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The influence of fintech on the profitability of commercial banks

Liangye
University of International Business and Economics, Beijing, China

* Corresponding Author: **Liangye**

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Abstract
The Fintech are characterized by rapid update and iteration, crossover, and mixed industry. It is the superposition and integration of big data, artificial intelligence, blockchain technology and other cutting-edge disruptive technologies with traditional financial businesses and scenarios. It mainly includes four core parts: big data finance, artificial intelligence finance, blockchain finance and quantitative finance.In recent years, the rapid development of financial technology has brought advanced technology to commercial banks, accelerated the pace of reform of commercial banks, and also brought a severe test to the traditional business model of commercial banks. On the positive side, commercial banks have received new technical support. The application of financial technology has greatly optimized the traditional business model of commercial banks, simplified the business process of banks, and promoted the development of banks in the direction of digitalization. On the negative side, fintech and the traditional business of banks produce interactive competition and running in, and the uncertainty of the original market share of banks is strengthened. Therefore, facing the "double-edged sword" of financial science and technology, how commercial banks should respond, and how to expand customer channels, improve profitability, and achieve transformation and upgrading with the help of the dividends of financial science and technology development become the top priority. Based on the relevant theoretical research, this paper combs the specific impact mechanism from both positive and negative aspects, and then uses the data of 22 commercial banks from 2011 to 2020 to analyze the mechanism of financial technology affecting the profitability of commercial banks through systematic GMM.

Keywords: Financial technology, commercial banks, Profit, GMM Method

1. Introduction

The research background of fintech on the profitability of commercial banks

In recent years, with the iterative update of Internet technology, advanced technologies such as artificial intelligence, big data and blockchain have gradually matured and applied. Coupled with the development needs of the financial industry itself, the pace of the combination of Finance and technology has been accelerating [1]. As a product of the integration of Finance and technology, financial technology has become an important part of the future development planning of various countries. The rapid development of financial technology is bringing advanced technology to commercial banks, accelerating the pace of reform of commercial banks, and also bringing a severe test to the traditional business model of commercial banks. On the positive side, commercial banks have received new technical support [2]. The application of financial technology has greatly optimized the traditional business model of commercial banks, simplified banking business processes, and promoted the development of banks in the direction of digitalization. In the process of absorbing and applying new technologies, the original business model of commercial banks has been improved, and diversified financial products and service models have been innovated to meet the requirements of different customers [3]. On the negative side, fintech and the traditional business of banks have interactive competition and running in, and the uncertainty of the original market share of banks has strengthened.

Therefore, facing the "double-edged sword" of financial technology, how should China's commercial banks deal with it, and how to use the dividends of the development of financial technology to broaden customer channels, improve profitability, and achieve transformation and upgrading become the top priority.

2. The current situation of the impact of fin-tech on Commercial Banks

2.1 Establish a financial technology subsidiary of the bank

With the extensive use of financial technology, commercial banks began to realize the shortcomings. In order to better solve the problems of high internal operating costs, low efficiency, cumbersome business processes and so on Banks adjusted their organizational structure and established financial technology subsidiaries. By establishing fintech subsidiaries, commercial banks can transform external competition and shocks into internal ones, which can alleviate the pressure brought by the rapid development of banks in the era of science and technology to a certain extent. Due to the strong capital strength of the parent company, fintech subsidiaries can obtain a strong R & D team and advanced scientific research technology. Generally, they develop along the business path from inside to outside, that is, at the initial stage of establishment, they mainly provide the required services for the group and subsidiaries. With the gradual improvement of technology, fintech subsidiaries continue to grow and provide technical support, management consulting and intelligent services to other financial institutions [4]. On the one hand, the establishment of fintech subsidiaries can provide solid technical support for the transformation and upgrading of commercial banks and improve their utilization of cutting-edge fintech; On the other hand, promote banks to expand their business scope in the field of financial technology, improve market share, and achieve new profit growth points. In 2015, industrial bank took the lead in establishing a fintech subsidiary, followed by five banks including Everbright and China construction [5]. In the future, it is an inevitable trend for banks to establish fintech subsidiaries.

