Research on the Influence of Interest Income on the Profitability of Commercial Banks

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Abstract. Based on the panel data of 42 listed banks from 2010 to 2020, this paper uses the individual fixed effect model to study the impact of interest income on bank ROE, taking the percentage of interest income to turnover as the analysis object, and carries out empirical test on this basis. It shows that the increase of interest income ratio has a significant positive impact on ROE, which can also improve the profitability of banks.

Keywords: Interest income · commercial banks · profitability

1 Introduction

For a long time, interest income is the most important source of income for commercial banks. Due to the continuous opening up of China's financial market in recent years, coupled with the rapid development of Internet finance, the spreads of deposit and loan has been declined. Therefore, many commercial banks are forced to shift their business focus to non-interest income. However, it is worth noting that the interest income of commercial banks accounts for 81.2% in 2022. Thus, interest income still plays a dominant role in the income of commercial banks. Therefore, this paper will explore the impact of interest income on the profitability of commercial banks, and analyze the significance of interest income to the development of commercial banks.

2 Literature Review

As for the research on the impact of business performance of commercial banks, the academic circles at home and abroad focus more on non-interest income, holding positive and negative views on it. However, there are relatively few studies on interest income, and there is a lack of empirical analysis and test.

Some studies believe that non-interest business can significantly increase the profitability of banks. Boyd [1] et al. found that the development of non-traditional banking business could reduce risks to a certain extent. Diamond (1984) [2] believed that the development of non-interest business is conducive to improving the diversity of customers and ultimately improving the overall business income. Saunders and Walter [3]

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found that the expansion of banks into new businesses will bring potential benefits, which can reduce the risks of banks. Staikouras and Wood [4] investigated the financial institutions in 15 European countries, and found that the profit from non-interest business was more stable than that from interest business. Domestic scholars Sheng Hu and Wang Bing [5] conducted a regression analysis on the panel data of 14 Chinese listed banks from 2003 to 2007 and found that the increase of non-interest income was beneficial to the improvement of commercial banks' profitability.

On the other hand, some scholars believe that there is a negative correlation between non-interest income and bank performance. Acharya [6] found that banks giving up traditional business and increasing non-interest income could not improve business performance. Berger et al. [7] argued that non-interest business would increase the operating costs of banks and reduce their earnings by their empirical study on Chinese commercial banks. De Young and Rice [8] analyzed the data of 4712 American commercial banks from 1989 to 2001, and the results showed that the speed of well-managed banks expanding to non-interest income was slower. Based on the data of 734 European banks from 1996 to 2002, Lepetit et al. [9] showed that banks would face higher market risk and bankruptcy risk expanding non- interest income business faced. Domestic scholars Wang Jing and Zhou Haowen [10] found that there was a negative correlation between non-interest income and return on capital.

Based on the above literature review and theoretical research, this paper determines the research hypothesis as follows: interest income has a positive promoting effect on bank earnings.

3 Research Samples, Variable Selection and Descriptive Statistics

3.1 Sample Selection and Data Sources

The samples in this article are selected on the basis of research needs. Data from 42 listed banks were selected for this paper, such as Bank of China, Industrial and Commercial Bank of China, China Construction Bank, CITIC Bank. The data comes from Wind and the official websites of commercial banks, and the samples range from 2010 to 2020. The sample panel data has 42 observations in cross section and 11 observations in time series, totaling 462 observations.

3.2 Variable Selection

According to the above research basis and assumptions, this paper takes ROE as the explained variable, percentage of interest income turnover as the core explanatory variable, and the number of employees, per capita deposits, fixed assets, asset-liability ratio, non-performing loan ratio and total asset turnover as the controlled variable, constructs panel regression model, and makes clear symbol definition and variable interpretation. For details, it is shown in the Table 1:

Table 1. Introduction of Variables

Variable types	Variable symbol	Variable name	Variable meaning
Explained variable	ROE	Return on equity	earnings per share/net asset value per share
Core explanatory variable	PII	Percentage of interest income	interest income/turnover
Controlled variables	NE	Number of employees	log(employees of each commercial bank/1000)
	DE	Deposits per capita	log(per capita deposits by commercial banks)
	FA	Fixed assets	log(fixed assets)
	AL	Asset- liability ratio	total liabilities/total assets
	NPL	Non-performing loan ratio	winsor NPL ratio p(0.05), tail reduction of NPL ratio according to p = 0.05
	TA	Total asset turnover	total sales revenue/average total assets

[1]Tables may have a footer.

