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Research on the Influence of Financial Technology on The Profitability of Small and Medium-sized Commercial Banks

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Abstract: This paper analyzes the overall profitability of city commercial banks and agricultural commercial banks, analyzes how financial technology has an impact from the existing theory and impact mechanism, and establishes panel data in the empirical part for analysis, it is concluded that financial technology can promote the profitability of small and medium-sized commercial banks, but there is heterogeneity between urban and rural commercial banks, finally, the paper gives some suggestions on the healthy upgrading and transformation of small and medium-sized banks and how to regulate the use of financial technology by regulatory authorities.

Keywords: Financial technology, Commercial banks, Profitability, PKU inclusive financial index.

1. Introduction

Several of the hottest technologies of recent years, such as AI, Big Data, cloud computing, blockchain, digital payments and robotics consultants, are rapidly reshaping traditional banking. The profit structure of our country's commercial banks is relatively single, non-interest, Capital adequacy ratio and other factors are still restricting their development, and the emergence of network finance has also brought greater difficulties to the commercial banks, interest income and non-interest income growth slowed, and some companies have even regressed. In the face of increasingly fierce competition, China's commercial banks in the face of increasingly fierce competitive pressure, how to increase investment in the financial sector, to seek opportunities for online finance, to realize the organic combination of technology with financial products, services and business, and to promote its strategic transformation and business deepening has become an urgent problem to be solved.

In this paper, through the mechanism of small and medium-sized commercial banks and data analysis, to small and medium-sized commercial banks to provide a reference for the use of financial technology. And through empirical analysis of the impact of small and medium-sized commercial banks in the development of financial technology, and put forward recommendations in the supervision, in order to better promote the transformation of such small and medium-sized banks, to guide the healthy and orderly development of the banking industry and promote the ability to serve the real economy.

2. Literature Review

Delong and Geyoung's research shows that while online finance can improve U.S. profits, it can change the deposit structure of banks[1]. Li Dazhi and Xu Yihan analyzed that compared with the traditional low-interest demand deposit, the low-liquidity time deposit, the online financial products have higher liquidity and profitability, and have a certain impact on commercial banks, and a certain impact on the level of interest rates[2]. Zhan Minghua and others from a macro-analysis of the impact of bank credit channels in the face of Internet finance[3]. Research by Li, spigt & Swinkels shows that financial technology and traditional banking are complementary[4]. Wang believes that financial technology will bring other problems, such as increasing price competition and interest rate liberalization, which will reduce banks' profits and increase their risks[5]. Tang's empirical research shows that with the development of financial technology, the bank's credit risk control ability has been further improved[6],Yao Ting,based on her analysis of fintech, believes that fintech can improve its profitability by reducing transaction costs between commercial banks and customers[7].

Financial Science and technology has just started in our country. At present, the academic research on it is still at the theoretical level.

3. Analysis of Changes in NIM and ROA

3.1. Change in net interest margin

In the third quarter of this year, the net interest margin of Chengshang Bank was 1.89% , which is lower than the average net interest margin of 2.07% of commercial banks, in the same period, the net interest margin of state-owned big banks, joint-stock banks and agricultural and commercial banks was 2.03% , 2.15% and 2.26% respectively. From the 2018 data, the city commercial bank net interest margin and commercial banks as a continuous narrowing trend. Some of the 16 a-share city commercial banks reported a net interest margin of 1.82% to 2.29% in the third quarter, with Qingdao Bank the lowest and Ningbo Bank the highest.