2.2 Upgrade traditional customer service

With the development of big data, cloud computing and artificial intelligence technology, the traditional customer service model of commercial banks is also upgrading. With the help of intelligent technology, the banking industry has made rich innovations in customer service, and invested intelligent robots, intelligent speech systems, intelligent speech recognition and other interactive technologies into various fields with manual services [6]. The bank upgrades the physical channel, provides all-weather and multi-style customer service, and realizes the development of intelligent services, which can not only meet the personalized financial needs of customers, provide customers with new experiences, and tap the potential needs of young customers, but also reduce human costs, improve the handling efficiency of traditional services, so as to enhance the profitability of the bank. According to the report released by the banking association, the utilization rate of intelligent technology in banking customer service centers reached 71% in 2020, 2% higher than that in 2019. Commercial banks accelerated the construction of intelligent customer service channels [7]. Industrial Bank was the first to apply intelligent AI robots to business processing, and some banks followed suit, introducing intelligent emerging Machinery and equipment.

2. An empirical study on the impact of fintech on the profitability of commercial banks

2.1research hypothesis

There are two opposite influence mechanisms of fintech on the profitability of commercial banks. At the current stage of the development of fintech, this paper believes that the technology spillover effect is less than the competitive effect, and fintech has a negative impact on the profitability of commercial banks.

2.2 Variable selection

2.2.1 Explained variable

This paper chooses the return on total assets as a representative indicator of the profitability of commercial banks. The return on total assets (ROA) represents the profits brought by the bank's investment in all assets. The larger the ROA, the higher the profit margin of the bank; Return on net assets (ROE) refers to the value created by banks using their own capital. The higher the roe, the higher the efficiency of commercial capital utilization.

2.2.2. Explanatory variables

This paper uses the digital inclusive finance index compiled by the digital finance center of Peking University to measure the development level of financial technology., This paper uses the provincial fintech index and takes the proportion of operating income of each region in the bank's annual report as the weight, and multiplies the two to obtain the fintech development level of the bank's environment. The specific calculation is as follows:

2.3 Control variable

2.3.1 Internal factors of the bank

Total asset size: the asset size of commercial banks is an important factor affecting their profitability. Generally, banks with larger assets have stronger operating capacity, more diversified products and services, higher market share, easier scale effect and stronger profitability. Therefore, total bank assets are selected as an indicator to measure their profitability. Cost income ratio (CR): It is the ratio of bank operating and management expenses to operating income, and it is the main indicator of bank operating efficiency. The cost income ratio reflects how much the bank needs to pay for each unit of income. The smaller the indicator, the higher the return on investment and output and the stronger the profitability of the bank. Proportion of non-interest income (nirr): Non-interest income is the income obtained by banks from intermediary business. For a long time, the interest margin income obtained through deposit and loan business has been the main source of bank profits, but the risk of bad debt of interest income is high, and it is vulnerable to the impact of policy control measures and interest rate marketization. It is no longer stable. Most commercial banks gradually focus on non-interest income sources, which is more stable, safe and high profit margin than interest income, Banks have paid more and more attention to the development of intermediary business. The more non-interest income, the higher the profitability of the bank. Asset structure (LA): whether the asset structure of a bank is reasonable or not will directly affect its profitability. At this stage, loan income is an important source of bank operating profit. The larger the

loan scale of a bank, the higher the interest income and the better the profitability. This paper uses loan asset ratio to measure the asset structure of banks. Liquidity level (DPR): liquidity refers to the ability of commercial banks to meet the daily capital needs of customers and repay debts when due. Facing the negative external environment, the resistance of banks is stronger. Preventing banks from liquidity crisis can enhance the profitability of banks to a certain extent. However, cash, short-term notes and other liquid assets have an obvious feature: the yield is low.

If the bank maintains high liquidity, the expected income it can obtain will be reduced, which is not conducive to the improvement of the bank's operating profit. Therefore, the relationship between bank liquidity and profitability needs to be made a specific empirical analysis. This paper uses the deposit loan ratio to reflect the liquidity level of banks.

