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On Factors Affecting the Year-on-Year Growth of Bank Operating Revenue

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Abstract

This study focuses on the influencing factors of year-on-year growth in bank operating revenue, aiming to construct a multiple linear regression model for in-depth analysis. At the theoretical level, the core viewpoints of financial intermediation theory are detailed. Traditional theory emphasizes transaction costs and information asymmetry, while modern theory extends this to risk management and participation cost functions. As a financial intermediary, the bank's credit intermediation, payment intermediation, and financial service functions significantly impact operating revenue growth. For example, credit intermediation drives revenue growth through interest rate spreads, payment intermediation through fees, and financial services through service charges. In terms of data analysis, various methods are employed. Descriptive statistical analysis calculates statistics such as the mean and median to demonstrate the distribution characteristics of each variable. Correlation analysis calculates the Pearson correlation coefficient and performs significance tests to determine the degree of linear association between variables. Based on this, a multiple linear regression model is constructed. The regression coefficients are estimated using the least squares method, and goodness-of-fit and significance tests are conducted to quantify the impact of each factor on operating revenue growth, providing a scientific basis for bank management decisions.

Keywords

Banks; Year-on-year growth in operating revenue; Multiple linear regression; Influencing factors.

1. Introduction

Currently, the banking industry faces a complex and volatile market environment and intense competitive pressure. From a market environment perspective, macroeconomic uncertainty is a major challenge. Slowing global economic growth and trade frictions have increased business risks, putting the quality of bank credit assets to the test. Simultaneously, the continued advancement of interest rate liberalization has led to a narrowing of the interest rate spread between deposits and loans, impacting traditional profit models. Furthermore, the rapid development of financial technology has reshaped the financial ecosystem, resulting in significant changes in customer needs and expectations for financial services, with a greater emphasis on convenience, personalization, and intelligent services.

In terms of competitive pressure, the banking industry faces fierce internal competition. Banks of different sizes and natures engage in comprehensive competition in areas such as customer resources and business areas. Large state-owned banks hold an advantage due to their strong financial resources and extensive branch network, while small and medium-sized banks need to seek survival through differentiated competitive strategies. At the same time, cross-industry competition from non-bank financial institutions and financial technology companies is also intensifying. Internet finance platforms, with their efficient service processes and innovative

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product models, have attracted a large number of young customers, diverting some of the business from banks.

Against this backdrop, studying the factors influencing the year-on-year growth of bank operating revenue is of significant practical importance. For the banks themselves, a thorough understanding of the factors affecting revenue growth helps them formulate precise development strategies. By analyzing factors such as market trends, customer needs, and internal management, banks can optimize their business structure, increase investment in high-yield businesses, improve operational efficiency, and enhance their core competitiveness. For example, if it is found that the application of financial technology has a significant positive impact on revenue growth, banks can increase investment in technology research and development and talent cultivation.

For the stability of the financial market, banks, as the core of the financial system , are crucial to its stable development. Stable growth in bank operating income helps strengthen banks' capital strength and risk resistance capabilities, reducing systemic financial risks. When banks can achieve sustainable revenue growth, they can better support the development of the real economy, promote the rational allocation of funds, and maintain the stable operation of the financial market. Therefore, studying the factors influencing the year-on-year growth of bank operating income plays an indispensable role in ensuring the sound operation of banks and the stability of the financial market.

