The Impact of Financial Technology on the profitability of Commercial Banks—Base on Science and Technology and Artificial Intelligence

Di He
hedi1115@qq.com

University College London, Department of Statistical Science, London UK, WC1E 6BT

Abstract—With the development of science and technology, the fourth industrial revolution started. Science and technology have gradually increased their weight in the development of enterprises, but it is not certain about the effect of integrating fintech into financial institutions. This paper uses Stata16.0 to construct a fixed-effect model for regression analysis to study the impact of fintech on the profitability of financial institutions. The explanatory variable used is fintech, while the explained variable is ROA, the control variables are capital adequacy ratio (CAR), cost-income ratio (COST), the bank's total assets (ASSET), non-performing loan ratio (NPL), loan-to-deposit ratio (LTD), annual gross domestic product growth rate (GDPGR), and aggregate financing to the real economy (SSF). The financial data of 15 listed commercial banks from 2012 to 2020 used in this paper are from the wind database, and the annual GDP growth and social financing scale data are from the National Bureau of Statistics of China. The fintech index of China is represented by the calculated mean of the "total digital financial inclusion index" of 31 administrative divisions in the Study of Fintech Competitiveness Index of Chinese Cities. The empirical results show that the development of fintech has a negative impact on the profitability of commercial banks.

Keywords-fintech; financial technology; commercial banks; profitability

1. INTRODUCTION

With the rapid development of network technology and the Internet in 2012, China has entered the development period of fintech. In 2016, China accounted for 46% of global venture capital in fintech investments. Companies, financial institutions, and governments in China are all developing fintech and hoping to benefit from it to boost their own development. Nowadays, there are an increasing number of scholars investigating the impact of financial science and technology on the economic environment and various traditional industries, and putting forward suggestions on how to make use of the development of financial technology, promote the operation of the real economy in China, and make constructive suggestions that will benefit the people. The booming fintech disrupts commercial banks' traditional business models, posing significant challenges to the development mode and way of thinking in commercial banks in the financial field [1]. The study of the impact of fintech can enable commercial banks to find their weaknesses and improve their performance through financial innovation and reform, thereby better serving economic development and promoting China's financial stability. Therefore, based on the financial data and other relevant statistical data of 15 listed commercial banks

ICEMME 2022, November 18-20, Nanjing, People's Republic of China

DOI 10.4108/eai.18-11-2022.2326879

from 2012 to 2020, this paper conducts an empirical analysis of the impact of fintech on the profitability of commercial banks.

2. LITERATURE REVIEW AND HYPOTHESIS

Currently, financial technology (fintech) has been defined in detail by worldwide organizations and scholars. According to the international authority, the Financial Stability Board (FSB) [2], Fintech is a technology-enabled financial innovation. Such innovation would disrupt traditional industry structures, create fundamental change to the existing business model, reshape the way existing businesses produce and provide goods and services, and create new avenues for entrepreneurship. Fintech has been defined as the general term for a set of technical means; fields include artificial intelligence (AI), BlockChain, Cloud Computing, and Data Analysis.

It can be found from the existing literature that most research results show that fintech will greatly promote China's economic development. But there are also some studies, such as Qiu Han, Huang Yiping, Ji Yang [3], which illustrate that fintech may have an impact on the development of commercial banks in some aspects, to a certain extent. Zhai Xingyu found that while promoting the progress of China's financial market, Internet finance also disrupted the business operation mode of commercial banks and weakened the intermediary role of commercial banks [4]. The emergence of a series of artificial intelligence (AI) services, including mobile banking and third-party payment platforms, also affects the payment functions of commercial banks negatively [5].

Based on the above analysis, the hypothesis is that the development of fintech affects the growth of commercial banks' profits and has a negative effect on the profitability of commercial banks.

3. INDEX SELECTION AND DATA

3.1 Explanatory Variable: Fintech

Based on the index selected by Qiu Han [3] and other scholars, the author uses the “Digital Financial inclusion index” compiled by the Institute of Digital Finance Peking University to measure the development degree of Fintech in China. The “digital Financial Inclusion Index” built on the data from Ant Financial Service Group (Ant Group)'s transaction accounts, measures fintech development across provincial, city and county levels. Ant Group is a leading company in China's Internet finance industry. Its products include Yu Ebao, which is the world's largest monetary fund and it provides balance value-added service and demand fund management service; Alipay, China's largest third-party payment platform, and Ant Credit Pay, a consumer credit product. These products are used at a high frequency by a wide range of people in China. The “Digital Financial inclusion index” is built based on three dimensions, which are breadth of coverage, depth of use and degree of digitalization, include 33 specific indicators. Both the population covered by Ant Group and whether the covered population uses Ant Group’s services are considered, therefore this index should measure the level of development of Fintech in China precisely.

