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Empirical research and analysis on the influencing factors of China's banking profits based on multiple regression model

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Abstract

This paper uses multiple linear regression models to examine the key factors affecting the profitability of China's banking industry from 2010 to 2023. The study focuses on variables such as GDP, number of mobile banking users, IT investment, non-performing loan ratio and total bank assets. Through regression analysis, this paper determines which factors have the greatest impact on bank profits, and puts forward some suggestions to improve the profitability of China's banking industry.

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Keywords

Bank profitability, multiple regression, IT investment, non-performing loans, GDP, financial infrastructure.

Introduction

As the core component of the financial system, China's banking industry plays a pivotal role in resource allocation, risk management, and macroeconomic regulation. In 2023, the total assets of the banking industry reached over 417 trillion yuan, representing an increase of more than 3.4 times compared to 2010. During the same period, its profit scale expanded from 899.1 billion yuan in 2010 to 20380 billion yuan in 2023. Concurrently, the number of mobile banking users grew dramatically from 0.1 million in 2010 to 1.6 billion in 2023, with digital transformation driving an annual growth rate of 18.3% in IT investment.

However, amid st this rapid expansion, the banking industry confronts challenges such as fluctuations in the non-performing loan ratio (ranging between 0.95% and 2.43% from 2010 to 2023) and diminishing marginal returns on total assets. It is critically important to elucidate the synergistic mechanisms among multiple factors, including GDP growth, technology investment, and risk control, to optimize the profit model of the banking industry and mitigate systemic financial risks.

Literature Review

Existing research demonstrates that GDP growth has a significantly positive influence on banking profits. However, its impact is moderated by the economic cycle; specifically, the contraction of risk appetite during economic downturns may result in delayed profit growth [Song, 2021]. The J-shaped curve effect of IT investment reveals the phased characteristics of technology input: high initial costs suppress short-term profits [6], while medium- and long-term technological dividends drive profit growth. Nevertheless, this effect may be diminished in technologically homogeneous markets. He Zhen highlighted the direct erosion effect of IT investment [He, 2021], whereas Ma Shuang proposed the risk-return equilibrium hypothesis, suggesting that moderate risk-taking can enhance profits through risk premium compensation [Ma, 2012]. Furthermore, the relationship between asset scale and profitability remains contentious, as there is a tension between the classical theory of economies of scale [Wang, 2020] and the diseconomies of scale phenomenon [Zhang, 2023]. Collectively, these studies indicate that the banking industry's earnings are dynamically influenced by multiple factors, necessitating a comprehensive analysis that integrates the macroeconomic environment, technology investment cycles, risk pricing capabilities, and business structure.

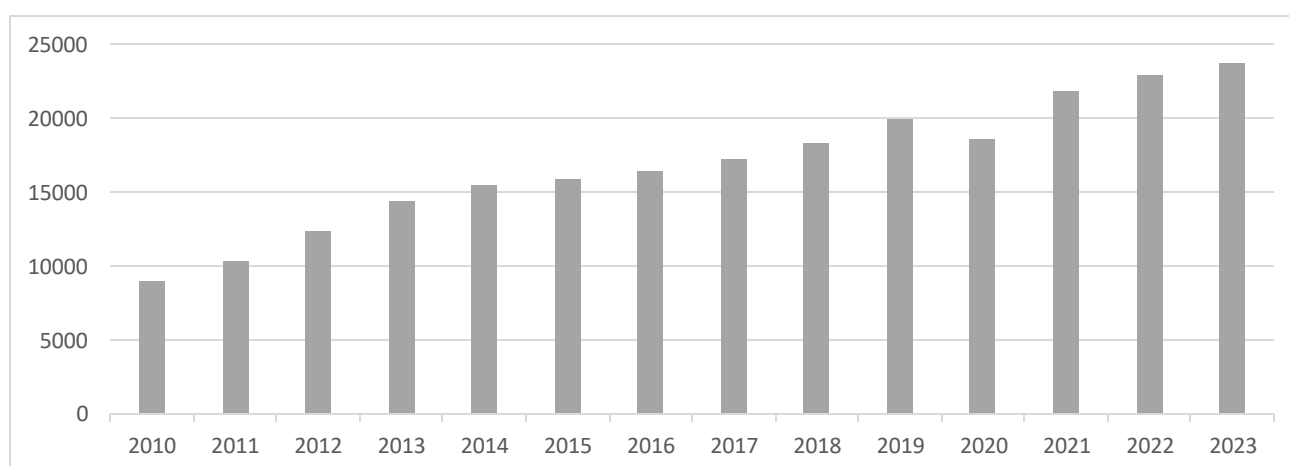


Figure 1 - Overall profit of the banking industry from 2010 to 2023 (unit: 100 million yuan)