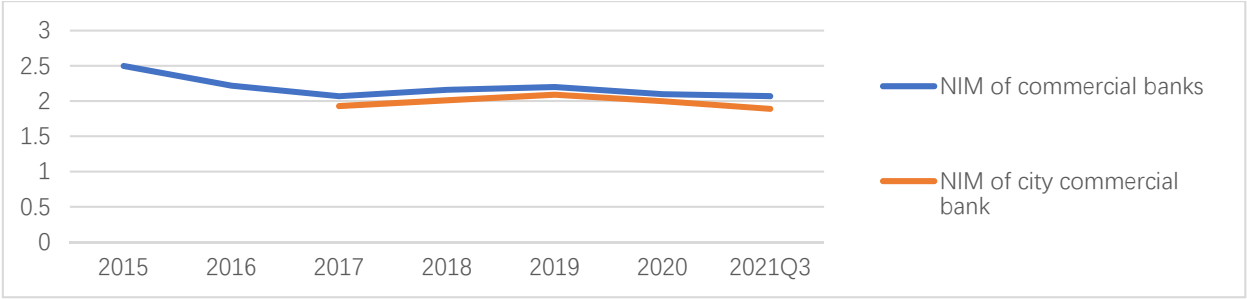

Figure 1. 2015-2021 the first three quarters of commercial banks NIM Change Chart

3.2. Changes in the profitability of assets

In the first three quarters of this year, Chengshang's average return on assets was 0.60 per cent, lower than the 0.82 per cent average ROA of commercial banks and the lowest of the six categories of commercial banks. The figure was up 0.05 percentage points from the same period last year and in line with the average for commercial banks.

Considering the average return on assets of 16 a-share listed city commercial banks in the first three quarters of about 0.85% , it can be calculated that the ROA of other city commercial banks will be less than 0.60% during the same period. For example, Hebei Bank has an annualized ROA of about 0.59% , Guilin Bank has an annualized ROA of about 0.43% , and Fudian Bank has an annualized ROA of about 0.22% .

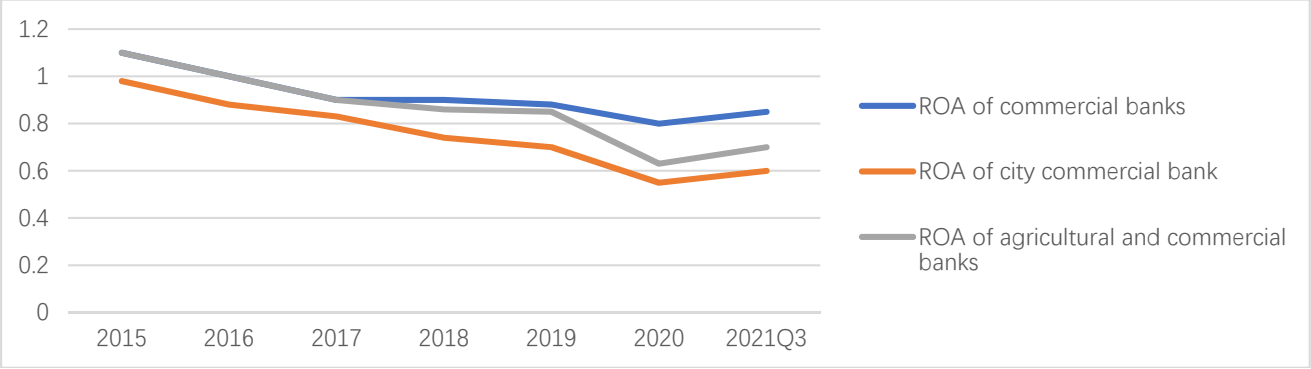

Figure 2. 2015-2021 the first three quarters of commercial banks ROA Change Chart

4. How Fintech Affects Commercial Banks' Profits

The profitability of commercial banks is reflected in the aspects of customer-oriented marketing, product service, compliance risk control and Operation Management. The impact mechanism is shown in figure 3.

