



Research on the Impact of Fintech on the Performance of Commercial Banks Based on Text Mining and Panel Metering

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Abstract. The development of Fintech is both an opportunity and a challenge for traditional commercial banks. It systematically analyzes the theoretical basis of the impact of Fintech on the performance of commercial banks. Based on the sample data of 37 listed commercial banks from 2011 to 2020, it uses the text mining method to build the Fintech index and the multiple regression model for panel metering analysis. The results demonstrate that Fintech effects on the performance of commercial banks. Finally, combined with the actual development of Fintech in commercial banks, effective policy recommendations are given.

Keywords: Fintech · Performance of commercial banks · Text mining · Panel metering

1 Introduction

In the 1990s, Citibank launched the “Financial Services Technology Alliance” project, and Fintech came. Currently, governments of all countries pay more attention to financial technology. Banks are actively integrating Fintech to seek transformation, innovation and development [1]. The Chinese government has also begun to strengthen its support in this field, promoting the development of financial science and technology through a series of policies. In August 2019, the Financial Technology Development Plan came into being, marking that financial technology innovation has officially risen to the government’s strategic level. The development of Fintech is in good momentum, and the financial market pattern has changed. Commercial banks also take this opportunity to promote the internal reform [2].

There is no unified definition of FinTech in academia. Bai et al. [3] believed that the development of FinTech was to break the current situation of inefficient and expensive traditional services. Schueffel [4] argued that the modern financial market combined with modern information technology to generate the field of FinTech. Gomber et al. [5] believed that FinTech is a cutting-edge technology, which transforms the financial market through network technology. Liu and Huang [6] hold the view that FinTech includes Internet finance, mobile payment, big data technology and artificial intelligence. Vučinić

et al. [7] regarded FinTech as a new technology, which is usually carried by financial products, financial services and financial models. In summary, after the rapid development of information technology, FinTech has promoted social and economic development, transformation, and upgrading, especially in the traditional financial industry. Thanks to the development of FinTech, the business model of the financial industry and relevant sectors have undergone tremendous technological changes. Therefore, financial market demanders can obtain the efficient services.

The negative impact of FinTech on commercial banks is incarnated in the asset-liability business. Musau et al. [8] discovered that the negative impact of Fintech on commercial banks is caused by the competitive effect. Phan et al. [9] found that FinTech will bring more risks to banks and reduce their capital operation ability and profitability. Wang et al. [10] discovered a significant negative correlation between FinTech and the total market value of China's commercial banks. At the same time, some scholars believe that FinTech is a driving force for economic growth. Dong [11] argued that traditional commercial banks must rely on the existing level of FinTech to build a financial service platform, by which banks can reduce the operating costs of financial services. Shou [12] believed that FinTech can not only serve the traditional financial industry, but also add impetus to the development of China's real economy. Zuo et al. [13] regarded that FinTech has improved the financial service level of commercial banks and promoted the transformation and development of commercial banks.

Through sorting out the existing literature, we can see that there are still many differences in the relationship between FinTech and traditional banks. One of the most remarkable differences is: what role does Fintech play in traditional banking? While FinTech improves the operation ability of commercial banks and reduces business costs. It also generates more potential financial risks due to its characteristics. To sum up, it can be divided into advantages and disadvantages to discuss the impact of FinTech on commercial banks. On the one hand, the disadvantage of FinTech is that the operation mode of FinTech is quite different from traditional commercial banks. Therefore, the performance of related businesses is significantly negatively affected. On the other hand, it is precise because FinTech promotes its business transformation and upgrading, which improves operational efficiency while reducing business costs, and ultimately achieves well sustainable development. Therefore, this paper explores the impact of Fintech on the performance of commercial banks. In addition, it puts forward constructive policy recommendations for commercial banks to develop Fintech based on the empirical analysis results. The remainder of this paper is organized as follows. Section 2 describes the empirical research design. In Sect. 3, we discuss the main empirical results. Section 4 provides the research conclusions and policy recommendations.

2 Empirical Research Design

2.1 Research Hypothesis

The impact of the development of Fintech on commercial banks is complex. Changing the profit sources and channels of commercial banks, it adds an unstable factor to the bank's performance. With the maturity of Internet technology, information technologies are widely used in the banking industry and will become a trend in the future development

of the finance. At the same time, the application of Fintech in the commercial banks will generate some costs in the short term. But in the long term, the costs will be apportioned in the development process of business. Commercial banks can improve their competitiveness and profitability through the application of Fintech. Based on this, this paper proposes the research hypothesis: Fintech effects on the performance of commercial banks.

2.2 Sample Selection and Data Sources

This paper selects 37 commercial banks among China's A-share listed companies from 2011 to 2020, including 6 large state-owned commercial banks, 11 joint-stock banks, 20 urban commercial banks and rural commercial banks. The financial index data of the bank comes from the Guotai'an database and the bank's annual report. In addition, the macro data comes from the Wind database. This paper uses the text mining method to build the financial technology index, and takes it as the explanatory variable of the regression model.