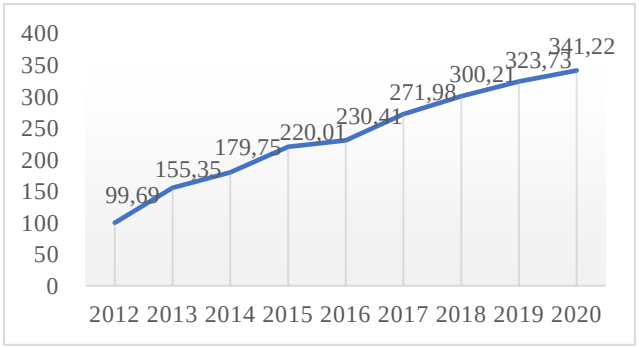

FIGURE 1: TREND OF FINTECH INDEX FROM 2012-2020 IN CHINA

From Figure 1, it can be illustrated that the development of Fintech in China has grown steadily from 2012-2020, in which the growth rate of Fintech index increased significantly in 2012.

3.2 Explained Variable: ROA

Most previous studies used single indicators, western scholars mostly use Tobin 'Q to evaluate the performance of commercial banks. However, China's capital market is in the stage of development, and some small and medium-sized banks have only been listed in recent years, so it is difficult to comprehensively obtain the data of capital market valuation involved in this index.

ROA (Return On Asset) is often used as indicators to measure the profitability of commercial banks by Chinese scholars [6], it is a measure of how much net profit can be generated per unit of total assets, calculated by dividing net income by total assets. ROA reflects how the commercial banks use their total assets to create profits, in addition, represents the profitability and risk control ability of banks. Therefore, the author chooses ROA as an indicator to measure the profitability of commercial banks.

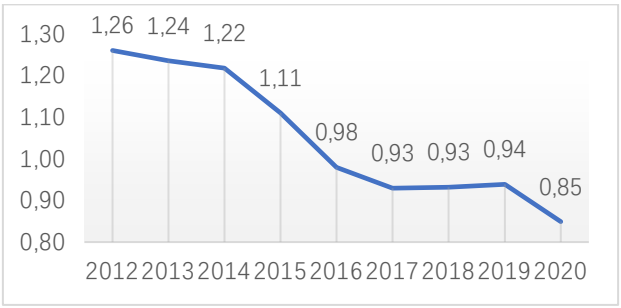

FIGURE 2: TREND OF ROA OF CHINA'S COMMERCIAL BANKS FROM 2012-2020

In figure 2, the annual ROA of China's commercial banks is the mean ROA of 15 listed commercial banks. It can be seen that, the ROA of commercial banks declined since 2012 which means the profitability of Commercial banks in China weakened. The reason for that might be the significant development of Fintech. To achieve sustained and stable development, the fintech has been introduced to commercial banks' business from 2012, but they cannot fully

use fintech to compete with other external third-party financial institutions, resulting in reduced efficiency in the use of resources.

3.4 Control Variables

Based on the existing research methods, the chosen control variables including both bank and country aspects. From the bank perspective, the control variables are Capital adequacy ratio (CAR), bank's capital / risk-weighted assets; Cost income ratio (COST), operating costs / operating income; Bank's total assets (ASSET), in the unit of trillion RMB; Non-performing loan ratio (NPL)，non-performing loans/ total loans; Loan-to-deposit ratio (LTD), total loans/ total deposits. From the macro perspective, the control variables are annual gross domestic product growth rate (GDPGR) and aggregate financing to the Real Economy (SSF), a unit of ten thousand RMB.

