Research on the Impact of Fintech Investment on the Profitability of Internet Banks in China

Li Yuman and Zhang Rubing

Abstract—**Fintech investment is the driving force for the survival and development of Internet banks. Based on the domestic and foreign research on the impact of bank profitability, this paper selects 16 Internet banks in China in 2019, uses Factor Analysis method to extract three factors of fintech investment, which are scale, increment and structure factors, and constructs a linear regression model with asset scale and equity structure as control variables. The results show that the scale factor of fintech investment has the most important and significant positive impact on the profitability, which indicates that in the initial stage of Internet banks, we should closely rely on fintech innovation to improve scale economy effect, so as to successfully achieve value creation and sustainable development.**

Index Terms—**Fintech investment, Internet Bank, Profitability, Factor analysis.**

I. INTRODUCTION

In the era of digital banking, fintech is a technology-driven financial innovation, at the same time, it is also a "new engine" for high-quality financial development. In recent years, with the rapid development of China's consumer finance and supply chain finance, Chinese government has paid more and more attention to improving the development of fintech. The Chinese "14th Five-Year Plan" proposes to upgrade the level of financial science and technology and enhance financial inclusiveness. The Fintech Development Plan (2019-2021) issued by Chinese central bank strengthens the top-level design of Fintech development from a long-term perspective. Internet banks, as the vanguard of fintech innovation and application in China, have no branches and outlets, and mainly take online business. With the help of communication technology, financial R&D and application drive business development. Driven by policy, demand and technology, they have achieved explosive growth in recent five years. By the end of 2020, 19 Internet banks had been established in China, excluding Yumin Bank and Xishang Bank, which did not disclose information publicly. The total assets of other 17 Internet banks were nearly 1 trillion yuan, and the compound annual growth rate exceeded 50%; The total number of employees is 7,713, and the average proportion of

scientific and technical personnel is 42.9%, with an average annual growth rate of 26%. There are both WeBank with assets of 291.2 billion yuan and XinAn Bank with a smaller scale of 10.4 billion yuan. Besides, WeBank and XW Bank, whose return on net assets exceeds 20%, and OneBank, which is close to zero. This shows that the operational differentiation of China's Internet banks has been widen, especially the outbreak of COVID-19 epidemic in 2020, the global spread and the long-term existence. This has further increased the demand for fintech investment. Obviously, fintech investment has higher initial investment cost and lag effect for bank, but its marginal revenue is increasing, and service efficiency is higher. Does this double-edged sword have an impact on the financial performance of Internet banks? What is the impact? Which is more important between scale and structure of fintech investment? At present, few scholars have studied these problems, and most of them focus on their impact on traditional banks. Therefore, it is necessary to study the quantitative relationship between fintech investment and financial performance of Internet banks.

Based on the analysis of domestic and foreign literature and related research in recent years, this paper selects 16 Internet banks in China as research samples, extracts three factors of fintech investment, which are scale, increment and structure factors by using principal component analysis, constructs a linear regression model, and finally discusses the impact of fintech investment on the profitability of Internet banks, and draws conclusions and conclusions.

II. THEORETICAL ANALYSIS AND HYPOTHESIS

A. Measurement of Fintech Investment

At present, there are many ways to measure the bank's fintech investment. From a macro perspective, the fintech index is used to measure it indirectly. Gao Yijun *et al.* (2020) selected the average value of risk weighted index of fintech competitiveness of five major cities in Chinese mainland as the whole Fintech index of China [1]. Wang Junshan (2020) established Fintech thesaurus, constructed Fintech measurement index based on text mining method, and then constructed fintech index by factor analysis method [2]. Liu Tingyu (2018) classified the business of 16 commercial banks into three dimensions: Internet payment business, Internet financial management business and Internet financing business, and established an individual effect model as a measure of Fintech [3]. Li Yimao (2020) took the market size of four core technology types, such as mobile payment, big data, artificial intelligence and cloud computing, as the Fintech index [4]. From the perspective of