This study focuses on the core issue of year-on-year growth in bank operating income, with multi-dimensional and clear research objectives, aiming to provide practical guidance for the development of the banking industry. (1) Identify key influencing factors: Taking into account the macroeconomic environment, industry competition, and internal operation and management of banks, the study accurately identifies the key factors that have a significant impact on the year-on-year growth of bank operating income through in-depth analysis. (2) Quantify the degree of impact: Using advanced statistical analysis techniques, the study determines the quantitative relationship between each key factor and the year-on-year growth of bank operating income, clarifies the degree and direction of each factor's impact, and provides accurate data support for subsequent strategy formulation. (3) Propose targeted strategies: Based on the analysis and quantitative results of key factors, and combined with the actual situation of different banks, the study formulates highly targeted and operable operating income improvement strategies to help banks optimize their business structure and improve operational efficiency. (4) Promote differentiated development of banks: The study helps banks of different sizes and natures identify their own advantages and disadvantages, achieve differentiated competition, and improve the market vitality and competitiveness of the entire banking industry. (5) Maintain the stability of the financial market: As the core of the financial system, the stable growth of bank operating income is crucial to the stability of the financial market. The findings of this study can provide a reference for regulatory authorities in formulating policies, promoting the healthy development of the banking industry, and maintaining the stability of the financial market.

2. Literature Review

2.1. Review of relevant domestic research

Scholars have explored the influencing factors of commercial banks' non-interest income from different perspectives. ZhouZhengqing (2016) analyzed the impact of various factors on the non-interest income of China's banking industry based on data from 41 commercial banks from 2003 to 2015 [1]. Zhu Weidong and Chen Long (2013) conducted a comparative analysis of the influencing factors of non-interest income of China's banking industry [2]. Gao Jingyi (2016), Zhou Yu (2019), and others explored the influencing factors of non-interest income of Chinese

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commercial banks from different samples and data intervals through empirical research [3]. These studies cover multiple aspects such as the macroeconomic environment and the characteristics of banks themselves, providing a multi-dimensional perspective for understanding the formation mechanism of non-interest income.

Regarding income diversification, Xia Qing and Huang Yongxing (2017) analyzed the relationship between non-interest income and the effects of income diversification in Chinese commercial banks [4]. Zhai Guangyu and He Yujie (2016) explored whether commercial banks should accelerate income diversification [5]. The research group of Wuhan Branch of Guangfa Bank et al. (2012) studied the impact of income diversification on income fluctuations in commercial banks [6]. Cui Huatai (2017) empirically studied the impact of income diversification on operating performance and risk of commercial banks based on data from 16 listed banks from 2005 to 2015 [7]. These studies show that income diversification has an important impact on the income stability, operating performance and risk of commercial banks, but there are certain differences in the relationship between the degree of diversification and its effects among different research conclusions.

Market competition is also an important factor affecting the revenue structure of commercial banks. Zheng Zhidan and Xiang Huiling (2016) empirically analyzed the impact of market competition on the net interest margin and non-interest income of commercial banks based on data from the Chinese banking industry from 2006 to 2015 [8]. Jiang Yongdan and Yuan Kun (2017) studied the impact of the level of market competition on revenue diversification of banks through an unbalanced panel model [9]. The results showed that changes in the degree of market competition would prompt commercial banks to adjust their revenue structure to adapt to the market environment.

Regarding the impact of revenue structure on the operating performance of commercial banks, Yin Kairui and Zhu Jianlin (2017) conducted an empirical study from the perspective of bank nature and market power [10]. Chu Ya (2018) studied the impact of revenue structure on the operating performance of listed commercial banks in China [11]. Sun Mengyang (2018) took the Bank of China as an example and analyzed the impact of the proportion of non-interest income on the operating performance of commercial banks [12]. These studies provide a reference for commercial banks to optimize their revenue structure and improve their operating performance.

2.2. Review of relevant international research

Regarding profitability, Ding et al. (2017) compared the profitability of Chinese and American banks, laying the foundation for cross-regional bank profitability research [13]. Tan (2020) focused on banks of different ownership in China, revealing the relationship between competition and profitability, and emphasizing the profitability differences of banks with different ownership types in a competitive environment [14]. These studies help identify key factors affecting bank profitability and provide a basis for banks to formulate profit strategies.

The field of market competition research has yielded fruitful results. Phan et al. (2019)'s empirical study on competition, efficiency and stability of East Asian commercial banks, as well as Banyen and Biekpe's discussion on financial integration, competition and bank efficiency, all highlight the important impact of competition on bank efficiency and stability [15].