3.5 Model and data sources

Based on the above selected variables, the regression model is:

$$ROA_{it} = \beta_0 + \beta_1 Fintech_t + \beta_2 CAR_{it} + \beta_3 COST_{it} + \beta_4 SIZE_{it} + \beta_5 NPL_{it} + \beta_6 LTD_{it} + \beta_7 SSF_t + \beta_8 GDPGR_t + \varepsilon_i$$

While β_0 is a constant, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ are variable coefficients，ε_i is statistical residual，i represents ith commercial bank，t represents in year t. Based on this paper's hypothesis, the expected β_1 is negative.

The financial data of 15 listed commercial banks from 2012 to 2020 used in this paper are from wind database, and the annual GDP growth and social financing scale data are from The National Bureau of Statistics of China. The fintech index of China is represented by the calculated mean of the "total digital financial inclusion index" of 31 administrative divisions in the Study of Fintech Competitiveness Index of Chinese Cities. Descriptive statistics of each variable are shown in Table 1

TABLE 1. DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std.Dev.	Min	Max
Roa	135	1.05	0.23	0.52	1.76
Fintech	135	235.82	76.82	99.69	341.22
Car	135	13.18	1.70	9.88	17.52
Cost	135	29.16	3.80	21.59	40.77
Size	135	8.57	8.10	0.11	33.35
Npl	135	1.35	0.38	0.43	2.39
Ltd	135	76.77	14.66	38.97	115.99
Gdpgr	135	6.53	1.60	2.30	7.90
Ssf	135	21.26	6.27	15.41	34.86

4. MODEL AND REGRESSION ANALYSIS

4.1 Correlation analysis

Table 2 shows the correlation between explanatory and control variables, the correlation coefficients are mostly less than 0.5, indicating that there is no serious endogeneity issue in the selected variables, and all the data could be used to analyze.

TABLE 2. CORRELATION COEFFICIENT TABLE

Variable	1	2	3	4	5	6	7	8
Fintech	1.000							
Car	0.447	1.000						
Cost	-0.401	-0.339	1.000					
Size	0.242	0.672	-0.210	1.000				
Npl	0.624	0.160	-0.224	0.275	1.000			
Ltd	0.543	0.090	-0.117	0.054	0.539	1.000		
Ssf	0.827	0.443	-0.276	0.216	0.351	0.516	1.000	
Gdpgr	-0.742	-0.424	0.336	-0.201	-0.331	-0.439	-0.879	1.000

4.2 Model Selection

To select the appropriate panel data model for regression, Hausman test is used. The null hypothesis of Hausman test is a random-effects model, and the alternative hypothesis is a fixed-effects model. Calculated by Stata16.0, the Chi-square of the Hausman test is chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 12.61 ,the P value is equals to 0.0497, which is less than the confidence level of 5%. Therefore, the test result rejects the null hypothesis, and the fixed effect model should be used.

4.3 Regression analysis

Based on above analysis, the regression result of the model is as shown in Table 3, the goodness of fit of the above model is 0.79, indicating that the fitting effect is significant and can well explain the degree of influence of technological finance on the profitability of commercial banks. The P value of the model in F test is approximately 0, illustrating that the model is significantly valid.

TABLE 3. REGRESSION RESULTS OF FINTECH IMPACT ON RETURN ON ASSET (ROA) OF COMMERCIAL BANKS

VAR	COEF.	St.Error	T-statistic	P-value
Fintech	-.0008	.0003	-2.72	0.008
CAR	.0192	.0103	1.87	0.065
COST	.0014	.0042	0.32	0.750
SIZE	-.0071	.0055	-1.29	0.199
NPL	-.1683	.0359	-4.69	0.000
LTD	.0016	.0015	1.10	0.276

SSF	-.0125	.0034	-3.64	0.000
GDPGR	-.0105	.0102	-1.04	0.302
_cons	1.4378	.1923	7.48	0.000
R-squared	0.7944	F(14,112)	17.32	
Adj R-squared	0.7541	Prob>F	0.0000	

1) Explanation of the impact of Fintech on commercial banks

The estimated coefficient of Fintech index is significantly negative at the significant level of 1%. In terms of the impact, when the Fintech index increases by one unit, the profitability of commercial banks will decrease by 0.8%, that is, the development of financial technology has a negative impact on the profitability of commercial banks. The reasons of the development of fintech would weaken the commercial banks can be explained through three aspects.