micro-enterprises, the measurement of Fintech investment can be divided into three categories, namely, business type investment, physical capital investment and human capital investment. He Xiaogang *et al.* (2019) combined with physical and human investment, thought that the fintech investment of banks theoretically included the expenses of hardware equipment and software, as well as the salaries of technology R&D and operation personnel [5]. Li Yunda *et al.* (2020), based on the perspective of physical capital investment of listed banks, collected the investment of hardware and network equipment in fixed assets and the investment of software projects in intangible assets of 29 listed banks from 2007 to 2019, and obtained the fintech investment of banks over the years according to the annual sum [6]. From the statistical practice of banks' own investment in fintech, China's state-owned commercial banks and most joint-stock commercial banks have disclosed their fintech investment in detail since the 2019 annual report, including the total amount, the number and proportion of fintech personnel and the ratio of fintech investment to operating income. However, Internet banks attach great importance to the information disclosure of fintech investment from the beginning of their establishment because of their innate network advantages. Most banks disclose the number of their fintech personnel, some banks disclose the amount of fintech investment, and some banks use the number of undergraduate and above personnel to measure the fintech investment.

B. Impact of Fintech Investment on the Profitability of Banks

As an important means for banks to develop smart banking and inclusive financing, the investment level of fintech has a significant impact on their business performance. Puschman(2017) thinks Fintech is a dynamic process of continuous technological innovation in financial industry [7]. Chen *et al.* (2017) used case analysis to compare the adjustment and effectiveness of Citibank and Industrial and Commercial Bank of China in the development of fintech, and held that fintech is beneficial to the transformation and upgrading of commercial banks [8]. Lang Xiangxiang *et al.* (2018) took 25 A-share listed commercial banks in China from 2007 to 2016 as research samples, and divided them into three sub samples: large state-owned listed commercial banks, national joint-stock commercial banks, urban commercial banks and rural banks [9]. Mao Mingxing (2018) selected the data of 16 A-share listed commercial banks in China from 2010 to 2016 to analyze the operating performance of listed commercial banks from two aspects of internal and external factors [10]. Li Junyi (2019) defined the Internet economy industry as pay (third-party payment transaction scale), P2P (online loan transaction scale) and NSF (Internet fund transaction scale) in the research process of Internet amount on the profitability of the five major state-owned commercial banks, and drew a conclusion through the correlation analysis of these variables on the profitability of the five major state-owned commercial banks [11]. Coetzee(2018), taking South African retail banks as an example, thinks that by adapting to the fintech revolution, South African retail banks are expected to take the lead in strategy [12]. Gao Yijun *et al.*

(2020) selected 16 listed commercial banks to conduct empirical analysis by regression analysis, and found that increasing the fintech strength of commercial banks in the short term will bring more negative impacts. Wang Junshan (2020) empirically tested the panel data of 42 commercial banks in China, and found that the impact of fintech on the profit of retail business of commercial banks showed a "U-shaped" trend. From the perspective of business types of commercial banks on bank operating efficiency, Li Yimao (2020) used panel data to regress various models (Internet payment scale, mobile payment scale, big data scale, cloud computing scale, etc.), indicating that there is a linear relationship between bank profitability and selected variables.

The above research results have a strong guiding significance for this study, but there are still two shortcomings in the research on the profitability of Internet banks. First, the existing research objects are mainly listed banks and state-owned commercial banks, which have been established for a long time and have a large scale, and there is a lack of relevant analysis taking Internet banks as research objects; Secondly, most of the current researches on the influencing factors of bank profitability are based on the types of banking business, while the researches on the profitability of fintech empowerment are less. Based on this, this paper takes 16 Internet banks since the establishment of our country in 2015 as the research objects, uses factor analysis method to extract the factors of fintech investment, namely scale, increment and structure, and constructs a linear regression model with asset scale and ownership structure as control variables, and discusses the influence of fintech investment on profitability from a micro perspective.

C. Assumptions

According to the above literature, the following four hypotheses are put forward:

H1: In the initial stage of the development of Internet banks, due to their rapid scale expansion, the development status is closely related to the input of "people", and the growth of personnel is the basis of their development. Therefore, the scale of investment in fintech is more important than the structure, and the number of scientific and technological personnel is positively related to the profitability of banks.