3.3 Descriptive Statistics of Variables

In the analysis of the statistical description of variables, I used Stata as the analytical tool. Through statistical processing, descriptive statistics of statistics can be obtained, that of 42 listed commercial banks from 2010 to 2020.The specific results are shown in Table 2.

As can be seen from the above table, the mean value and standard deviation of the explained variable ROE are 0.1558 and 0.4164, indicating that the profitability of commercial banks fluctuates to a certain extent. And the mean value of the core explanatory variable is 0.3733 and the standard deviation is 0.0073, and the ratio of standard deviation to the mean fluctuates greatly. In addition, the number of employees, per capita deposits, fixed assets, asset-liability ratio, non-performing loan ratio, total assets turnover and other controlled variables all have large fluctuations. From the perspective of statistics, core explanatory variables, controlled variables and explained variables show certain volatility, and there may be some internal correlation among the three variables. Therefore, an empirical regression model can be further constructed for in-depth analysis.

Table 2. Descriptive Statistics of Variables

Variables	Observed value	Mean	Standard deviation	Minimum	Maximum
ROE	404	0.1558	0.4164	0.0930	0.2327
PII	459	0.3733	0.0073	0.1908	0.6161
NE	412	9.4316	1.7338	6.6758	13.1285
DE	412	17.7243	0.3343	16.6876	18.9499
FA	461	22.1472	1.8329	19.0307	26.2587
AL	461	0.9309	0.0160	0.7648	0.9835
NPL	454	1.2477	0.4326	0.5300	2.1500
TA	462	2.9134	0.5676	1.0000	5.0000

[2]This table is from Stata.

4 Empirical Results and Analysis

4.1 Construction of Regression Model

Since banks belong to large oligopolistic enterprises, the business strategy and business structure will not change significantly in the relatively short period (2010–2020) chosen in this paper, so the time-fixed model is not considered. To sum up, the model in this paper includes the following three forms:

$$ROE_i = a_i + b_i PII_i + \gamma_i + u_i \tag{1}$$

$$\begin{aligned} ROE_{\mathrm{i}} =& a_i + b_i PII_i + c_i NE_i + d_i DE_i + \mathrm{e}_i\, FA_i + f_i\, DAR_i \\ &+ g_i\, ULR_i + \mathrm{h}_i\, TA_i + \gamma_i + u_i \end{aligned} \tag{2}$$

$$\begin{aligned} ROE_{\mathrm{i}} =& a_i + b_i PII_i + c_i NE_i + d_i DE_i + \mathrm{e}_i\, FA_i + f_i\, DAR_i \\ &+ g_i\, ULR_i + \mathrm{h}_i\, TA_i + (\gamma + u_i) \end{aligned} \tag{3}$$

The explained variable is ROE, and the core explanatory variable is the percentage of interest income in the turnover in these three models.

Model (1) is a univariate regression model. The missing individual variable changes with the individual. Model (2) is an individual fixed effect model. In addition, other controlled variables are added. The missing individual variable changes with the individual. Model (3) is an individual random effect model. Other controlled variables are also added. But the missing individual variable does not change with individual time.

The regression results of the three models are in Table 3.

According to Model (1) univariate regression model, interest income is significant to bank ROE at the significance level of 1%, which indicates that the increase of interest income under the selected sample can improve ROE anda profitability. According to model (2), individual fixed effect model, interest income, number of employees, per

Table 3. Regression Results of the Three Models

ROE	(1) Univariate regression model	(2) Individual fixed effect mode	(3) Individual random effects model
PII	2.425*** (0.398)	0.828*** (0.226)	0.737*** (0.222)
NE	–	−0.032*** (0.006)	−0.015*** (0.004)
DE	–	−0.069*** (0.007)	−0.055*** (0.006)
FA	–	0.015*** (0.004)	0.015*** (0.004)
AL	–	1.042*** (0.148)	1.362*** (0.140)
NPL	–	−0.042*** (0.004)	−0.046*** (0.004)
TA	–	0.005* (0.003)	0.009*** (0.003)
C	0.643*** (0.151)	0.403* (0.221)	−0.332* (0.186)
Adjusted R^2	0.093	0.744	0.728
F-statistic	37.14	140.46	879.37
Prob(F-stat)	0.00	0.00	0.00
N	404	388	388

[3]This table is from Stata.
Notice: *, **, and *** mean significant at the significance level of 10%, 5%, and 1%, respectively

capita deposits, fixed assets, asset-liability ratio and non-performing loan ratio are significant to ROE at 1% significance level. According to model (3), individual random effect model, it can be seen that all variables are significant to ROE at the significance level of 1%. In models (2) and (3), interest income and asset-liability ratio have significant positive effects on bank profitability.