a) The impact of fintech on the asset end of commercial banks

Commercial banks' asset business in China mostly consists of bank loans, financing service, and intermediary services. Loan service is one of the most significant among them, as it is one of the most important ways for commercial banks to manage assets and benefit their capital operations. Before the emergence of fintech, the loan service of commercial banks remained firmly in the first place in the market. With the development of fintech, Internet companies have expanded their loan service in the field of industrial chain finance and consumer credit, result in the loss of commercial loans from banks and reduce their asset value, which promotes commercial banks to innovate on systems. Especially for micro-, small- and medium-sized enterprise loans and personal loans, commercial banks have high credit requirements and cumbersome loan procedures for customers considering risks and other factors. Therefore, traditional credit cards have been gradually replaced by a third-party platform such as Ant Credit Pay, which has lower interest and borrowing conditions compared to a bank, and micro-, small- and medium-sized businesses and individuals can raise required capital easily. To increase the interest revenue, commercial banks that have lost part of their loan service lower the borrowing conditions for customers. However, as a result, the non-performing loan ratio increases, which not only increases the operating risk of banks, but also negatively affect the profitability of banks.

b) The impact of fintech on the liability end of commercial banks

Commercial banks operate on their own capital. In terms of capital sources, most of the capital is paid in the form of liabilities, and such liabilities usually have costs. Deposit interest is the main financing cost of commercial banks, and with the progress of fintech, this cost keeps rising. Technology finance through the third-party payment and financing platforms take consumer's demand deposits in large quantities. As a result, the deposits which were in commercial banks transferer into the non-bank financial institutions, and the banks' interest income decreases due to lower net interest margins. And banks raise deposit interest rates will lead to the increase of financing costs, and then reduce the profit of commercial banks. Therefore, commercial banks lost most of their original deposits, and the deposit interest rate was also affected, increasing their cost liabilities. This has a negative influence on commercial bank performance.

c) The impact of fintech on the intermediary service of commercial banks

Commercial banking relies heavily on intermediary services to make profit, produces mainly fee and commission income. Various fee-based financial services and products are provided by a bank to different customer groups, which requires accumulation of customer resources. In the past, commercial banks promoted the development of intermediary services by virtue of their numerous branches and wide coverage of customers. As the financial concepts of people change, the requirements of financial products get higher. In addition to the pursuit of profitability and safety, the convenience and flexibility of wealth management products is needed, such as whether the money can be accessed at any time, and the demand of small quantity capital management are increasing. The products developed by current financial technology companies, such as the Yu Ebao produced by Ant Group, Tencent's Licaitong, obtain and analyze large amounts of customer data at very low cost, using high-end financial technology for instance big data, artificial intelligence, blockchain, etc. Therefore, the launched wealth management products in line with customers' needs, and provides more equitable and refined products and services. In the contrast, due to the rigid financing and credit model and high investigation cost, commercial banks are unable to provide flexible products satisfied customers' requirements, which leads to the decrease of commission income of banks.

Third-party payment platforms such as Alipay, WeChat Pay and Apple Pay, and other institutions provide financial services for consumers, focusing on peer-to-peer payment, digital wallets, foreign exchange transactions and remittances. With the advance of face recognition technology, payment with facial recognition spreads rapidly in the market in China since 2019, and is more stable than other systems with faster recognition speed and accuracy. The third-party payment platform has transformed consumers' payment preferences due to its convenience, efficiency, and low cost., which has impacted the payment services of commercial banks in terms of quantity and amount negatively, and the commission income of commercial banks decreases.

2) Explanation of the impact of control variables on commercial banks

From the regression results in table 4, the CAR, NPL and SSF have a significant estimated coefficients at significant level of 10%.

The estimated coefficient of CAR is positive, indicating that the increase of commercial banks' capital adequacy ratio would have a positive impact on their profitability. Capital adequacy ratio reflects the debt repayment ability of commercial banks, the increase of CAR improves the banks' ability to take risks and repay debts, therefore improve profitability of commercial banks.

The estimated coefficient of NPL is negative, indicating that the increase of commercial banks' NPL would have weakened their profitability. Non-performing loans are the main source of risk for commercial banks. The increase of non-performing loans lowers the operation efficiency and rise the credit risk, which has a negative impact on long-term development of commercial banks.