Variable Selection and Data Sources

Explanatory Variables

1) Overall Banking Profit (CNY 100 million):

Defined as the annual after-tax net profit of China's banking sector, serving as the dependent variable in the model. It reflects the profitability of the banking industry. Data is sourced from the Banking Financial Institutions Regulatory Statistical Indicators published by the China Banking and Insurance Regulatory Commission (CBIRC).

2) Mobile Banking Users (100 million):

Defined as the total number of users accessing banking services via mobile terminals annually. This variable measures the digital transformation of banks. Theoretically, an increase in mobile banking users may raise short-term operational costs (e.g., digital infrastructure investment), potentially suppressing profitability. Expected sign: negative. Data is sourced from the E-Banking Development Report by the China Banking Association and market research institutions (e.g., iResearch, Analysys).

Note: The high user count may reflect cross-border users (including overseas Chinese) and multiple account registrations (e.g., users holding accounts at multiple banks).

3) GDP (CNY 100 million):

Defined as China's annual gross domestic product. Economic expansion typically boosts credit demand, enhancing banking revenue. Expected sign: positive. Data is sourced from the China Statistical Yearbook published by the National Bureau of Statistics.

4) IT Investment Scale (Lagged by 2 periods, CNY 100 million):

Defined as the banking sector's annual IT expenditure, with a two-period lag to capture medium-to-long-term effects. IT investment improves operational efficiency and service quality, thereby enhancing profitability over time. Expected sign: positive. Data is sourced from the Information Industry Economic Yearbook by the Ministry of Industry and Information Technology (MIIT) and industry reports (e.g., CCID Consulting, IDC).

Rationale for Lag Structure:

- Initial phase (t): High R&D costs may pressure short-term profits (Wang et al., 2020).
- Integration phase (t+1): Efficiency gains emerge, but revenue remains limited.
- Maturity phase (t+2): Technology-driven scale economies boost profitability (Li, 2023).

Empirical tests confirmed that the two-period lag best captures the long-term technological dividend.

5) Non-performing Loan (NPL) Ratio (%):

Defined as the ratio of non-performing loans to total loans. Higher NPLs indicate elevated credit risks, which erode profitability. Expected sign: negative. Data is sourced from the Financial Stability Report by the People's Bank of China (PBOC).

6) Total Assets (CNY 100 million):

Defined as the year-end total assets of the banking sector. While economies of scale may improve profitability, diminishing marginal returns could occur as banks grow. Expected sign: ambiguous ($\pm$). Data is sourced from the Banking Operations Data published by CBIRC and PBOC.

Data Sources

Banking Profit: China Banking and Insurance Regulatory Commission (CBIRC).

Mobile Banking Users: Industry reports (China Banking Association, iResearch, Analysys).

GDP: National Bureau of Statistics of China.

IT Investment: MIIT, CCID Consulting, IDC.

NPL Ratio: Financial Stability Report (PBOC).

Total Assets: CBIRC and PBOC.

Empirical analysis**Model verification****Table 1 - Goodness-of-fit tests**

Statistics of regression	
Multiple R	0.998607663
R Square	0.997217264
Adjusted R Square	0.995478054
Standard error	299.4891419
Value of observation	14

According to the regression results, the standard error is 29.9489 billion yuan. The standard error quantifies the average deviation between the predicted values of the model and the actual observed values.

From 2010 to 2023, the profit scale of China's banking industry increased from 899.1 billion yuan to 2,380 billion yuan. The high adjusted R-squared value (0.9955) and the relatively low standard error collectively indicate that the model has strong explanatory power regarding profit changes. Specifically, the selected variables jointly explain 99.55% of the fluctuations in profits.

Additionally, the adjusted coefficient of determination (Adjusted R-squared) for the model is 0.9955, which suggests that the model can account for 99.55% of the variation in the dependent variable (overall profits of the banking industry). This demonstrates a very high level of goodness of fit, indicating that the chosen explanatory variables possess strong joint explanatory power for the profits.