2.3.2 External environmental factors

The larger the GDP growth rate, the faster the economic development of our country. The future planning and development direction of commercial banks are closely related to economic development, and then affect the profit performance of commercial banks. This paper uses the growth rate of GDP to reflect the external macro environment. As a means of macroeconomic regulation and control, monetary policy will have an important impact on the operating conditions of commercial banks and further affect the profitability of banks. This paper selects M2 growth rate as the proxy variable of monetary policy. CPI reflects the degree of inflation or deflation in a country. Because the profit model of commercial banks is mainly based on the deposit loan spread, it is very vulnerable to inflationary pressure. This paper chooses the inflation level to reflect the changes of China's macro-economy.

$$FL_{it} = \sum P_{t,ij} * FL_{it,j}$$

Among them, flit represents the financial technology development index of commercial bank I in year t, Pt, ij represents the proportion of business income of commercial bank I in province J in year t, FLT, J represents the financial technology development index of province J in year t.

Table 1

Variable type	Variable name	Variable symbol
Explained variable	Return on total assets	ROA
Explanatory variables	Fintech index	FI
	Loan asset ratio	LA
	Liquidity level	DPR
	Cost income ratio	CR
	Proportion of non-interest income	NIRR
	Asset size	SIZE
control variable	Macroeconomic level	GDP
	Growth rate of broad money supply	M2
	Inflation level	CPI

3. Model design

Based on the existing literature, the following model is designed

$$ROA_{it} = \beta_0 + \beta_1 ROA_{i,t-1} + \beta_2 FI_{it} + \beta_3 CR_{it} + \beta_4 DPR_{it} + \beta_5 SIZE_{it} + \beta_6 NIRR_{it} + \beta_7 LA_{it} + \beta_8 GGDP_{it} + \beta_9 CPI_{it} + \beta_{10} M2_{it} + \varepsilon_{it}$$

3.1 Sample selection and data source

This paper selects 22 listed banks as the research sample, mainly because the data of listed banks during the sample study is more comprehensive and persuasive. Including 5 large state-owned banks, 9 joint-stock banks and 8 urban commercial banks. The research time is from 2011, mainly because in the post financial crisis era, fintech plays a more significant role in the profitability of commercial banks, so this paper chooses 2011-2020 to study. The provincial fintech index and its sub level index are available on the official website of the digital finance research center of Peking University. The internal data at the bank level comes from the annual report, choice data and reset database of major banks' official websites, and the data of external environmental factors comes from the statistical yearbook and the database of China economic network.

3.2 Descriptive statistics of variables

The minimum return on total assets is 0.51% and the maximum is 1.66%, indicating that the selected bank samples have achieved profits from 2011 to 2020, and there are great differences in the profitability of different banks. In recent years, the development of fintech has shown an exponential growth trend, so the fintech index is logarithmicized in combination with existing studies. After treatment, the minimum value is 3.35, the maximum value is 6.05, which shows that although fintech started late in China, from the embryonic stage to explosive growth, its development process is faster and faster, and its application fields are more and more extensive.

As for the variables of internal factors of banks, there is a large difference between the maximum and minimum values of commercial banks in terms of bank size, which is mainly reflected in the gap between large commercial banks and urban commercial banks. In terms of bank liquidity, since 2017, the deposit loan ratio of individual banks has exceeded 100%, and banks have taken on high risks, which may have an adverse impact on their profitability. There is a large difference between the maximum value, minimum value and standard deviation of the cost income ratio, the proportion of non-interest income, and the loan asset ratio, indicating that there are obvious differences in the operation and management, profit structure, business decision-making and other aspects of China's commercial banks, which may be related to the differences in the business scale and management strategies of major commercial banks; In terms of macro-economy, the price index remained relatively stable; The nominal GDP growth rate reached a maximum of 19.38% in 2011 and a minimum of 2.53% in 2020, probably because of 2020.

