Analysis of the Impact of Financial Technology Innovation on the Profitability of Commercial Banks

Ni Jiangwei[1, 2]

1 University of the Visayas, Philippines

2 Guangzhou Institute of Science and Technology, China

Abstract: With the rapid development of financial technology, it has brought new impetus to commercial banks and accelerated the transformation of traditional commercial banks, but it has also brought new challenges to the traditional business model of commercial banks. The favorable effect is that commercial banks can improve efficiency by optimizing traditional business models through fintech. The negative impact is that the development of fintech will crowd out the original market share. Therefore, when commercial banks face financial technology, how to deal with the impact, how to use financial technology to change the original business model, improve profitability, and achieve bank transformation is very important.

Based on relevant theoretical studies, this paper analyzes the impact mechanism of fintech on commercial banks from the two aspects of crowding-out effect and technology spillover effect. Data from 5 state-owned banks, 9 joint-stock banks and 14 urban commercial banks from 2012 to 2021 are selected, and performance indicators of commercial banks are synthesized by factor analysis, and then regression is carried out by fixed-effect model The impact of financial technology development on commercial banks is analyzed. Finally, the robustness test of the alternative variables is carried out and some suggestions are put forward to improve the performance of commercial banks.

Keywords: Financial technology; Performance of commercial banks; Impact analysis

1 Introduction

1.1 Research Background

Financial technology is a financial innovation driven by science and technology. Representative information technologies such as big data, artificial intelligence, cloud computing, blockchain, and mobile Internet are deeply integrated with finance, resulting in a series of emerging financial formats such as mobile payment, big data credit, intelligent investment advisory, financial cloud, cryptocurrency, and insurance technology.

In this context, although the nature of finance and the growth model of the economy have not changed fundamentally, science and technology, while promoting the healthy development of the traditional financial industry and improving the economic welfare of the people, is also increasingly penetrating into all the "cells" of traditional finance and changing the model of traditional financial business.

1.2 Research Significance

The significance of studying the impact of fintech innovation on the performance of commercial banks is mainly reflected in the following aspects:

First, guiding decision-making: Understanding the impact of fintech innovation on the performance of commercial banks can provide guidance for bank management on strategic and business decisions. Second, drive change: Fintech innovation brings opportunities for digitalization and automation to commercial banks. Understanding their impact can help banks better grasp new technologies and innovations, driving change both within the institution and in the industry. Third, improve efficiency: Fintech innovation can significantly improve the operational efficiency of commercial banks and reduce costs. Studying its impact on performance can help banks identify and adopt efficient technology tools and solutions to improve business efficiency and achieve better performance. Fourth, optimize risk management: financial technology innovation can improve the risk management capabilities of commercial banks, help banks better understand the role of scientific and technological innovation in risk monitoring, identification and management, improve banks' risk prevention measures, and reduce potential risks.

In short, the significance of studying the impact of fintech innovation on the performance of commercial banks is to provide guidance for banks in decision-making, change, efficiency, risk management and customer experience, so as to improve the performance and competitiveness of banks.

2 Literature Review

Some domestic experts and scholars believe that there is a relationship between the development of banking technology and the profitability of commercial banks. Liu Mengfei and Wang Qi (2021) et al., using the single-panel financial data of the top 33 commercial banks in China from 2010 to 2018, built a model to analyze the relationship between financial technology and the profitability of Chinese commercial banks. The research results show that the relationship between financial technology and the performance of Chinese commercial banks presents a significant "inverted U-shaped" relationship, which increases first and then decreases. By constructing dynamic panel modeling and multiple intermediary effect model, Yu Fengqin and Yu Qianhui (2021) et

al. show that the development of financial technology can improve the performance management level of commercial banks in the early stage, but reduce the performance of commercial banks in the later stage. Yao Ting, Song Liangrong (2020) et al. empirically investigated the heterogeneity of financial information technology on the risk level of different types of commercial banks by using GMM method. The survey results show that the rational application of financial information technology significantly reduces the overall risk of commercial banks, and the risk level of commercial banks with good return performance is significantly improved. The research of some foreign scientists shows that the rapid development of financial technology in the world can also promote the gradual improvement of the profitability of commercial banks.

In addition, the studies of Berger et al. (2003) and DeYoung et al. (2007) show that online banking, e-commerce transactions and the application of information technology have improved the service quality and profit level of commercial banks. Martin-Olivera et al. (2013) explained the "input-output" phenomenon of fintech in commercial banks from a technology-driven perspective. Hamid et al. (2020) also defined the threshold value of the role of financial technology input on commercial banks, and pointed out that commercial banks' financial technology input within the threshold range will bring about a favorable effect on the sustainable growth of commercial banks' profits. Cheng Maoyong et al. (2020) explored the relationship between profitability of commercial banks and financial service technology by using financial technology indicators formed and measured by web crawler technology and word frequency technology.