In order to further analyze and determine the specific impact of core explanatory variables and controlled variables on the explained variables, this paper conducts Hausman test on the panel model. The chi-square value of the test result is 56.11, and the adjoint probability is less than 0.0001. According to the judgment principle of adjoint probability less than 0.05, this paper considers that the coefficient difference of the panel regression model is systematic. As a result, this paper takes the individual fixed effect model as the benchmark model, and then explores the impact of interest income on bank profitability.

4.2 Heterogeneity Analysis

Heterogeneity Analysis Based on the Bank's Attributes
Listed commercial banks in the sample can be divided into state-owned banks and non-state-owned banks according to bank attributes. State- owned banks include: Industrial and Commercial Bank of China, Bank of China, Bank of Communications of China, China Construction Bank, Agricultural Bank of China and Postal Savings Bank of China; The other 36 banks in the sample are non-state banks. Accordingly, this paper conducts individual fixed effect regression for the two types of banks, and the results are shown in the Table 4.

According to the above regression results, it can be seen that by dividing listed banks according to their attributes, the percentage of interest income to turnover (PII), the number of employees (NE), per capita deposits (DE), fixed assets (FA), asset-liability ratio (AL), non-performing loan ratio (NPL) and total assets turnover (TA) have inconsistent impacts on the return on equity (ROE) of each bank. In general, the interest income of state-owned banks has a more significant promoting effect on ROE than that of non-state-owned banks. For state-owned banks, PII, DE, DAR and NPL have a significant

Table 4. Heterogeneity Analysis Based on the Bank's Attributes

ROE	State-owned banks	Non-state banks
PII	1.184* (0.691)	0.881*** (0.246)
NE	−0.038 (0.039)	−0.037*** (0.006)
DE	−0.079*** (0.019)	−0.063*** (0.007)
FA	−0.002 (0.007)	0.018*** (0.005)
AL	1.317** (0.447)	0.918*** (0.164)
NPL	−0.023** (0.008)	−0.044*** (0.004)
TA	0.001 (0.004)	0.005 (0.003)
C	0.848 (0.947)	0.362 (0.235)
Adjusted R^2	0.954	0.712
F-statistic	138.18	100.75
Prob(F-stat)	0.00	0.00
N	60	328

[4]This table is from Stata.

impact on ROE. While for non-state-owned banks, PII, NE, DE, FA, DAR and NPL have a significant impact on ROE.

In addition, the regression coefficient of the percentage of interest income to turnover for the return on equity of state-owned banks is 1.184, indicating that the ROE of state-owned banks will increase by 1.184 units for every 1 unit increase in PII, and the interest income has a significant positive promoting effect on the return on equity. However, the regression coefficient of non-state-owned banks is 0.881, indicating that state-owned banks' interest income has a greater impact on profitability than non-state-owned banks.

Heterogeneity Analysis Based on Bank Scale

In this paper, the relevant data of fixed assets of sample listed banks are processed, and banks are divided into large banks and small banks according to the mean value of fixed assets. On this basis, the heterogeneity analysis is carried out. The regression results are in the Table 5.

According to the above regression results, PII, NE, DE, FA, AL, NPL and TA have inconsistent effects on ROE of each bank. In general, interest income of small banks has a more significant promoting effect on return on equity than that of large banks.

Table 5. Heterogeneity Analysis Based on Bank Scale

ROE	Large scale banks	Small scale banks
PII	0.762** (0.298)	0.836*** (0.304)
NE	−0.033*** (0.009)	−0.039*** (0.008)
DE	−0.094*** (0.010)	−0.044*** (0.010)
FA	−0.013** (0.005)	0.001 (0.006)
AL	0.877*** (0.221)	1.020*** (0.213)
NPL	−0.040*** (0.005)	−0.040*** (0.005)
TA	0.001 (0.003)	0.011*** (0.004)
C	1.083*** (0.418)	0.279 (0.272)
Adjusted R^2	0.846	0.748
F-statistic	131.50	65.65
Prob(F-stat)	0.00	0.00
N	197	191

[5]This table is from Stata.