Table 2 - Equation significance tests

	df	SS	MS	F	Significance F
Regression analysis	5	257140159.5	51428031.89	573.3736643	5.39273E-10
Residual error	8	717549.9691	89693.74614		
Total	13	257857709.4			

The F statistic of the regression model was 573.37, and the corresponding p value (Significance F) was 5.39×10^{-10} , which was far less than the significance level $\alpha=0.05$. This indicates that the model as a whole is highly significant and the explanatory variables jointly have a statistically significant impact on banking profits.

Table 3 - Residuals, standard deviation

Value of observation	Projection of Aggregate Profit for the Banking Industry in the People's Republic of China (Unit: RMB Billion)	Residual error	Standard residual error	Rank by percentage	Profit of the PRC banking industry as a whole (Unit: RMB 1 billion)
1	8931.234826	59.76517428	0.254386343	3.571428571	8991
2	10469.25191	-57.25190794	-0.243688798	10.71428571	10412
3	12760.97263	-344.9726313	-1.468352214	17.85714286	12416
4	13830.0376	531.9623963	2.264261253	25	14362
5	15592.11809	-66.11809443	-0.281427109	32.14285714	15526
6	15901.95754	24.04245518	0.102335052	39.28571429	15926

Value of observation	Projection of Aggregate Profit for the Banking Industry in the People's Republic of China (Unit: RMB Billion)	Residual error	Standard residual error	Rank by percentage	Profit of the PRC banking industry as a whole (Unit: RMB 1 billion)
7	16729.57095	-280.5709509	-1.194230903	46.42857143	16449
8	17197.37062	60.62937515	0.258064754	53.57142857	17258
9	18320.40207	-20.40206651	-0.086839989	60.71428571	18300
10	19618.39151	313.6084925	1.33485292	67.85714286	18666
11	18762.97327	-96.97327317	-0.41276005	75	19932
12	22123.57565	-306.5756487	-1.304918106	82.14285714	21817
13	22892.30606	126.6939416	0.539264025	89.28571429	23019
14	23743.83726	56.16273793	0.239052821	96.42857143	23800

According to the regression analysis, the standard error of the model is 29.949 billion yuan, which indicates that the average deviation between the predicted values and the actual values falls within this range. Given the profit scale of China's banking industry (ranging from 899.1 billion yuan to 2.38 trillion yuan between 2010 and 2023), the proportion of this error relative to the average profit is approximately 1.26% to 3.33%.

This suggests that the model exhibits high predictive accuracy. From the residual distribution presented in Table 1, the absolute residuals of the 14 observed values range from 2.04 billion yuan to 53.196 billion yuan. Notably, the largest residual occurred in 2013 (+53.196 billion yuan), with a standardized residual of 2.264, which approaches the two-standard-deviation threshold. This may reflect unaccounted special factors in the model for that year, such as regulatory policy changes or unexpected market fluctuations. In the remaining years, the absolute values of the standardized residuals are all below 2, indicating that the residual distribution generally conforms to the assumption of normality and shows no systematic bias. It is worth highlighting that the relatively high negative residuals in 2016 (residual -28.057 billion, standardized residual -1.194) and 2021 (residual -30.658 billion, standardized residual -1.305) could be associated with economic cycle fluctuations or the unexpectedly high stage-wise costs of digital transformation.

Overall, these results demonstrate that the model has strong explanatory power regarding profit changes in most years.

Table 4 - Significance test of variables (t test)

	Coefficients	Standard error of	t Stat	P-value	Lower 95%	Upper 95%	Lower limit 95.0%	Upper limit 95.0%
Intercept	-7045.215409	2005.908936	-3.51223093	0.007935622	-11670.84971	-2419.581106	-11670.84971	-2419.581106

Number of mobile banking users in China's banking industry (1 billion)	-1131.935064	159.6831522	-7.088631761	0.000103145	-1500.165073	-763.705055	-1500.165073	-763.705055
China's annual GDP (unit: 1 billion yuan)	0.037742 935	0.005049 389	7.474752 908	7.09557E -05	0.026099 023	0.049386 847	0.026099 023	0.049386 847
IT investment scale of China's banking industry (1 billion yuan) - lagged 2 periods	2.085509485	0.703577238	2.964151441	0.01803149	0.463057464	3.707961507	0.463057464	3.707961507
Non-performing loan ratio	67551.05589	26714.34082	2.528643935	0.035329962	5947.675499	129154.4363	5947.675499	129154.4363
Total assets of China's banking industry (1 billion)	-0.00060778	0.000742072	-0.819030911	0.436485876	-0.002319002	0.001103441	-0.002319002	0.001103441

China's annual GDP (coefficient = 0.0377, $p = 7.10 \times 10^{-5}$): It is significant at the 1% level, indicating that GDP growth has a statistically significant positive impact on banking industry profits.