2.3 Model Design

The specific model construction is as the following Eq. (1): take the return on equity (*ROE*) as the explanatory variable, and the financial technology index (*FinTech*) as the explanatory variable. The control variables include the logarithm of bank asset size (*Asset*), the capital adequacy ratio (*CAR*), the non-performing loan ratio (*NPL*), the cost-income ratio (*CIR*), the asset profit ratio (*RTA*), and the *M2* growth rate. This paper constructs a multiple regression model to verify that financial technology has a positive impact on the performance of commercial banks. The subscript *i* represents the *i*th commercial bank. The subscript *t* represents the statistical data of year *t*, and the range of *t* is 2011 to 2020. In addition, ε represents the random error term.

$$ROE_{i,t} = \alpha_0 + \alpha_1 FinTech_{i,t} + \alpha_2 Asset_{i,t} + \alpha_3 CAR_{i,t} + \alpha_4 NPL_{i,t} + \alpha_5 CIR_{i,t} + \alpha_6 RTA_{i,t} + \alpha_7 M2_{i,t} + \alpha_8 Year_t + \varepsilon_{i,t} \quad (1)$$

2.4 Variable Definition

2.4.1 Explained Variable

The return on equity (*ROE*) is one of the key indicators to measure the profitability of banks, which can measure the level of bank performance [14]. This paper selects it as the explained variable.

2.4.2 Explanatory Variable

The core explanatory variable is the financial technology index (*FinTech*) of commercial banks. This paper selects the relevant indexes corresponding to the headquarters of commercial banks as the development variables of Fintech. Comparing the Fintech

Table 1. Text mining classification

Dimensions	Key words
Payment and settlement	Third party payment, Online payment, Mobile payment, Mobile payment, Online payment
Resource allocation	Online financing, Network financing, Network loan, Online investment, Network investment
Wealth management	Online financial management, Internet insurance, Internet financial management, Internet financial management, Mobile financial management
Information channels	E-banking, Mobile banking, Online banking
Technical basis	Fintech, Block chain, AI, Biometric, Big data

development level of each bank from a micro perspective, this paper uses the text mining method to build the financial technology index of commercial banks [15]. The text is divided into five categories by the text mining, including payment and settlement, resource allocation, wealth management, information channel, and technical basis. This paper filters the Fintech keywords in each dimension through Baidu searching, and compares them through the frequency of statistical year keywords, as shown in Table 1.

2.4.3 Control Variables

There are many indicators to measure the performance of commercial banks. To ensure the accuracy of the research and improve the reliability of the regression results, the following control variables were selected when building the model: the logarithm of bank asset size (Asset), the capital adequacy ratio (CAR), the non-performing loan ratio (NPL), the cost income ratio (CIR), the asset profit ratio (RTA), and the M2 growth rate. In addition, this paper sets year (Year) as dummy variable to control the impact of macro factors brought by years on empirical analysis.

3 Empirical Results Analysis

3.1 Descriptive Statistics

Table 2 presents the descriptive statistics of all variables. This paper has obtained 370 sample data from 37 companies in 2010–2020. The average return on equity (ROE) is 0.143, and the average FinTech index is 1.994. It reflects that the level of FinTech index varies greatly among different commercial banks. In addition, the values of each variable are in a reasonable range, providing a well sample basis for subsequent research.

3.2 Correlation Analysis

To avoid the correlation between variables and improve the reliability of multiple regression analysis, it enacts correlation tests. As shown in Table 3, the correlation coefficient

Table 2. Descriptive statistics of variables

Variables	Observations	Mean	Std	Min	Max
<i>ROE</i>	370	0.1430	0.0436	0.0649	0.2940
<i>FinTech</i>	370	1.9940	0.3630	1.2700	2.8080
<i>Asset</i>	370	27.5900	1.7660	24.6600	31.1400
<i>CAR</i>	370	0.1330	0.0160	0.0988	0.2490
<i>NPL</i>	370	0.0127	0.0046	0.0024	0.0275
<i>CIR</i>	370	0.3050	0.0465	0.1240	0.4280
<i>RTA</i>	370	0.0102	0.0024	0.0051	0.0176
<i>M2</i>	370	0.1150	0.0302	0.0699	0.1730

Table 3. Correlation coefficient of variables

	<i>ROE</i>	<i>FinTech</i>	<i>Asset</i>	<i>CAR</i>	<i>NPL</i>	<i>CIR</i>	<i>RTA</i>	<i>M2</i>
<i>ROE</i>	1.000							
<i>FinTech</i>	0.340***	1.000						
<i>Asset</i>	0.103**	0.081	1.000					
<i>CAR</i>	-0.303***	0.213***	-0.117**	1.000				
<i>NPL</i>	-0.573***	0.431***	-0.041	0.109**	1.000			
<i>CIR</i>	0.105**	-0.381***	-0.253***	-0.051	-0.043	1.000		
<i>RTA</i>	0.776***	-0.623***	0.099*	0.020	-0.515***	0.055	1.000	
<i>M2</i>	0.649***	-0.435***	-0.042	-0.158***	-0.453***	0.293***	0.538***	1.000