H2: From the perspective of total investment in science and technology, the profitability of banks is positively correlated with the scale index of investment in science and technology.

H3: From the angle of increasing investment in science and technology, the profitability of banks is positively related to the increasing index of investment in science and technology, including the increase of staff salary and the increase of the number of scientific and technological personnel.

H4: From the perspective of science and technology investment structure, the profitability of banks has a marginal diminishing effect, that is, whether it is human capital investment or science and technology facilities investment, once it exceeds a certain amount, it will be negatively correlated with the return on net assets.

III. METHODS AND DATA DESCRIPTION

A. Data Sources

By the end of 2020, there are 19 Internet banks in China, and the basic situation is shown in Table I. We Bank was first established in 2014, with 4 in 2015 and 3 in 2016, reaching its peak in 2017. A total of 9 Internet banks opened, and only 1 Internet bank was established in 2019 and 2020 respectively. Observing the headquarters locations of all Internet banks, they are mainly distributed in the economically developed southeast coastal areas of China, and less distributed in the underdeveloped areas in the central and western regions, including two in Zhejiang and two in Guangdong. In terms of registered capital, the online merchant bank occupies the highest position with RMB 6.57

billion, while the Blue Ocean Bank with RMB 200 million is the lowest, and most Internet banks are distributed between RMB 2 billion and RMB 3 billion. As for the distribution of shareholders' industries, most of them are led by industry leading enterprises, which have strong competitiveness and influence in the industrial chain. Observing the strategic positioning of banks, Internet banks with the key words of "universal benefit", "science and technology" and "credit" occupy the dominant position. Considering that the Internet banks have not disclosed the annual report in 2020, this paper selects the relevant data in 2019 for research. Because the information disclosure of Yumin Bank, Xishang Bank and Xin'an Bank, which were established recently, is incomplete in 2019, this paper will take 16 Internet banks, such as We Bank and Huarui Bank, as research samples.

TABLE I: STATISTICS OF INTERNET BANKING IN CHINA

number	Name	Opening	Headquarters	Capital	Shareholders
A	We bank	2014	Shenzhen	30	Tencent,Baiyeyuan and Liye
B	Huarui bank	2015	Shanghai	30	Junyao Group and Meters Bang Wei
C	MSbank	2015	Wenzhou	20	Zhengtai Group, huafeng spandex
D	KinCheng Bank	2015	Tianjin	30	North China Group and Maigou Group
E	Mybank	2015	Hangzhou	66	Ant Financial, Fosun and Wanxiang
F	Fumin bank	2016	Chongqing	30	Hanhua Financial Control and Zongshen Industry
G	XWbank	2016	Chengdu	30	New Hope, Xiaomi
H	Sanxiang bank	2016	Changsha	30	Sany, Hansen Pharmaceutical
I	One bank	2017	Fuzhou	24	Yonghui Supermarket and Sunshine Holdings
J	Z- bank	2017	Wuhan	20	Zall Holdings, Wuhan Contemporary
K	Blue Ocean Bank	2017	Weihai	2	Weigao group and Chishan group
L	Yilian bank	2017	Changchun	20	Zhongfa financial holding, Jilin Sankuai
M	Zhongguancun bank	2017	Beijing	40	UFIDA, bishuiyuan
N	Suning bank	2017	Nanjing	40	Suning e-buy, sunrise Oriental
O	Merchant bank	2017	Meizhou	20	Baoxin energy and tapai group
P	Revitalizing the bank	2017	Shenyang	20	Rongsheng Zhongtian, tianxinhao
Q	Xin'an bank	2017	Hefei	20	Nanxiang trade, Huatai Group
X	Yumin bank	2019	Nanchang	20	Zhengbang group, Boneng industry
Y	Xi Shang bank	2020	Wuxi	20	Hongdou Group, Chengxing industry

Note: registered capital(100 million yuan), the data are from the official website of China's Internet banking and the annual report summary.