Income diversification is also a hot topic. Le (2020) explored the impact of multi-market connections, diversification and bank ownership on bank profitability, pointing out the differences in the role of diversification strategies in banks with different ownership [16]. Githaiga et al. (2019) studied the relationship between bank income diversification and performance, suggesting that banks need to weigh the pros and cons when making diversification decisions [17]. Meslier et al. (2014) studied the benefits of bank income diversification in emerging economies, providing a reference for the diversification

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development of banks in emerging markets. The relationship between bank performance and market structure has also attracted attention [18]. Barra (2019) revealed the relationship between bank performance, financial stability and market concentration through a study of cooperative and non-cooperative banks, providing empirical support for regulators to formulate market structure policies [19].

3. Research Design and Data Sources

3.1. Model Setting

To study the impact of fixed asset investment on fiscal revenue, this paper constructs the following benchmark regression model:

$$y_{it} = \alpha + \beta x_1 + \gamma_1 x_2 + \gamma_2 x_3 + \varepsilon_{it} \quad (1)$$

Where, α is the intercept term, β is the coefficient to be estimated, and ε is the random error term.

3.2. Data Sources and Sample Selection

In this study on the factors influencing the year-on-year growth of bank operating revenue, we selected financial performance data from major state-owned banks and numerous local commercial banks in my country in 2023, primarily sourced from multiple authoritative channels. These include the annual reports of each bank, containing detailed financial data and business information such as net interest income and total liabilities, providing fundamental data support for our research; and financial statistics databases, which are comprehensive and authoritative. Furthermore, data from MarkData.com, after screening and processing, effectively supplemented and improved our research sample, ensuring the accuracy and reliability of the data.

3.3. Data Processing and Analysis Methods

3.3.1. Data Processing

In real-world data, missing values are unavoidable. We employed different methods to handle missing values for different variables. For important continuous variables such as net interest income (x_1) and total liabilities (x_2), if there are few missing values, we used mean imputation, filling in the missing values with the average of the variable; if there are many missing values, we considered deleting records containing missing values or using more complex multiple imputation methods. For the liquidity ratio (x_3), given its reasonable range, we used median imputation based on industry experience and the distribution of existing data.

3.3.2. Data Analysis Methods

(1) Descriptive Statistical Analysis. Descriptive statistical analysis is used to summarize and describe the basic characteristics of the data. We calculated the mean, median, standard deviation, minimum, and maximum values of operating revenue (y), net interest income (x_1), total liabilities (x_2), and liquidity ratio (x_3), and plotted histograms and box plots to visually demonstrate the distribution of each variable. Through descriptive statistical analysis, we can gain a preliminary understanding of the central tendency, dispersion, and distribution pattern of the data, providing a foundation for subsequent in-depth analysis.

(2) Correlation Analysis. Correlation analysis is used to examine the degree of linear association between variables. We calculated the Pearson correlation coefficients between operating revenue (y) and net interest income (x_1), total liabilities (x_2), and liquidity ratio (x_3), and performed significance tests. The correlation coefficients range from -1 to 1; the closer the absolute value is to 1, the stronger the linear correlation between the variables. Through correlation analysis, we can determine which variables have a strong association with operating revenue, providing a basis for establishing a multiple linear regression model.

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(3) Multiple linear regression analysis. Based on the previous analysis, we constructed a multiple linear regression model to analyze the factors affecting the year-on-year growth of bank operating income and conducted goodness-of-fit tests (such as R^2 test) and significance tests (such as F test and t test) on the regression model. Through multiple linear regression analysis, we can quantify the degree of influence of each factor on the year-on-year growth of bank operating income, determine which factors have a significant impact on operating income growth, and provide a reference for the bank's business decision-making.