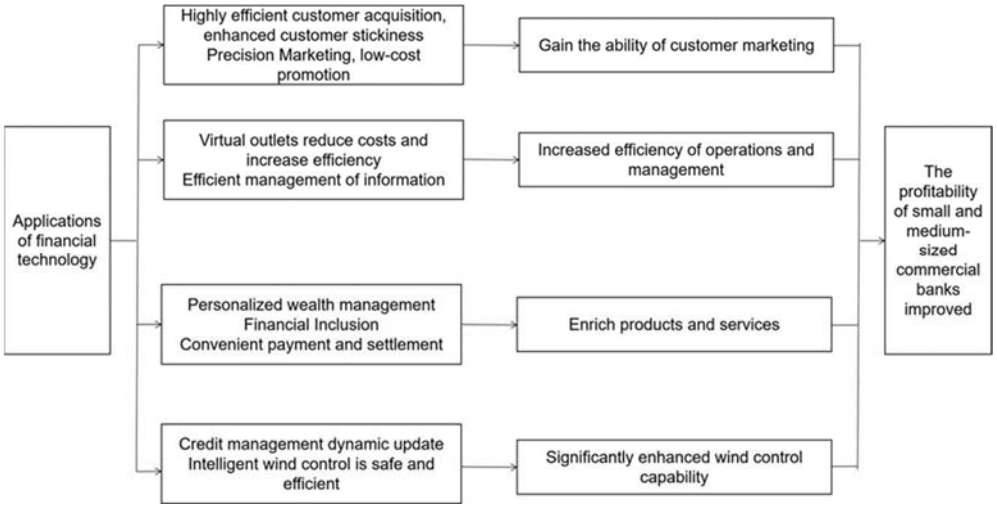

Figure 3. Impact mechanism diagram

5. Empirical Analysis

5.1. Research hypothesis

This paper holds that the long tail theory can help small and medium-sized commercial banks to tap a large potential customer base in the development of financial technology, open up the market share of the long tail, and thus increase the profitability of banks, and from the theory of financial

function, it can reduce the operating cost, improve the efficient management of information and enhance the efficiency of risk control.

Hypothesis 1: the application of financial technology has a positive impact on the profitability of small and medium-sized commercial banks.

Hypothesis 2: the application of fintech has heterogeneity to the promotion of its profitability.

5.2. Model design

In this paper, the small and medium-sized commercial banks in 2015-2020 through the collection of data panel data for regression analysis, the model is as follows:

$$ROE_{it} = \beta_0 + \beta_1 FT_t + \beta_2 CAR_{it} + \beta_3 NPL_{it} + \beta_4 CIR_{it} + \beta_5 \mathrm{LNSIZE}_{it} + u_i + v_t + \varepsilon_{it}$$

In the model, T stands for time, I stands for commercial banks in each region, Roe stands for listed banks' profits, FT stands for their use of financial technology, CAR stands for Capital adequacy ratio, NPL stands for non-performing loans, CIR represents the cost income ratio, LNSIZE represents the natural logarithm of total assets, εit represents the error term, and UI and VT represent the individual and time-fixed effects, respectively.

5.3. Data sources

Taking 2015 as the starting point of empirical analysis, the data span is 2015-2020. In order to ensure the integrity of the data and research, this article selected 43 commercial banks data, a total of 258, selected in addition to the listed 16 city commercial banks, there are also other urban commercial banks and rural commercial banks in the various regions. The bank data comes from wind database and is processed by SPSS Software.

5.4. Descriptive analysis

As shown in table 1, the Roe (%) mean and standard deviation were 13.258 and 4.222, respectively, and the minimum and maximum were 1.55 and 31.71, respectively, with significant differences among small and medium-sized commercial banks. The maximum and minimum values of the total index were 431.93 and 193.29, respectively, with a mean of 302.695 and a standard deviation of 56.943. In the control variables, the average non-performing loan ratio is 1.525, the standard deviation is 0.498, which indicates that the asset quality of small and medium-sized commercial banks is very good, and the dispersion is very small. The asset size and standard deviation were 8.135 and 1.45, respectively. The results show that the asset scale of small and medium-sized commercial banks is very different, and the difference between urban and rural areas is also very big, which will have a certain impact on the profitability of the company. The mean Capital adequacy ratio (%) was 13.551 with a standard deviation of 1.65. This suggests that different banks have different risk defences.