The estimated coefficient of the SSF is negative, indicating that the increase of aggregate financing to the real economy would have an adverse impact on their profitability. With the development of China's financial revolution in recent years, the proportion of on-balance-sheet activities in aggregate financing to the real economy has gradually declined, while the proportion of off-balance sheet activities and direct financing has been rising. The single-mode

of financing which relies on bank loans has gradually been changed and the direct financing which has lower cost is promoted in China, attracting an increasing number of high-quality enterprises which reduces loan market share of commercial banks, resulting in the decrease of interest income and profitability of commercial banks.

Other control variables have insignificant estimated coefficients, which illustrate that they have only little effect on the profitability of commercial banks.

4.4 Robustness test

To verify the stability of the results in Table 4, ROE (Return On Equity) is used instead of ROA as the commercial banks' profitability indicators in the regression analysis. ROE reflects the efficiency of a company's use of its own capital, calculating by net income divided by shareholders' equity. The regression results are shown in Table 4. The sign of the variable coefficients and other results are almost the same as the previous results, and the goodness of fit of the model is about 0.91, indicating the stability of the regression model to some extent.

TABLE 4. REGRESSION RESULTS OF FINTECH IMPACT ON RETURN ON EQUITY (ROE) OF COMMERCIAL BANKS

VAR	COEF.	St.Error	T-statistic	P-value
Fintech	-0.0181	.0043	-4.20	0.000
CAR	-0 3015	.1557	-1 94	0.055
COST	0.0420	0642	0.66	0.514
SIZE	-0.0934	.0833	-1.12	0.265
NPL	-3.3590	.5442	-6.17	0.000
LTD	-0 0373	.0227	-1.64	0.103
SSF	-0.1101	.0521	-2.11	0.037
GDPGR	-0.0151	.1539	-0.10	0.922
C0ns	33.2731	2.9166	11.41	0.000
R-8quared	0.9109	F(8,112)	143.15	
Adj R-squared	0.8934	Prob>F	0.0000	

5. CONCLUSION

This paper finds that the development of fintech has a negative impact on the profitability of commercial banks using empirical analysis and investigates the reasons from the perspectives of assets end, liability end and intermediary services of commercial banks. The booming development of technology finance is inevitable and commercial banks should make rational use of fintech to promote its development.

There are shortages in the empirical analysis in this paper. Firstly, part of the data of commercial banks in China has a short availability period, therefore the data used in this paper has a short period and may have cyclical fluctuation. Secondly, as fintech is a new and advanced technology, currently there is no unified official standard for the quantitative measurement of the development of fintech. The "Digital Financial Inclusion Index" compiled

by the Institute of Digital Finance at Peking University is used in this paper as the fintech index in China. The statistical time range of this index is short, covering the period from 2011 to 2020, so the stability is relatively insufficient. In addition, most banks do not publish data on "investment in fintech research and development", which also results in the limitation of the selection of indicators in this paper.

This paper studies the impact of fintech on the profitability of commercial banks. Further research can investigate the impact of fintech on other aspects such as the risk and efficiency of commercial banks. Moreover, the research in this paper is conducted from the perspective of commercial banks, and the government and society are not considered. Therefore, it is hoped that more detailed research on this topic will be carried out in the future.

REFERENCES

[1] Petralia, K., T. Philippon, T. Rice, and N. Véron (2019). Banking disrupted? financial intermediation in an era of transformational technology. Technical Report 22, Geneva Reports on the World Economy, ICMB and CEPR.

[2] FINANCIAL STABILITY BOARD. (2017) Financial stability implications from FinTech. https://www.fsb.org/ 2017/06/financial-stability-implications-from-fintech/.

[3] Han Qiu, Yiping Huang, Yang Ji. (2018) The impact of fintech on traditional banking behavior -- From the perspective of Internet financial management. Journal of Financial Research,11:17 − 29.

[4] Xingyu Zhai. (2019) Discussion on the Impact of Internet finance on commercial banks and countermeasures. Consume Guide, 13:161-161.

[5] Robard Williams. (2016) Fintech Transforms Competitive Landscape, but Unlikely to Displace Banks' Central Role. https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1023176

[6] Wentao Hu, Li Zhang, Xiangjun Li. (2019) Research on nonlinear relationship between financial innovation and profitability of Commercial Banks -- Threshold model based on Panel data of China's listed commercial banks. Financial Regulation Research, 9:16-31