4. Empirical Results and Analysis

4.1. Descriptive Statistical Analysis

Descriptive statistics are performed on the main variables, including mean, median, standard deviation, maximum, and minimum values, to visually demonstrate the basic characteristics of the data.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
y	44	7.361	5.078	-4.25	23.2
x1	44	14.599	11.726	-3.83	44.84
x2	44	12.603	4.553	4.19	25
x3	44	69.511	23.094	28.28	139.44

4.2. Correlation Analysis

As shown in Table 2, the correlation matrix of variables is adopted to preliminarily detect potential multicollinearity, which offers a reference for the following regression analysis.

The correlation coefficient between operating revenue (y) and net interest income (x1) is 0.642, indicating a strong positive correlation between the year-on-year growth rate of operating revenue and the year-on-year growth rate of net interest income. From a banking operations perspective, net interest income is typically an important component of a bank's operating revenue. The faster the year-on-year growth of net interest income, the more likely it is to drive the year-on-year growth of operating revenue, which aligns with general economic logic.

The correlation coefficient between total liabilities and total liabilities (x_2) is 0.350, showing a certain positive correlation, but the correlation is relatively weak. This means that the year-on-year growth of total liabilities has a certain promoting effect on the year-on-year growth of operating revenue, but it is not the main influencing factor.

The correlation coefficient with the liquidity ratio (x_3) is 0.349, which is also a weak positive correlation. The liquidity ratio reflects the liquidity status of a bank's assets. A higher liquidity ratio helps banks cope with sudden funding needs and conduct business, but its impact on the year-on-year growth of operating income is not very significant.

Table 2. Correlation coefficients

Variables	(1)	(2)	(3)	(4)
(1) y	1.000			
(2) x1	0.642	1.000		
(3) x2	0.350	0.139	1.000	
(4) x3	0.349	0.125	0.010	1.000

As shown in Figure 1, there is a linear relationship between the variables, so it can be determined that the model uses a multiple linear regression model for analysis.

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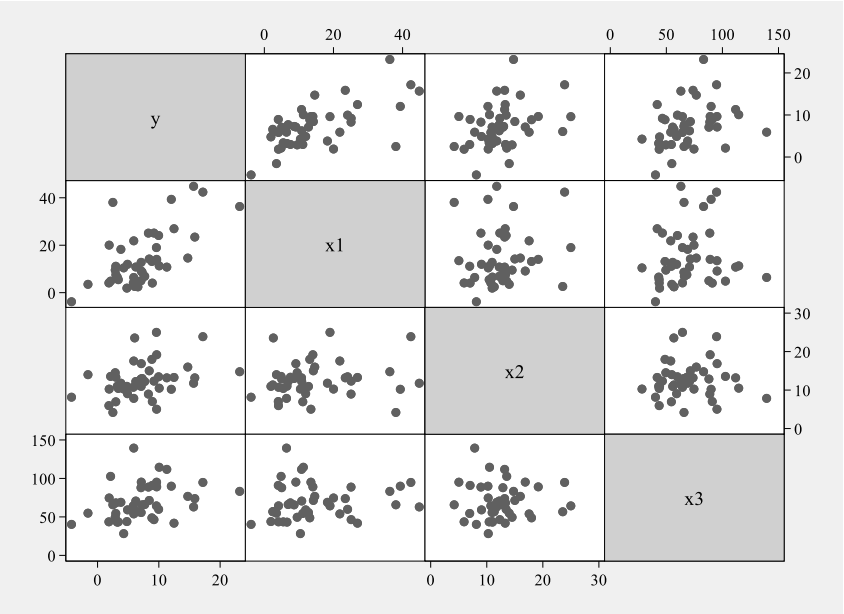

Figure 1. Related graph matrix

4.3. Regression Results Analysis

Table 3 presents the estimation results of the multiple linear regression model, explains the meaning and significance level of the regression coefficients, and analyzes the degree and direction of the impact of each factor on the year-on-year growth of bank operating income.