Table 1. Variable correlation coefficient table

Variable	Obs.	Max	Min	Mean	Std.Dev	Variance
ROE	231	31.71	1.55	13.258	4.222	17.828
ROA	231	2.58	0.12	0.896	0.277	0.077
Non-performing loan ratio	231	3.71	0.42	1.525	0.498	0.248
Capital adequacy ratio	231	18.94	7.15	13.551	1.65	2.724
Core Capital adequacy ratio	231	16.08	6.03	10.422	1.872	3.504
Size of capital (logarithm)	231	11.284	3.467	8.135	1.45	2.103
Cost-to-income ratio	231	77.96	18.93	30.497	7.099	50.395
Reserve coverage	231	541.23	114.05	249.991	83.763	7016.304
Total Index	231	431.93	193.29	302.695	56.943	3242.481
Depth	231	488.68	125.25	301.894	75.04	5630.976
Breadth	231	397	160.98	280.473	58.045	3369.21
Digit	231	462.23	295.07	377.547	42.873	1838.081

Then, the correlation between the explanatory variables and the control variables was tested. The results are shown in table 2.

Table 2. Correlation analysis of control variables

	Non-performing loan ratio	Capital adequacy ratio	Core Capital adequacy ratio	Size of capital (logarithm)	Cost-to-income ratio	Reserve coverage
Non-performing loan ratio	1.000	-0.146	-0.013	-0.077	0.117	-0.596
Capital adequacy ratio	-0.146	1.000	0.657	-0.159	-0.183	0.233
Core Capital adequacy ratio	-0.013	0.657	1.000	-0.491	0.098	0.197
Size of capital (logarithm)	-0.077	-0.159	-0.491	1.000	-0.615	-0.152
Cost-to-income ratio	0.117	-0.183	0.098	-0.615	1.000	0.050
Reserve coverage	-0.596	0.233	0.197	-0.152	0.050	1.000

This was followed by a multicollinearity analysis of the control variables, as shown in table 4.4, resulting in a tolerance of 0.492, greater than 0.4, and a VIF of 2.156, much less than 10, and therefore considered multicollinearity. You can create the following panel model.

Table 3. Multicollinearity test

Variance expansion factor test	Tolerance	VIF
Non-performing loan ratio	0.608	1.644
Capital adequacy ratio	0.486	2.056
Core Capital adequacy ratio	0.404	2.473
Size of capital	0.539	1.854
Size of capital (logarithm)	0.288	3.475
Cost-to-income ratio	0.529	1.889
Reserve coverage	0.589	1.698
Mean	0.492	2.156

5.5. Empirical test

First, the mixed effect, the fixed effect and the random effect are used to analyze the regression model. When the first two models were compared, a P value of 0.000 was found, suggesting that the original hypothesis should be rejected, with the assumption that an individual effect was present, and therefore no mixed regression was used. In the comparison of POOL and RE, the LM test results also negated the original assumption that mixed regression was not applicable for the analysis. In the Hausman test for FE and RE, P is 0.000, strongly rejecting the original hypothesis, and therefore the FE model should be used. So select time-individual bidirectional fixed effect model.

Table 4. Regression model tests

Test method	Statistics	P value	Results
F-test	11.042	0	FE modle
Breusch-Pagan-test	187.899	0	RE modle
Hausman-test	22.754	0.004	FE modle

