DIV is significantly NC with the Z – Score, both at the 0.1% confidence level. This suggests that an increase in NON reduces the bank's bankruptcy risk, whereas income diversification increases bankruptcy risk. This contradictory conclusion reflects the instability of NON.

Among the control variables, the leverage ratio EQUITY is significantly PC with the Z – Score at the 1% confidence level, while the loan ratio LOAN is significantly NC with the Z – Score at the 5% confidence level. These findings align with the results of the previous two models, indicating that a larger loan scale increases the bank's bankruptcy risk, while a higher capital-to-asset ratio reduces it.

### 3.4. Results and Limitations

In terms of NON results, this paper is consistent with earlier studies, such as those by Chiorazzo and Yi, which confirm that NON can potentially reduce bank risk by enhancing risk-adjusted profitability [2].

Regarding the results of diversification, this paper contrasts with the primarily positive views observed in early studies by Gallo [1]. The current research indicates that higher levels of income diversification may lead to increased bankruptcy risk. This disparity suggests that banks need to exercise careful strategic management in their income diversification efforts, as unrestricted expansion of various income sources may not always help mitigate risk.

This paper conducted a general panel data regression analysis involving only 13 banks and did not separately analyze different types of banks, such as state-owned versus private banks, or by bank size, thus the conclusions drawn are not comprehensive.

The variable selection in this analysis also did not account for changes in the global economic environment, such as the impact of COVID-19, which has led to economic downturns in various countries.

## 4. Conclusions

This study focuses on data from 13 Chinese commercial banks from 2015 to 2022, employing a multifactor panel regression model to explore the relationships among NON, levels of *DIV*, and bank risk. The following conclusions have been drawn:

NON can reduce bank risk to a certain extent, significantly enhancing the bank's risk-adjusted returns and lowering bankruptcy risk. In contrast, the effects of income diversification are more complex, showing a PC with risk-adjusted return metrics and a negative correlation with bankruptcy risk metrics. Additionally, control variables such as leverage and deposit ratio exhibit a significant positive effect on reducing bank risk. The impacts of loan-to-deposit ratio and bank income growth rate on bank risk appear negligible.

The implications for Chinese commercial banks derived from the above conclusions are as follows:

Given the PC between the increase in NON and the reduction of overall bank risk, banks should explore diverse services and products, such as fee income, consulting services, and asset management, to moderately increase the proportion of NON. However, research indicates that excessive enhancement of NON may increase risk.

While income diversification can reduce bank risk in certain scenarios, this paper's data also indicates that diversification may increase bankruptcy risk. Therefore, banks must conduct thorough risk assessments and management when pursuing business diversification, ensuring that new business

lines align with the bank's core competencies and risk management capabilities, thereby avoiding the burdens of excessive expansion on management and finances.

The proportion of deposits is PC with a bank's ability to withstand risk. Banks should implement strategies to attract and retain customer deposits, such as offering competitive interest rates, optimizing customer service, and promoting convenient electronic banking services. A stable deposit base will enhance the bank's liquidity, helping maintain stable operations during economic fluctuations or market pressures.

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