3 The empirical analysis

3.1 Sample selection

Considering the rise of financial technology and the listing time of commercial banks, this paper selected a total of 10 years of data from 2011 to 2021 for analysis, and selected 5 state-owned banks and 9 joint-stock commercial banks, a total of 14 commercial banks, as the model research object.

Most of these banks were listed before 2011 and have full, representative disclosures. Our data mainly comes from Guotai 'an Database, a database company in China. In addition, we comb through the annual reports of commercial banks and supplement the insufficient parts. Macroeconomic data is mainly obtained through the portal of the Chinese Bureau of Statistics, and the original data of financial technology is mainly from the Baidu search engine.

3.2 Variable selection

Explained variable: Return on Total Assets (ROA)

Explanatory variable: Fintech index

This paper uses the Peking University Digital HP Finance Index (2011-2020), compiled by the project team of the Digital Finance Research Center of Peking University, to measure the international leading level of China's fintech.

Control variables: This paper selects several indicators that mainly reflect the risk and profitability of commercial banks:In summary, Table 3-1 lists the meanings of the variables included in this paper:

Table 3-1: Descriptive list of relevant variables

Variable type	Variable name	Variable symbol	Description
Explained variable	Return on total assets	ROA	
Explanatory variable	Fintech index	FINTECH	Numbers HP Financial Index weighted composite take logarithm
Control variable	Macroeconomic level	gdp	GDP growth rate
	Monetary policy	M2	M2 growth rate
	Inflation	CPI	CPI index
	Unemployment rate	UR	Unemployment rate
	Cost-income ratio	CR	
	Percentage of non-interest income	NIRR	
	Asset structure	LA	
	Liquidity level	DPR	

3.3 Model design

Based on the data analysis of domestic scholars and the hypotheses provided in this paper, in order to intuitively study the impact of fintech innovation on the profitability of Chinese commercial banks, the construction model is as follows:

$$ROAit = \beta0 + \beta1FINTECHit + \beta2gdpit + \beta3M2it + \beta4CPIit + \beta5URit + \beta6CRit + \beta7NIRRit + \beta8LAit + \beta9DPRit + \varepsilon it$$

(t represents the year, i represents the bank, and εit is the random disturbance term)

3.4 The empirical analysis

（1）Descriptive statistics of variables

Table 3-2: Descriptive statistical results of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	510	0.9149	0.2377	0.1160	1.7044
FINTECH	510	5.3597	0.5890	2.9161	6.0683
gdp	510	9.7945	3.8162	2.5353	17.4467
M2	510	11.6939	2.7800	8.1716	17.3230

CPI	510	102.5120	1.0628	101.4000	105.4000
UR	510	3.9910	0.1683	3.6000	4.2000
CR	510	31.3227	6.3595	17.1181	66.1913
NIRR	510	18.6588	11.6313	-14.6245	73.8604
LA	510	46.0077	9.2494	17.9734	80.2845
DPR	510	68.9583	16.1440	25.9283	237.3236

As shown in Table 3-2, the average return on equity is 0.91%, the maximum is 1.7%, and the return rate of 14 commercial banks in recent 10 years is positive. In recent years, due to the rapid development of financial technology in China, the weighted financial technology index is taken logarithm, which can be seen that the development speed of financial technology in China is extremely fast, and the use of a wide range.

(2) Correlation analysis

Since there are many variables involved in the empirical part of this paper, in order to avoid multilinearity, it is necessary to conduct relevant research on variables before regression. The correlation analysis results are shown in Table 3-3

Table 3-3: Correlation analysis of variables

FINTECH	gdp	M2	CPI	UR	CR	NIRR	LA	DPR	
FINTECH	1.000								
gdp	-0.697***	1.000							
M2	-0.864***	0.518***	1.000						
CPI	-0.717***	0.607***	0.631***	1.000					
UR	-0.414***	-0.062*	0.578***	0.116***	1.000				
CR	-0.179***	0.198***	0.174***	0.089**	0.096**	1.000			
NIRR	0.262***	-0.138***	-0.249***	-0.092**	-0.228***	-0. 275***	1.000		
LA	0.129***	-0.099**	-0.075*	0.143***	-0.070*	-0. 176***	0.115***	1.000	
DPR	0.328***	-0.232***	-0.259***	-0.014	-0.152***	-0. 375***	0.378***	0.626***	1.000

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

It can be seen from the results in the table that most of the correlations among variables are obvious at the level of 1%, while the correlations among individual variables are obvious at the level of 5% and 10%.