4.3 Robustness Analysis

Robustness of the model means that if the significance, direction, and strength of the coefficients do not change significantly from model specification to model and from sample to sample, then the influence of the relevant variables on the results can be assumed to be robust.

In this paper, the method of reducing the number of samples is chosen, that is, the samples from 2020 are eliminated, and the samples from 2010–2019 are re-regression. The regression results are in the Table 6.

By comparing the two regression results, it is found that the regression coefficients between the explained variable ROE and the core explanatory variable PII are 0.828 and 0.780. The coefficients change slightly, and both are significant under the significance level of 1%, which indicates that the impact of PII on the explained variable ROE is robust. It is reasonable and feasible to use the individual fixed effect model to study the impact of interest income on profitability. In addition, other controlled variables have significant impacts on ROE, among which FA, DAR and TA have positive promoting effects on ROE.

Table 6. Robustness Analysis

ROE	Individual fixed effects model	Robust analysis
PII	0.828*** (0.226)	0.780*** (0.243)
NE	−0.032*** (0.006)	−0.030*** (0.006)
DE	−0.069*** (0.007)	−0.067*** (0.007)
FA	0.015*** (0.004)	0.016*** (0.004)
AL	1.042*** (0.148)	1.016*** (0.159)
NPL	−0.042*** (0.004)	−0.044*** (0.004)
TA	0.005* (0.003)	0.006* (0.003)
C	0.403* (0.221)	0.322 (0.234)
Adjusted R^2	0.744	0.723
F-statistic	140.46	110.46
Prob(F-stat)	0.00	0.00
N	388	346

[6]This table is from Stata.

4.4 Endogeneity Analysis

Endogenous analysis means that, the interaction between the core explanatory variable, other controlled variables and the explained variable may lead to endogenous problems. To solve this problem, this paper carries out the endogeneity analysis by using the data of PII in the next period as instrumental variables. The regression results are in Table 7.

According to the regression results, it can be seen that after variable processing, the influence coefficient of the percentage of interest income in turnover of core explanatory variable on ROE is 0.778, while the influence coefficient is 0.828 when no endogenous problem is processed. Therefore, this paper believes that after endogenous problem processing, The effect of the percentage of interest income to turnover on ROE did not change significantly, so it is considered that the endogeneity of the model is not serious. Therefore, this model can be used to analyze the impact of the core explanatory variable on ROE. In addition, the influence of other controlled variables on ROE is not significant, so it is believed that the endogenous influence of controlled variables of the individual fixed effect model on ROE is not significant. On the whole, the endogeneity of the whole model is not serious, so this model can be used for in- depth analysis.

Table 7. Endogeneity Analysis

ROE	Individual fixed effects model	Endogeneity analysis
PII	0.828*** (0.226)	0.778** (0.356)
NE	−0.032*** (0.006)	−0.030*** (0.006)
DE	−0.069*** (0.007)	−0.067*** (0.007)
FA	0.015*** (0.004)	0.016*** (0.004)
AL	1.042*** (0.148)	1.016*** (0.161)
NPL	−0.042*** (0.004)	−0.044*** (0.004)
TA	0.005* (0.003)	0.007** (0.003)
C	0.403* (0.221)	0.322 (0.234)
Adjusted R^2	0.744	0.723
F-statistic	140.46	26883.33
Prob (F-stat)	0.00	0.00
N	388	346

[7]This table is from Stata.

4.5 Research Conclusions and Policy Recommendations

This paper uses the data of 42 listed banks in China from 2010 to 2020 to test the impact of interest income on their profitability. The research conclusions are as follows:

There is a positive correlation between interest income and return on equity, which plays an important role in improving bank profitability. Therefore, it is necessary to stabilize the contribution of interest income to the ROE of commercial banks and maintain the steady development of commercial banks' asset business.

Compared with non-state-owned banks, the influence coefficient of state-owned banks' interest income on ROE is greater, but the actual proportion of state-owned banks' interest income is relatively small, which shows the importance of interest income. Compared with large-scale banks, the interest income of small-scale banks has a greater influence coefficient on ROE. Therefore, small-scale banks should concentrate on using limited resources to strengthen the development of traditional business, namely interest income.

Appropriate development of new business, especially to improve the bank's off-balance sheet business capacity. State-owned banks have the advantage of having many branches and lower fixed costs to expand non-interest income business; However, small-scale banks should not rush to expand non-interest business, and should make use of mature sales network, customer resources, brand effect, etc. to control costs and improve profitability when interest business is mature.

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