TABLE II: NAME AND DESCRIPTION OF VARIABLE

Primary index	Secondary index	Three-level index	label	formula
profitability	-	Return on Common Stockholders' Equity	ROE	Net profit/net assets ×100%
		Return on total assets	ROA	Net profit/average total assets ×100%
Asset size	Control variable	Total assets	TA	Total assets (unit: yuan) (taking logarithm)
Shareholder structure		Equity control degree	DEY	Shares held by the largest shareholder/shares held by the second largest shareholder *100%
Scale index	Human capital	Number of Fintech personnel	TP	Number of scientific and technological employees in banks (take logarithm)
		Number of employees	NOE	Number of employees in each bank
		Employee compensation	ES	Employee compensation payable by banks in 2019 (take logarithm)
	Facility investment	fixed assets and intangible assets	F&IAI	Fixed assets+intangible assets (taking logarithm)
Incremental index	Human capital	Employee compensation year-on-year	SGR	(Payroll payable in current year - Payroll payable last year)/Payroll payable *100%
		Year-on-year number of employees	EGR	(current employees- last employees)/ last employees *100%
Structure index	Human capital	Proportion of Fintech personnel	TPR	Number of Fintech employees/total number of employees *100%
	Facility investment	ratio of fixed assets and intangible assets	F&IAIR	(fixed assets+intangible assets)/total assets *100%

Note: The data of the shares held by the largest shareholder and the second largest shareholder are from Tianyanchao, and the rest of the index data are obtained by sorting out the annual report of China's Internet bank in 2019.

B. Variable Selection

Explained Variables. For the representative indicators of Internet banks' profitability, this paper selects roe and ROA as dependent variables.

Explanatory Variables. Scale Indicators: Human capital investment is measured by the number of Fintech personnel, the number of employees and their compensation, and the

scale of investment in Fintech facilities of internet banks is expressed by logarithm of investment in fixed assets and intangible assets. At the same time, in order to control the heteroscedasticity of the model, the above four variables were treated with logarithm. Increment Index: As internet banks have few physical outlets and mainly rely on the internet, they are human capital intensive industries. From

the perspective of increment, the total investment in fixed assets and intangible assets grows slowly. Structure Indicators: The proportion of Fintech personnel is used as the human capital input index of internet banks, and the ratio of fixed assets and intangible assets to total assets is used as the input index of Fintech facilities.

Control Variables. Asset Size: The total assets (TA) is chosen as an indicator to measure the scale of banks. At present, China's internet banks are in the initial stage of development. The asset size is relatively smaller in general, but the difference is larger. In order to control the heteroscedasticity of the model, the logarithm is taken as the control variable. Ownership Structure: The degree of equity control (DEY) is chosen to reflect the bank's equity structure, that is, the ratio of the shares held by the largest shareholder to the shares held by the second largest shareholder.

To sum up, variable descriptions are shown in Table II.

C. Model Building

In this paper, after selecting the above variables, the scale factor (F1), increment factor (F2) and structure factor (F3) of

Fintech investment are extracted by factor analysis method, and then a regression model of internet bank profitability is constructed according to the Fintech investment index to test the four hypotheses mentioned above. The model is constructed as follows:

$$ROE_i(ROA_i) = \beta_0 + \beta_1 TA_i + \beta_2 DEY_i + \beta_3 F_{1i} + \beta_4 F_{2i} + \beta_5 F_{3i} + \varepsilon_i \quad (1)$$

In which, β_0 represents the intercept term, i represents the ith internet bank, β_0, β_1, β_2, β_3, β_4 and β_5 are the variable coefficients in the model, and εi is the residual term.

D. Descriptive Statistical Analysis

As shown in Table III below, perform descriptive statistical analysis on the selected variables from the mean, maximum, minimum, median, standard deviation, skewness, and kurtosis. Through descriptive statistical analysis, there are certain differences among the variables that affect the rate of return of Internet banks, and follow-up analysis can be carried out.