Note: *, **, and *** indicate 10%, 5%, and 1% significant, respectively; T-statistics are reported in the parentheses

between FinTech index (*FinTech*) and return on equity (*ROE*) is 0.340. It means that the return on equity (*ROE*) of banks increases with the increase of FinTech index (*FinTech*), which is consistent with the research hypothesis of this paper. It can be seen from Table 4 that the correlation between variables is relatively reasonable, and it is not easy to have multicollinearity problems.

4 Model Regression Analysis and Robustness Test

To explore the impact of FinTech on the performance of commercial banks, the regression results of this model are shown in Column (1) of Table 4. The results display that the FinTech index (*FinTech*) and the return on equity (*ROE*) are significantly positively correlated at the level of 1%. Its regression coefficient is 0.034, indicating that when the FinTech index increases, the bank's performance will increase by 3.4%. Therefore, the hypothesis of this paper has been confirmed, and financial technology can play a positive role in the business performance of commercial banks.

The non-performing loan ratio (*NPL*) is significantly negatively correlated with the return on equity (*ROE*), indicating that the higher the non-performing loan ratio of a bank, the lower the bank's performance level. The capital adequacy ratio (*CAR*) and the return on equity also demonstrate a negative correlation trend. It indicates that the excessive capital adequacy ratio will reduce bank performance. It may be due to the bank's insufficient use of debts.

To enhance the credibility of the conclusions, it conducts a robustness test. In the empirical model, we use the return on total assets (*ROA*) to replace the explained variable. The rest is consistent with the above assumptions. The regression results are shown in Column (2) of Table 4. It has a positive correlation at the level of 5%, and the coefficient is 0.011. It displays that there is no significant difference between this result and the previous regression analysis.

Table 4. The regression test results

Variables	(1)	(2)
<i>FinTech</i>	0.034*** (2.37)	0.011** (1.03)
<i>Asset</i>	0.011 (1.08)	0.007 (0.05)
<i>CAR</i>	-0.670*** (-8.70)	-0.012*** (-3.21)
<i>NPL</i>	-0.965*** (-3.23)	-0.031** (-2.15)
<i>CIR</i>	0.081*** (3.07)	0.002* (1.88)
<i>RTA</i>	4.873*** (10.13)	1.798*** (14.59)
<i>M2</i>	0.290** (2.28)	0.021** (4.59)
<i>Constant</i>	0.236*** (7.65)	yes 0.002
<i>Year</i>	yes	(1.47)
Observations	370	370
R-squared	0.799	0.799

Note: *, **, and *** indicate 10%, 5%, and 1% significant, respectively; T-statistics are reported in the parentheses

5 Conclusions and Policy Recommendations

5.1 Research Conclusions

Through theoretical analysis and empirical analysis, this paper discovers that Fintech has a significant impact on the performance of commercial banks. This paper takes 37 A-share listed commercial banks from 2010 to 2020 as the research sample, and specifically analyzes the relationship between Fintech and the performance of commercial banks. The main conclusions are as follows. Firstly, the results show that the FinTech index and the return on equity are positively correlated at the level of 1%. Therefore, the hypothesis of this paper has been confirmed. Fintech can play a positive role in the business performance of commercial banks. Secondly, the non-performing loan ratio is significantly negatively correlated with the return on equity. It indicates that the higher the non-performing loan ratio of a bank, the lower the bank's performance level. Thirdly, the capital adequacy ratio and the return on equity also demonstrate a negative correlation trend. In summary, we can discover that Fintech can enhance the profitability of commercial banks. Banks should actively adjust their investment direction and increase capital investment to improve the level of Fintech. In addition, they should follow the development of Fintech and drive the overall innovation of commercial banks.

5.2 Policy Suggestions

Fintech drives the reform of financial market and gradually infiltrates into all aspects of commercial bank business management. However, commercial banks still have some problems and shortcomings, such as the high input-output ratio of R&D applications, the imperfect risk prevention system, and the lack of innovation ability. Based on the above problems and the actual situation of the development of Fintech in commercial banks, this paper gives suggestions in the following aspects. First, commercial banks should increase their investment in R&D to transform technological achievements. Combined with big data technology and risk model, commercial banks can build a sound credit evaluation system. Second, commercial banks should complement their advantages with the advanced technology of Fintech companies to improve their comprehensive competitiveness. Specifically, commercial banks can promote the implementation of financial technology applications by establishing financial technology companies. Third, commercial banks should establish a sound legal system and a risk-early warning mechanism. To sum up, commercial banks can build an effective internal control mechanism to prevent financial risk events.

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