In the first half of, the epidemic was serious, and the growth rate of GDP decreased significantly; The M2 growth rate was positive from 2011 to 2020, with a standard deviation of 3.19%, indicating that China's money supply showed an overall upward trend in these 10 years.

Table 2

variable	minimum value	Maximum value	average value	standard deviation
ROA	0.51	1 .66	1 .0456	0.2188
FI	3.3464	6.0552	5.3447	0.5772
CR	18.93	41 .89	29.5352	4.1635
NIRR	3.4504	51.0873	23.052	9.5568
SIZE	11.1911	17.3224	14.81 98	1.3607
DPR	41.751	115.9852	73.5158	14.2626
LA	292,568	62.0325	47.6563	8.2257
GGDP	2.5352	18.3978	9.508	3.8155
CPI	101.4	105.47	102.80 73	1 .3874
M2	6.99	17.32	11 .686	3.1904

4. An empirical analysis of the impact of fintech on the profitability of commercial banks

4.1 Model setting

In the empirical method, this paper first analyzes the formula (5.2) without the lag of the return on total assets by one order according to the static panel model. The regression results are shown in the table: This paper preliminarily selects the fixed effect model.

Table 3

Inspection content	Inspection method	Statistics (P value)	Conclusion
Test the significance of individual influence	F inspection	18.73*** (0.000)	Fixed effect model is better than mixed regression
Test time effect	LM inspection	268.82*** (0.000)	Random effect model is better than mixed regression
Choose fixed effect model or random effect model	Hausman test	21.99*** (0.000)	Select fixed effect model

4.2 Empirical analysis

This paper uses the return on total assets to measure the profitability of banks. Because the profitability of banks may have viscous characteristics, we continue to introduce the lag term of the proxy variable of profitability as the explanatory variable. In addition, because the variables such as asset size, cost income ratio and non interest income of commercial banks in the model may have a causal relationship with profitability, resulting in endogenous problems, this paper uses systematic GMM for regression analysis combined with the dynamic and sustainable characteristics of bank profitability.

Table 4

Variable	Mixed regression model	Fixed effect model	Random effect model	Generalized moment estimation of systems
LROA				0.8886***(8.18)
FI	-02867(-4.67)	-0.1648**(-3.29)	-0.2614*(-5.84)	-0.0805***(-2.69)
CR	-0.0107***(-3.73)	-0.0071**(-3.01)	-0.0076**(-2.53)	0.0130***(3.64)
NIRR	0.0007(0.40)	0.0020(1.46)	0.0006(0.47)	0.0020(1.60)
SIZE	0.0127(1.03)	-0.2086***(-4.60)	-0.0493**(-2.45)	-00585**(-3.09)
DPR	-0.0054***(-4.90)	-0.0055***(-4.82)	-0.0055**(-483)	-0.0046***(-3.05)
LA	0.0064***(2.89)	0.0118***(563)	0.0142***(7.32)	0.0166***(3.93)
GGDP	-0.0130**(-2.36)	-0.0135***(-3.61)	-0.0145***(-3.79)	-0.0029*(-0.31)
CPI	-0.0400***(-4.48)	-0.0351***(-4.57)	-0.0509***(-8.02)	0.0226(0.67))
M2	0.0092(1.26)	0.0043(085)	0.0087*(1.70)	-00088**(-1.53)
Cons	6.8803***(6.08)	8.6879***(11.47)	8.3557***(10.69)	0.8538(0.43)
R2	0.5435	0.7662	0.7506	

Note: *p<0.1, **p<0.05, ***p<0.01; The values of T statistics are in brackets; The descriptions in all empirical results tables in this chapter are the same.

The regression coefficient of ROA is positive, indicating that the return on total assets of the previous period has a positive impact on the ROA of the current period, which is significant at the level of 1%, which has an obvious cumulative cyclical effect on the profitability of banks. The possible reasons are that, on the one hand, the better operating performance in previous years helps banks to enhance confidence and invest more money in service innovation; On the other hand, it makes the management full of hope for the current operating situation and will set higher profit targets, thus promoting the improvement of the current profit situation.