(3) VIF test

In order to further verify that there is no multicollinearity problem, we conducted VIF test, and the results are shown in Table 3-4:

Table 3-4: VIF test results

Variable	VIF	1/VIF
FINTECH	7.35	0.1360
M2	5.39	0.1855
gdp	2.81	0.3562
CPI	2.75	0.3630
UR	2.29	0.4364
DPR	2.29	0.4372
LA	1.77	0.5643
NIRR	1.28	0.7840
CR	1.23	0.8138
Mean VIF	3.02	

According to the VIF value detection results, the VIF value of each variable is 10, while the Mean VIF value is 3.06. This means that there is no strict multicollinearity between the factors, so regression calculations can be performed next.

(4) Regression analysis

In this paper, the fixed effect model was used for regression analysis, and the results of regression analysis were shown in Table 3-5:

Table 3-5: Empirical analysis result

ROA	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]		
FINTECH	-0.2528	0.0349	-7.23	0.000		-0.3214	-0.1841
gdp	0.0093	0.0030	3.05	0.002		0.0033	0.0152
M2	0.0200	0.0057	3.51	0.001		0.0088	0.0312
CPI	-0.0927	0.0100	-9.23	0.000		-0.1124	-0.0730
UR	-0.1092	0.0547	-2.00	0.047		-0.2168	-0.0017
CR	-0.0120	0.0021	-5.81	0.000		-0.0160	-0.0079
NIRR	-0.0016	0.0007	-2.16	0.031		-0.0031	-0.0001
LA	0.0067	0.0014	4.71	0.000		0.0039	0.0095

ROA	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
DPR	-0.0005	0.0007	-0.66	0.512	-0.0019	0.0010
cons	12.01431.1729		10.24	0.000	9.7092	14.319
sigma_u	0.1230					
sigma_e	0.1341					
rho	0.4569 (fraction of variance due to u_i)					
F test that all u_i=0: F(50, 450) = 8.09				Prob > F = 0.0000		

It can be seen from the regression research conclusion that when the coefficients in the control variables CPI, UR, CR, NIRR and DPR are all negative, the profit level of commercial banks will have a certain inhibitory effect. From the macroeconomic point of view, both the inflation level and the unemployment rate have a certain inhibitory effect on the profit level of commercial banks. The coefficient of FINTECH is -0.25, indicating that the rapid development of fintech has a certain inhibitory effect on the profitability of listed commercial banks in China.

4 Conclusion and enlightenment

First, commercial banks should strengthen the research and development and application of artificial intelligence technology to further improve the quality and effect of network financial services; Second, it is necessary to take the demand of the financial market as the guidance, rely on the huge customer base, according to the different needs of customers, increase the innovation of financial service products, in order to achieve the goal of "customer-centric". Third, the training of financial services scientists and technicians should be increased. Widely open channels, select personnel, and take the initiative to attract outstanding domestic financial services scientific and technical personnel. Increase investment in scientific and technological innovation and personnel training; Fourth, partnerships should be formed with financial institutions, science and technology service companies to enhance their competitiveness. Through collaboration with financial services technology services companies to enhance their technical capabilities to meet customer needs.

References

[1] Yu Bo, Zhou Ning, Huo Yongqiang. The impact of financial technology on the profitability of commercial banks: An empirical test based on the dynamic panel GMM model [J]. Southern Finance,2020(03):30-39.
[2] Liu Mengfei, Jiang Wei. Does Fintech help or hinder the efficiency of commercial banks? -- An empirical study based on China's banking industry [J]. Contemporary Economic Science, 2019,42(03):56-68.
[3] Yu Fengqin, Yu Qianhui. Analysis on the mechanism of financial technology affecting the profitability of commercial banks [J]. Finance and Economics,2021(02):45-52+62.
[4] Wang Junshan. Research on the impact of financial technology on the profitability of retail business of commercial banks [J]. Hubei Social Sciences,2020(10):81-88. (in Chinese).
[5] Can fintech help improve the efficiency of investment in the real economy? [J]. Liu Yuan, ZHENG Chenyang, Jiang Ping, LIU Chao. Journal of Capital University of Economics and Business. 2018(06).
[6] The impact of capital Market and Internet Finance on bank performance: from the perspective of heterogeneity [J]. Deng Yuanyuan. Finance and Accounting Monthly. 2018(02).