TABLE III: VARIABLE DESCRIPTIVE STATISTICS

Index	Mean	Maximum	Minimum	Median	Std.Dev	Skewness	Kurtosis
ROE	0.086	0.282	0.001	0.069	0.080	1.730	2.654
ROA	0.007	0.028	0.000	0.006	0.007	2.088	5.345
TA	10.578	11.464	10.029	10.547	0.356	1.000	1.601
DEY	1.277	2.000	1.017	1.200	0.262	1.475	2.574
TP	5.854	7.826	4.727	5.710	0.705	1.367	3.456
NOE	4.915	6.985	2.830	5.011	0.976	-0.121	1.038
ES	7.878	9.212	7.303	7.839	0.457	1.767	4.329
F&IAI	8.005	9.491	7.107	0.348	0.539	1.096	3.123
SGR	1.413	17.957	-0.203	166.000	4.427	3.954	15.735
EGR	0.244	0.691	-0.036	0.426	0.177	0.883	1.501
TPR	0.421	0.685	0.150	0.421	0.162	-0.188	-0.976
F&IAIR	0.005	0.011	0.001	0.004	0.003	0.605	-0.849

Note: The data is calculated by SPSS

IV. FACTOR ANALYSIS

A. Adaptability Test

In order to eliminate the difference of data caused by different dimensions, this paper uses Z-score method to standardize the original data before factor analysis, and uses KMO test and Bartlett sphericity test to test the adaptability of factor analysis through SPSS 21.0 software. Results can be seen from the table.

TABLE IV: INSPECTION OF KMO AND BARTLETT

Kaiser-Meyer-Olkin measure of sampling adequacy	0. 523
Sphericity test of Bartlett	
Approximate chi-square	111.408
df	28.000
Sig.	0.000

B. Extracting Common Factors

SPSS software is used to analyze the data, and principal component analysis model is used to determine the common factor. According to the principle that the eigenvalues of variables are greater than 1, it can be seen from Table V that the variable correlation coefficient matrix has three eigenvalues, namely: 3.719, 1.705 and 1.458. According to the principle that the cumulative contribution rate is greater than 85%, the first three factors explain 86.037% of

population variance, so it can be considered that the first three factors have basically included all the contents to be reflected in the evaluation indicators, which is enough to reflect the fintech investment status of various Internet banks.

TABLE V: CONTRIBUTION RATE AND VARIANCE

Composition	Initial eigenvalue			Rotate sum of squares load	
	total	Variance (%)	Cumulative (%)	Var (%)	Cum (%)
1	3.719	46.493	46.493	44.775	44.775
2	1.705	21.313	67.806	22.534	67.309
3	1.458	18.231	86.037	18.728	86.037
4	0.526	6.572	92.609		
5	0.350	4.375	96.984		
6	0.157	1.964	98.947		
7	0.081	1.017	99.964		
8	0.003	0.036	100.000		

C. Explanation of Naming Common Factors

In order to make the common factor variables reflect the practical economic information more clearly, the original factor load matrix is rotated by using the maximum variance orthogonal rotation method, and the orthogonal rotation matrix with the maximum variance is obtained, as shown in

Table VI. According to the orthogonal rotation matrix of factors, the index can be divided into three common factors.

As shown in the following table, for the first common factor F1, TP (technical personnel), NOE (number of employees), ES (employee salary), F&IAI (total fixed assets and intangible assets) have larger load, respectively 0.956, 0.898, 0.889 and 0.879. These four variables are a concept of scale, which mainly reflect the absolute amount of banks investment in fintech. Therefore, F1 is named as the scale factor of fintech input.

For the second common factor F2, SGR (employee salary growth rate) and EGR (employee number growth rate) have larger load, which are 0.924 and 0.891, respectively. This shows that the common factor F2 mainly reflects the fintech input of banks from the aspect of increment. Therefore, F2 is named as fintech input increment factor.

In the same way, the third public factor F3 has a higher load on TPR (technical personnel rate) and F&IAIR (total fixed assets and intangible assets rate), which are 0.815 and -0.710, reflecting the company's fintech investment structure, so F3 is named the Fintech input structure factor.