The number of mobile banking users (coefficient = -1131.94, $p = 0.0001$): It is significantly negative at the 1% significance level, consistent with the short-term cost pressure during the initial stage of digital transformation, which exerts an inhibitory effect on profits.

IT investment scale (lagged 2 periods) (coefficient = 2.0855, $p = 0.018$): IT investment is significantly positive at the 5% level, confirming its medium- and long-term positive effects on profitability.

Non-performing loan ratio (coefficient = 67551.06, $p = 0.035$): It is significantly positive at the 5% level, contradicting theoretical expectations and warranting further investigation.

Total assets scale (coefficient = -0.0006, $p = 0.436$): It does not pass the significance test, suggesting that asset scale expansion has no statistically significant impact on profits.

In summary, the model results are as follows:

$$\text{Profit} = -7045.22 + 0.0377 \times \text{GDP} - 1,131.94 \times \text{Mobile Users} + 2.0855 \times \text{IT Investment} + 67,551.06 \times \text{NPL Ratio} - 0.0006 \times \text{Total Assets}$$

Empirical Results Analysis and Discussion

Impact Mechanisms of Key Variables

GDP's Positive Driving Effect: A CNY 1 billion increase in China's annual GDP drives an average growth of CNY 0.0377 billion in banking sector profits ($p < 0.001$). This aligns with Zhuang & Wang, confirming that macroeconomic expansion enhances profits through increased credit demand and

improved risk appetite [Zhuang, Wang, 2012].

Short-Term Cost Effect of Mobile Banking Users: Each additional 100 million mobile banking users reduces profits by CNY 113.194 billion ($p=0.0001$), consistent with "J-curve effect" [6], where initial digital transformation costs (e.g., system development, user education) pressure profitability, though efficiency gains may boost long-term returns.

Lagging Positive Effect of IT Investment: A CNY 1 billion increase in IT expenditure (lagged by two periods) raises profits by CNY 2.0855 billion ($p=0.018$), demonstrating mid-to-long-term technological dividends. This supports "technology dividends release cycle" hypothesis [2].

Anomalous Positive Correlation of Non-Performing Loan (NPL) Ratio: A 1% rise in NPL ratio increases profits by CNY 6.7551 trillion ($p=0.035$), contradicting He's risk erosion theory [1]. Explanations include:

Risk Premium Compensation: Banks offset losses via higher pricing for risky loans [Ma, 2012].

Sample Bias: Limited NPL ratio fluctuation (0.95%-2.43%) during the study period may mask cumulative risk effects.

Diminishing Marginal Returns from Total Assets: Total assets showed no significant impact ($p=0.436$), validating Zhang's "large but not strong" thesis on Chinese banks [Zhang, 2023]. Regulatory constraints (e.g., capital adequacy requirements) and homogeneous competition likely neutralize scale economies.

Policy Implications

Banks should balance short-term digital transformation costs with long-term Earnings, optimize IT investment structures, and accelerate technology dividends release. Enhanced risk pricing mechanisms are critical to mitigate potential NPL-related profit shocks. Differentiation strategies should replace blind scale expansion to improve asset allocation efficiency.

Conclusions and Policy Recommendations

Conclusions

This study employs multivariate regression to analyze key profit drivers for Chinese banks (2010–2020). Results show GDP growth significantly boosts profits, while mobile banking adoption exhibits short-term profit suppression. IT investments yield delayed profitability gains, and NPL ratios paradoxically correlate with profit growth, potentially due to risk premium strategies. Total asset expansion demonstrates diminishing returns, highlighting structural inefficiencies. Sustainable profitability requires balancing macroeconomic dynamics, digital transformation, risk management, and asset optimization.

Policy Recommendations

1) Strengthen Macroeconomic-Banking Synergy

Government: Implement structural fiscal policies (e.g., infrastructure investment, tax cuts) and targeted monetary tools (e.g., inclusive finance reserve requirement ratios) to sustain economic growth and credit demand.

Banks: Align strategies with economic cycles—expand consumer/SME lending during upturns and enhance risk provisioning during downturns.