The regression coefficient of fintech index is -0.08, which is significant at the level of 1%, indicating that the development of fintech will have a negative effect on the profitability of commercial banks. It verifies the hypothesis that on the one hand, the popularity of fintech will also have a negative impact on the profitability of commercial banks. Professional fintech companies rely on emerging technologies to promote financial innovation business models such as third-party payment and online lending and financing, This overlaps with the three traditional businesses of banks, shaking the core position of commercial banks in the financial market. The products and channels that once had an absolute advantage are no longer accepted by the market, and the impact is extremely significant; However, on the other hand, fintech also forces banks to accelerate the pace of innovation, which has a positive technology spillover effect on the profitability of commercial banks. With the help of cutting-edge technologies such as big data and the Internet of things, commercial banks innovate and improve traditional services and products, improve the utilization of internal resources, and open up new ways to obtain customers, which can

promote the improvement of bank profitability.

At this stage, the substitution effect of fintech on the profitability of commercial banks is dominant, and the negative impact is greater than the positive impact. From the perspective of the control variables at the internal level of the bank, the regression coefficient of the total asset size is -0.0585, which is negative at the significance level of 10%, indicating that the expansion of the asset size of commercial banks has an adverse impact on the improvement of their profitability. This is mainly because when the scale of the bank expands to a certain extent, it needs to spend more time and money in decision communication, personnel planning and action measures; On the other hand, the larger the volume, the more conservative the business strategy of commercial banks is. Therefore, in the context of the Internet, facing the impact of financial technology, they are more willing to choose passive defense rather than active change, gradually losing their advantages in the fierce market competition, and the profit margin gradually declines.

The coefficient of the proportion of non-interest income is 0.0020, indicating that non-interest income is positively related to the profitability of commercial banks. Generally speaking, the higher the proportion of non-interest income, the stronger the innovation ability of banks. Such commercial banks can more sensitively capture the small changes in consumer demand, be good at using science and technology as an auxiliary tool, and be able to carry out the development of new products, practice and promotion of new services at a faster speed. However, this coefficient is not statistically significant, which may be because the non interest income of most commercial banks in China is still in the expansion period and has not formed a scale effect, so the improvement of the profitability of commercial banks is not significant.

The estimated coefficient of loan asset ratio is 0.0166, which is significantly positive at the level of 1%, indicating that the higher the proportion of loans in the total assets of banks, the stronger the profitability of banks. Within the scope specified by the CBRC, we should provide loans to enterprises and individuals as much as possible to improve the profit margin of the banking industry. The coefficient of liquidity level is -0.0046, which is significantly positive at the level of 1%. Since the deposit loan ratio is a reverse indicator of liquidity, a negative regression coefficient means that a higher liquidity level promotes the improvement of bank profit margin. Under the condition of maintaining a high liquidity level, China's commercial banks can buffer and protect the safety of banks when they are eroded by risks. The smaller the possibility of credit risk, the stronger the ability of commercial banks to obtain profits. The regression coefficient of the cost income ratio is 0.0130, which is significantly positive at the level of 1%, indicating that the cost income ratio is positively related to the profitability of banks, which seems to be out of common sense. However, Tang Xiaoxu believes that in the period of economic growth slowing down, under the background of the further narrowing of the deposit loan interest margin of the banking industry, a series of policies issued by the government will instead intensify the competition in the financial industry, making the comprehensive environment more complex. In this case, the cost income ratio, as a relative indicator, is not the lower the better. In the new financial context, if banks want to improve their profitability, they must change the current situation of relying on deposit and loan business to obtain profits, speed up the development of intermediary business, change the income structure, and improve business efficiency. Therefore, this paper believes that the analysis of cost income ratio should be targeted in combination with the current external environment. In the era of digital development, it is no longer applicable for commercial banks to improve operating efficiency by expanding the scale of loans. If commercial banks want to improve operating profits, they need to focus on intermediate business income, innovation ability, possible potential risks and other factors. Therefore, the lower the cost income ratio indicates that banks do not invest much in product innovation and R & D, which is not conducive to improving the profitability of banks. Commercial banks should actively improve the credit structure and speed up the development of digitalization. From the macro level variables, the regression coefficient of inflation rate is 0.0226, indicating that higher inflation rate promotes the profitability of banks. When the inflation rate is high, the economy is overheated, and there will be a phenomenon that supply exceeds demand in the market. In this case, businesses will raise prices, and for consumers, the demand for funds is stronger, so they choose to borrow from banks one after another; On the other hand, for manufacturers, rising prices and constant costs will expand the production scale in the pursuit of profits, which will encourage manufacturers to borrow from banks, improve the volume of bank loan business, increase interest income, and improve the operating performance of banks. However, the regression coefficient is not significant, indicating that the profitability of each sample bank is not sensitive to inflation changes. It may be that each bank has expected inflation changes and has adopted relevant countermeasures. The estimated coefficient of GDP growth rate is -0.0029, which is significantly negative at the level of 10%, which means that the increase of China's GDP growth rate will lead to the decline of bank operating profit, which is contrary to the previous assumption. However, from the actual situation of our country, China has experienced a period of sustained and rapid development of GDP growth rate, with the continuous expansion of GDP scale and the continuous rise of GDP, which may lead to the decline of GDP growth rate, However, the domestic production scale is still increasing, the financial market is still prosperous, and the financial demand of consumers is still strong, so the profitability of commercial banks is still improving. The regression coefficient of M2 growth rate is -0.0088, which is significantly negative at the level of 5%, indicating that loose monetary policy has an adverse impact on the profitability of banks. When the country implements loose monetary policy, driven by the desire to obtain high profits, banks will tend to radical business strategies, which will put their asset quality at risk and reduce the profitability of banks.