The regression equation is:

$$y = -0.4208 + 0.247x_1 + 0.299x_2 + 0.06x_3 \quad (2)$$

Table 3. Regression Analysis Results

y	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
x1	.247	.046	5.32	0	.153	.341	***
x2	.299	.119	2.51	.016	.059	.538	**
x3	.06	.023	2.59	.013	.013	.108	**
Constant	-4.208	2.257	-1.86	.07	-8.769	.353	*

Note: *** p<0.01, ** p<0.05, * p<0.1

4.4. Metrological Inspection

4.4.1. Economic significance test

The regression coefficient of the independent variable x1 is 0.247, which is positive. From an economic perspective, this indicates a positive correlation between the year-on-year growth rate of net interest income and the year-on-year growth rate of bank operating income, consistent with economic theory. This is because net interest income is typically a significant component of bank operating income; the faster the year-on-year growth of net interest income, the more it drives the growth of bank operating income. This means that for every unit change in x1, the average change in operating income y is 0.247 units. Statistically, this coefficient is significant at the 1% significance level, indicating that this positive correlation is relatively reliable.

The regression coefficient for the independent variable x_2 (total liabilities) is 0.299, which is positive. This means that the year-on-year growth rate of total liabilities is positively correlated with the year-on-year growth rate of bank operating income. Economically, a moderate increase in bank liabilities can provide more funds for lending, investment, and other business

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activities, potentially increasing operating income; therefore, the sign of this coefficient is consistent with economic logic. For every unit change in x_2, y changes by an average of 0.299 units. This coefficient is significant at the 5% significance level, indicating that this positive correlation has a certain degree of credibility.

The regression coefficient for the independent variable x3 (liquidity ratio (%)) is 0.06, which is positive. This indicates a positive correlation between the liquidity ratio and the year-on-year growth rate of bank operating income. A higher liquidity ratio helps banks cope with sudden funding needs, ensures the normal operation of business, and thus promotes operating income growth, which is consistent with economic common sense. When x3 changes by one unit, y changes by an average of 0.06 units. This coefficient is significant at the 5% significance level, indicating that its impact on the year-on-year growth of operating income is significant.

4.4.2. Goodness-of-fit test

As shown in the graph above, the R^2value is 0.556, indicating that the regression model can explain 55.6% of the change in the dependent variable y. In other words, the independent variables x1-x3 together explain 55.6% of the change in the year-on-year growth rate of bank operating income. Approximately 44.4% of the change cannot be explained by the model, possibly due to other factors not included in the model (such as market competition, sudden changes in macroeconomic policies, etc.). Generally, the closer R^2isto 1, the better the model fit; this model's fit is at a moderate level.

4.4.3. F-test

As shown in the figure above, the F-statistic is 16.678, corresponding to Prob > F = 0.000. This indicates that the regression model is significant overall at the given significance level. That is, at least one independent variable has a significant effect on the dependent variable y, thus rejecting the null hypothesis that the regression coefficients of all independent variables are zero.

In summary, the regression model generally meets expectations in an economic sense, and the direction of the impact of each variable on the year-on-year growth of bank operating income is consistent with economic theory. However, the goodness of fit of the model is at a moderate level, and there is room for further improvement. Introducing more relevant variables could be considered to enhance the explanatory power of the model.

4.4.4. Heteroscedasticity Test

The White test and other methods were used to test for heteroscedasticity in the model. If heteroscedasticity exists, it was corrected using robust standard error and other methods. From the heteroscedasticity test results in Table 4, the corresponding P-value of 0.486 is significantly greater than the significance threshold of 0.05. Therefore, the null hypothesis is accepted, and the model does not exhibit heteroscedasticity.

Table 4. Results of heteroscedasticity test

chi2	df	p
8.480	9	0.486
6.390	3	0.094
0.380	1	0.536
15.250	13	0.292

4.4.5. Multicollinearity test

The variance inflation factor (VIF) and other methods were used to test for multicollinearity among the explanatory variables. If multicollinearity was found, appropriate measures were taken, such as removing highly correlated variables or performing variable transformations. As

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shown in Table 5, the VIF values of all variables were less than 10, indicating that the model did not exhibit multicollinearity.