TABLE VI: FACTOR LOAD MATRIX AFTER ROTATION

index	F_1	F_2	F_3
TP	0.879	-0.144	0.422
NOE	0.956	-0.084	0.096
ES	0.898	0.050	-0.046
F&IAI	0.889	-0.069	-0.248
SGR	-0.103	0.924	0.168
EGR	0.015	0.891	-0.225
TPR	0.321	-0.239	0.815
F&IAIR	0.431	-0.250	-0.710

D. Calculate the Scores of Each Factor

After the common factors have been named, the component score coefficient matrix in the following table is obtained by regression analysis, and the common factor score and comprehensive factor score are calculated based on it.

TABLE VII: COMMON FACTOR SCORE MATRIX

index	F_1	F_2	F_3
TP	0.236	0.001	0.261
NOE	0.269	0.029	0.042
ES	0.266	0.097	-0.047
F&IAI	0.258	0.020	-0.187
SGR	0.038	0.533	0.150
EGR	0.078	0.508	-0.118
TPR	0.058	-0.082	0.532
F&IAIR	0.120	-0.138	-0.496

With F1, F2 and F3 as the scores of each Internet bank on three factors, there are:

$$F_1 = 0.236TP + 0.269NOE + 0.266ES + 0.258F\&IAI + 0.038SGR + 0.078EGR + 0.058\ TPR + 0.012F\&IAIR \quad (2)$$

$$F_2 = 0.001TP + 0.029NOE + 0.097ES + 0.020F\&IAI + 0.533SGR + 0.508EGR - 0.082TPR - 0.138F\&IAI \quad (3)$$

$$F_3 = 0.261TP + 0.042NOE - 0.047ES - 0.187F\&IAI - 0.150SGR - 0.118EGR + 0.532TPR - 0.496F\&IAIR \quad (4)$$

On the basis of calculating the public factor score of fintech investment, the comprehensive factor score is calculated, and then the overall fintech investment of each Internet bank is evaluated. The calculation method is weighted by the proportion of variance contribution rate of

common factors of fintech investment in its total variance contribution rate, and the formula is: $F = (\sum$ each factor score $\times$ its variance contribution rate)/cumulative total variance contribution rate, namely:

$$F = (46.493F1 + 21.313F2 + 18.231F3)/86.037 \quad (5)$$

E. Factor Score Analysis And Evaluation

According to the factor score coefficient matrix, the public factor scores, comprehensive factor scores and rankings of Internet banks in 2019 can be easily obtained through the above calculation, as shown in Table VIII. It is worth noting that the scores of some banks in the table below are negative because the original data are standardized, which does not mean that their Fintech investment is negative.

TABLE VIII: BANKING FACTOR SCORES AND RANKINGS

	F_1	rank	F_2	rank	F_3	rank	F	rank
1	2.986	1	0.286	3	-0.919	13	1.490	1
2	-0.299	10	-0.968	16	-0.164	9	-0.436	14
3	-0.975	15	-0.685	14	1.903	1	-0.293	11
4	-0.516	12	0.282	11	-0.365	12	-0.426	13
5	0.709	2	-0.182	9	1.078	2	0.566	3
6	0.401	4	-0.567	12	0.218	7	0.123	7
7	0.705	3	0.110	5	0.620	5	0.540	4
8	0.396	5	0.470	2	-0.017	8	0.327	5
9	-0.344	11	0.220	4	-1.262	15	-0.399	12
10	-0.108	8	-0.055	7	1.046	3	0.150	6
11	-0.272	9	-0.164	8	-0.277	11	-0.246	10
12	0.055	6	-0.774	15	0.813	4	0.010	8
13	-0.623	14	-0.277	10	-1.968	16	-0.822	15
14	0.025	7	-0.631	13	-0.195	10	-0.184	9
15	-1.606	16	0.079	6	-1.066	14	-1.074	16
16	-0.534	13	3.419	1	0.556	6	0.676	2