4.3 Stability test

In order to ensure the reliability of the research results, we need to test the robustness of the model. This paper chooses to change or replace some variables to verify whether the empirical results are still significant. We choose the subdivision dimension coverage breadth (width) and depth of use (depth) of fintech development index as the alternative indicators of the core explanatory variables ft, and re regression the model I. Table 4-11 shows the regression results under sub dimensions. The coefficients of fintech indexes are all negative, passing the significance test at the 1% level, and the positive and negative of the control variable

coefficients have not changed significantly, indicating that the empirical results of this paper are reliable.

Table 5

Variable	Total sample	Total sample
LROA	0.8872*** (8.73)	0.8713***(8.50)
WIDTH	-0.1620**(-2.37)	
DEPTH		-0.0889*** (-2.77)
CR	0 01008***(3.08)	0.0126*** (3.49)
SIZE	-0.0434***(-3.20)	-0 0521***(-2.70)
NIRR	0.0074(1.64)	0.0020(1.64)
DPR	-0.0043*** (-3.50)	-0.0044*** (-2.89)
LA	0.0126*** (3.68)	0.0159*** (3.70)
GGDP	-000707 (-0.36)	-0.0045 (-0.47)
CPI	00155 (0.91)	0.0133 (0.68)
M2	-0.0079* (-1.80)	-0.0065* (-1.26)
Cons	-0.6876 (-0.42)	-0.8104 (-0.38)
AR(2)	0.061	0.117
Sargan test	0.138	0.317

5. Research Conclusion

Based on the previous analysis, this chapter selects the data of 22 commercial banks in China from 2011 to 2020, takes ROA as the explanatory variable, and takes the weighted digital financial index as the proxy variable of fintech development, and selects 8 control variables from the perspectives of internal factors and macro environment of banks to establish a regression model. It is found that the technological empowerment brought by fintech to commercial banks is less than the competitive effect, which shows that the new financial formats derived from the development of fintech have a strong impact on banking business [8]. Although some commercial banks are actively using fintech to explore the way of business transformation and upgrading, it is not worth it, This also reflects that at present, the financial technology applied by commercial banks in their business operations is not perfect, and the cooperation with financial technology companies is still in the trial stage, which is not deep enough. At the same time, the development of financial technology has reduced the share of the banking industry in the financial market, and the competition among banks is more intense, which has also weakened the profit margin of banks to a certain extent.

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