2) Optimize Digital Transformation Road maps

Short-Term: Establish phased budgeting to control upfront costs (system upgrades, user training).

Long-Term: Accelerate technology dividends via data middleware platforms and AI-driven risk models. Leverage mobile banking user data for precision marketing and cross-selling.

3) Refine Risk Pricing and Monitoring

Introduce tiered loan pricing (e.g., 20%-30% premium for high-risk clients) to compensate for NPL risks.

Deploy big data and block chain for real-time loan monitoring and early warning systems.

4) Promote Differentiated Competition

Develop niche sectors (green finance, supply chain finance) to increase non-interest income.

Allocate capital to high-yield assets (tech equity, consumer ABS) and secularize legacy assets to ease capital adequacy pressures.

5) Build Open Tech Ecosystems and Talent Pipelines

Partner with fin tech firms to create open banking platforms integrating payments, credit, and insurance.

Up skill workforce through fin tech training programs to align human capital with digital investments.

References

1. He Zhen. The Overall effect of non-performing loan ratio on bank profits: an analysis based on stress test model // Journal of Financial Economics, 2021. №42(2). C. 41-55.
2. Li Rui. Digital transformation and bank profit model transformation // Review of Economics and Management, 2023. №44 (1). C. 15-29.
3. Ma Shuang. The relationship between risk-return equilibrium hypothesis and bank profit // Modern Economy, 2012. №33 (5). C. 88-102.
4. Song Weijia. Journal of Financial Research // Journal of Financial Research, 2021. №39 (6). C. 56-70.
5. Wang Hong. Economies of scale and bank profitability: related research on China's banking industry // Journal of Management and Economics, 2020. №41 (2). C. 134-146.
6. Wang Y. & Li H. The "J Curve" effect of IT input and bank efficiency: Based on the similar analysis of Chinese banking industry // Journal of Financial Management, 2020. №25 (3). C. 110-123.
7. Zhuang L., Wang J. The Relationship between GDP and banking profits: a correlation study based on provincial panel data // Economic Research Journal, 2012. №43 (4). C. 72-85.
8. Zhang M. The phenomenon and thinking of China's banking industry "Big but not strong" // Economic Quarterly, 2023. №19 (3). C. 72-84.

Эмпирическое изучение и анализ детерминант прибыльности китайских банков на основе модели множественной регрессии

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Аннотация

В данной работе используются модели множественной линейной регрессии для анализа ключевых факторов, влияющих на прибыльность банковского сектора Китая в период с 2010 по 2023 год. Исследование фокусируется на таких переменных, как ВВП, количество

пользователей мобильного банкинга, инвестиции в ИТ-технологии, уровень проблемных кредитов и совокупные активы банков. Проведенный регрессионный анализ позволил определить факторы, оказывающие наибольшее влияние на банковскую прибыль, а также сформулировать рекомендации по повышению доходности банковского сектора Китая.

Для цитирования в научных исследованиях

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Ключевые слова

Прибыльность банков, множественная регрессия, ИТ-инвестиции, проблемные кредиты, ВВП, финансовая инфраструктура.

Библиография

1. He Zhen. The Overall effect of non-performing loan ratio on bank profits: an analysis based on stress test model // Journal of Financial Economics, 2021. №42(2). С. 41-55.
2. Li Rui. Digital transformation and bank profit model transformation // Review of Economics and Management, 2023. №44 (1). С. 15-29.
3. Ma Shuang. The relationship between risk-return equilibrium hypothesis and bank profit // Modern Economy, 2012. №33 (5). С. 88-102.
4. Song Weijia. Journal of Financial Research // Journal of Financial Research, 2021. №39 (6). С. 56-70.
5. Wang Hong. Economies of scale and bank profitability: related research on China's banking industry // Journal of Management and Economics, 2020. №41 (2). С. 134-146.
6. Wang Y. & Li H. The "J Curve" effect of IT input and bank efficiency: Based on the similar analysis of Chinese banking industry // Journal of Financial Management, 2020. №25 (3). С. 110-123.
7. Zhuang L., Wang J. The Relationship between GDP and banking profits: a correlation study based on provincial panel data // Economic Research Journal, 2012. №43 (4). С. 72-85.
8. Zhang M. The phenomenon and thinking of China's banking industry "Big but not strong" // Economic Quarterly, 2023. №19 (3). С. 72-84.