As for the scale factor of fintech investment (F1), the explanation degree of scale factor accounts for 46.493%, which accounts for the highest proportion, so it is the most important for banks. At the same time, We Bank was established at the earliest time, and the development of WeChat and other network plaorms has provided considerable traffic entrance and profit foundation for it. As for the increment factor of fintech investment (F2), the explanation degree of increment factor accounts for 21.313%, and the importance is second. In order to seize the development opportunities and fully possess the advantages of backwardness, Revitalizing the Bank actively invested in fintech from 2018 to 2019, and made great efforts in increasing the investment in fintech. The growth rate of its employees and employees' salaries was as high as 69.106% and 1795.732% respectively. As for the structural factor of fintech investment (F3), its explanation degree accounts for 18.231%, and its importance is inferior to incremental factor. In 2019, the proportion of fintech personnel in the total staff is as high as 68.493%. It has established the relevant information technology organizational structure and optimized the fintech investment structure.

As far as the comprehensive factor (F) of fintech investment is concerned, from Table VIII, among the 16 Internet banks, the top five are Shenzhen Qianhai We Bank, Liaoning Revitalizing the Bank, Zhejiang MY Bank, Sichuan XW Bank and Hunan Sanxiang Bank. Among them, We Bank ranked first with a comprehensive score of 1.490. According to the ranking of the first three factors, We Bank ranks lower in F3, but because the rank of F1 is first and this factor is the most important, the comprehensive factor ranks

first in F, which is mainly to win by scale. Although Merchant Bank and Revitalizing the Bank opened in the same year, due to their failure to seize the development opportunities, with the change in the policies of Internet banks and the development of the times, they will face greater pressure of survival and development in the future competition.

V. REGRESSION ANALYSIS

A. Model Output

Based on the above factors of fintech investment, a multiple linear regression model is established by step-by-step method to analyze the sample data. In this model, the return on equity assets (ROE) and return on total assets (ROA) of each Internet bank in 2019 are taken as the explained variables, the three dimensions affecting the fintech investment of Internet banks are taken as the explanatory variables, and the total assets (taking logarithm) and equity control degree are taken as the control variables. The regression models of ROE and ROA are established respectively, and the regression results are shown in Table 10.

$$ROE=0.6523\,0.0579TA+0.0355DEY+0.0809F_1+0.0008F_2+0.0206F_3 \qquad \text{Model 1}$$

$$ROE=0.0855+0.0628F_1 \qquad \text{Model 2}$$

The fitting degree $R2$ of model 2 is 0.619, the adjusted $R2$ is 0.592, and the statistic of regression equation F is 22.738, which shows that the fitting degree of the equation is good and highly correlated.

$$ROA=0.0964-0.0085TA-0.0006DEY+0.0059F_1-0.0006F_2-0.0010F_3 \qquad \text{Model 3}$$

$$ROA=0.0075+0.0032F_1 \qquad \text{Model 4}$$

The fitting degree $R2$ of model 4 is 0.335, the adjusted $R2$ is 0.232, and the regression equation F statistic is 3.271, which shows that the influence of factors on ROA is less than that of ROE, and the fitting degree of ROE model 2 is better than that of ROA model 4.

B. Analysis of Empirical Results

The regression results in Table 10 show that in terms of the impact of fintech investment on ROE, the scale factor has passed the significance test in Model 1 and Model 2, and the coefficient β is 0.0809 and 0.0628 respectively. For every unit increase in F1, ROE will increase by 6.28%. This shows that the larger the scale of fintech investment of Internet banks, the higher their return on equity assets. This also means that the scale effect of Internet banks is the first in the initial stage of development. In terms of the impact of fintech investment on ROA, F1 failed the significance test in Model 3, but passed the 5% significance test in Model 4, and the coefficient β was 0.0032, indicating the impact of each unit increase in the F1 factor on ROA Will increase by 0.32%.

In addition, in the above four models, the asset scale, equity structure, and the incremental factors and structural factors in fintech investment have no significant impact on the profitability of Internet banks. However, from the perspective of the positive, negative and magnitude effects of the coefficients, the structural factors in fintech investment have a far greater impact on profitability than incremental factors.