Table 5. Results of Multicollinearity Test

VIF	1/VIF
1.040	0.965
1.020	0.981
1.020	0.984
Mean	1.020

5. Conclusion and Suggestions

5.1. Conclusion

By constructing a multiple linear regression model to analyze the factors influencing the year-on-year growth of bank operating income, the model passed the goodness-of-fit test and significance test, indicating that the model can well explain the relationship between various factors and the year-on-year growth of bank operating income. This means that our selection of the year-on-year growth rate of net interest income (x_1), the year-on-year growth rate of total liabilities (x_2), and the year-on-year change rate of liquidity ratio (x_3) as independent variables is reasonable and can effectively capture the key factors affecting the growth of bank operating income.

The regression coefficient for the year-on-year growth rate of net interest income (x_1) is significantly positive, indicating that the growth of net interest income has a positive driving effect on the growth of bank operating income. This is consistent with theoretical expectations, because net interest income is an important component of bank operating income. When the scale of bank loan business expands, loan interest rates rise, or deposit costs decrease, resulting in an increase in net interest income, it will directly lead to an increase in operating income.

The regression coefficient of the year-on-year growth rate of total liabilities (x_2) is positive and significant to a certain extent, indicating that the expansion of the liability scale contributes to the growth of bank operating income within a certain range. As an important source of bank funds, the increase in the scale of liabilities provides financial support for banks to carry out more business, promotes the development of lending and investment businesses, and thus drives the increase in operating income. However, it is also necessary to pay attention to the risks that may be brought about by excessive expansion of the liability scale.

The regression coefficient of the year-on-year change rate of the liquidity ratio multiplied by 3 is quite complex, being positive within a certain range and potentially negative beyond that range. This indicates that a reasonable change in the liquidity ratio has a positive impact on the growth of bank operating income. When the liquidity ratio is at an appropriate level, banks can allocate funds more flexibly, seize investment and business opportunities, and promote operating income growth. However, excessively high or low changes in the liquidity ratio may have an adverse impact on operating income growth.

5.2. Suggestions

Banks should actively expand their high-quality loan customer base, optimize their loan structure, and improve loan yields. They can increase lending support for emerging industries and small and micro enterprises, while strengthening risk management, reducing loan default rates, and ensuring stable growth in interest income. They can attract low-cost deposits by optimizing deposit product design and improving service quality. They should also rationally

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adjust deposit interest rate pricing strategies to avoid excessive competition leading to excessively high deposit costs.

Banks should scientifically plan the growth rate of their liabilities based on their own business strategies and risk tolerance. They should avoid blindly pursuing expansion of liabilities and focus on optimizing the liability structure, rationally allocating liabilities of different maturities and types to reduce liability costs and liquidity risks. They should establish and improve a liability risk management system to monitor and analyze the size, structure, and cost of liabilities in real time. They should strengthen their ability to predict and respond to market interest rate fluctuations, adjust their liability strategies in a timely manner, and ensure that the size of liabilities matches the size of assets and business development.

Banks should allocate assets rationally to improve liquidity and profitability. This includes increasing the proportion of highly liquid assets, such as short-term bonds and cash, while also allocating a reasonable proportion of long-term assets to ensure asset appreciation while meeting liquidity needs. A comprehensive liquidity early warning indicator system should be established to monitor changes in the liquidity ratio in real time. When the liquidity ratio approaches or exceeds a reasonable range, timely adjustments should be made, such as adjusting the asset-liability structure or securing short-term financing, to ensure the bank's liquidity security.

In addition to traditional deposit and loan businesses, banks should actively expand into diversified business areas, such as intermediary services and investment banking. By providing diversified financial services, banks can increase non-interest income sources, reduce reliance on net interest income, and improve the stability and risk resistance of their operating income. Continuous collection and analysis of relevant data are crucial to promptly grasp the dynamic changes of various influencing factors. Based on the data analysis results, banks should flexibly adjust their operating strategies to adapt to changes in the market environment and achieve sustainable growth in operating income.

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