Note: * * * , * * , * represent 1% , 5% , 10% significance levels respectively

Table 5. Diagnostic tests of the static panel data model

Variable	FE	Time-fixed effect model test	Time individual fixed effects model test
	ROE	ROE	ROE
Total Index	0.034***	0.032***	0.067**
	(4.918)	(3.399)	(2.329)
Non-performing loan	-3.075***	-3.942***	-2.375***
	(-5.129)	(-7.168)	(-3.022)
Core Capital adequacy ratio	0.1	-0.112	0.314*
	(0.596)	(-0.641)	(1.786)
Capital adequacy ratio	-0.136	-0.502***	-0.305**
	(-0.824)	(-2.515)	(-2.079)
Cost-to-income ratio	-0.239***	-0.091**	-0.278***
	(-5.466)	(-2.193)	(-3.632)
Reserve coverage	0.004	0.004	0.004
	(1.162)	(1.098)	(0.920)
Size of capital (logarithm)	-0.406	-1.294***	3.13
	(-0.288)	-4.864	(1.022)
Constant	38.776***	48.558***	-19.803
	(3.368)	(10.089)	(-0.642)
R-squared	0.751	0.765	0.789

Note: * * * , * * , * represent 1% , 5% , 10% significance levels respectively

The regression results show that the Pratt & Whitney index coefficient of the core explanatory variable is 0.067 when the

application time and the individual are bidirectionally fixed, it shows that the application of financial technology has a significant promoting effect on the profits of our listed commercial banks. The NPL coefficient of non-performing loan ratio is -2.375, which indicates that banks' non-performing assets will reduce ROE and affect their profits The LNSIZE factor of asset size is 3.13, which indicates that large commercial banks have a better ability to increase profits, because the larger the asset size of a bank, the more obvious its size effect. In the overall CAR sample, the Capital adequacy ratio coefficients were negative for both urban and commercial banks, but positive for rural and rural areas. This suggests that, because of the heterogeneity of banks across regions and regions, excessive Capital adequacy ratio can lead to a reduction in bank liquidity.

The regression analysis of sub-samples shows that the total index of the core explanatory variable remains positive, which indicates that financial technology has a significant positive effect on corporate earnings, but there are some differences among the indexes. The application of fintech in city commercial banks is not comprehensive, and the application of fintech in bank-related fields is gradually improved, and there is no perfect fintech layout, because of its small size and good understanding of its regional businesses, the bank's use of financial technology has paid off, with the use of basic technologies such as big data and cloud computing, in addition to the line of regional advantage, can better serve the local small and medium-sized enterprises, thus the profitability of a larger degree of improvement.

5.6. Test for heterogeneity

The total sample is divided into urban and rural sub-samples, urban mainly includes urban commercial banks, while rural mainly includes rural commercial banks, rural credit cooperatives and so on.

Table 6. Test for heterogeneity

Variable	Time individual fixed effects model test(urban sub-sample)	Time individual fixed effects model test(rural sub-sample)
	ROE	ROE
Total Index	0.043***	0.043***
	(5.060)	(5.060)
Non-performing loan ratio	-3.804***	-5.587***
	(-8.27)	(-4.984)
Capital adequacy ratio	-0.016	0.014
	(1.764)	(0.049)
Cost-to-income ratio	-0.087***	-0.447***
	(-3.161)	(-5.704)
Size of capital (logarithm)	0.611*	-0.398
	(1.764)	(-0.921)
Constant	28.776***	51.960***
	(6.532)	(7.411)
R-squared	0.619	0.520

Note: * * * , * * , * represent 1% , 5% , 10% significance levels respectively

6. Conclusions

The banking industry's increasingly sophisticated use of fintech, and its increased investment, has boosted corporate profits to some extent. Financial technology has greatly improved commercial banks' marketing, Operation Management, product service, compliance risk control and so on, which has a positive effect on banks' profits, there is heterogeneity.

There are some problems in this study, such as lack of data and insufficient disclosure of indicators, so whether the conclusions of this paper can be applied to commercial banks needs to be further explored. At present, the use of financial technology by major commercial banks can not be Quantitative analysis because it is not possible to obtain specific input from major commercial banks on financial technology.

Based on the research conclusion, this paper puts forward the following suggestions: (1) strengthen the cooperation with the main financial technology companies, strengthen the training of financial technology personnel, and perfect the financial technology risk control system. (2) improving the relevant legal system and strengthening the risk control of financial institutions.

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