TABLE IX: REGRESSION RESULT

DV	ROE		ROA	
EV	M1	M2	M3	M4
CON	0.6523	0.0855	0.0964	0.0075
	(0.9458)	(0.0128***)	(0.1129)	(0.0015***)
TA	-0.0579		-0.0085	
	(0.0920)		(0.0110)	
DEY	0.0355		-0.0006	
	(0.0616)		(0.0074)	
F_1	0.0809	0.0628	0.0059	0.0032
	(0.0320**)	(0.0132***)	(0.0038)	(0.0015**)
F_2	0.0008		-0.0006	
	(0.0149)		(0.0018)	
F_3	0.0206		-0.0027	
	(0.0150*)		(0.0010)	

Note: Figures in brackets in the table indicate standard error, * * * indicates 1% significance, * * indicates 5% significance and * indicates 10% significance

VI. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

The results of factor analysis show that the scale of fintech investment is the most important to the development of banks, followed by increment and structure; In the scale factor of fintech investment, the number of technical personnel and employees are very important. The regression analysis of the profitability of Internet banks shows that the scale factor of fintech investment has the strongest and significant positive influence on profitability, which shows that scale is one of the important factors that must be considered in the development of Internet banks in the initial stage. Although incremental factors and structural factors have no significant impact on the profitability of Internet banks, they are negatively correlated, which shows that after the scale development of Internet banks slows down, the above two factors will inevitably highlight their importance, and Internet banks may seek a balance between profit and fintech investment increment and structure.

B. Suggestions

1) Strengthening the investment in Fintech of Internet banks

Economies of scale is an unavoidable barrier for bank operation. In 2020, the People's Bank of China introduced strict regulatory policies such as obtaining customers through third-party traffic platforms, deposits in different places, deposits with high interest rates and Internet loans, which will inevitably slow down the expansion of Internet banks' assets. But at the same time, the "non-contact banking" service brought by the COVID-19 epidemic, and the vigorous development of consumer finance and supply chain finance have brought opportunities to Internet banks. In the future, fintech will become the key role for banks to create profits. Increase the scale of investment in fintech infrastructure of Internet banks. First, taking digital empowerment actions and leverage "ABCDT" (artificial intelligence, blockchain, cloud computing, big data, Internet of things) to improve product innovation and operational service efficiency, and build a digital bank. Second, to digging deep into the application scenarios of supply chain

finance, personal finance, platform finance, regional economy, etc., to plan the construction of Fintech capacity from the aspects of data governance, technical system, risk control and organizational structure, strengthen the in-depth integration of fintech and business, and build an open bank. Third, Internet banks should increase patent research and development, continuously increase the number of fintech patents, establish risk data platforms and risk data marts, and continuously improve the risk control ability of big data, so as to improve profitability sustainability and high-quality development and build technology banks.

2) Increasing the ncentive mechanism of Fintech personnel

Fintech talents are the most valuable wealth of Internet banks. The macroeconomic downturn and intensified competition in the future will prompt banks to pay more attention to the investment scale and development mechanism of fintech talents, promote the intensive research and development of Fintech research and development platforms, expand the business breadth and depth, and bring them greater profitability, thereby reducing operational risks and consolidating the profit base. Internet banks should continuously increase the investment in fintech personnel and the training and reserve of outstanding high-tech talents, and take the indicators such as the ratio of fintech investment to operating income, the proportion of fintech talents in all employees, and the per capita output of fintech personnel as the core indicators to measure the development of fintech.

3) Optimize the technology input-output structure to develop smart banks

It is a long process that the investment in fintech can't be achieved overnight, but only accumulated. While improving the efficiency and quality of banking services, the large increase in investment in the short term may cause the mismatch between input and output, that is, excessive investment does not bring corresponding profit growth, but makes banks face the problem of increasing operating costs. Only when increment gradually turns into stock, and its positive impact on the bank's return on assets is higher than the negative impact brought by input increment, will the bank's profit increase, which fully shows that the optimal fintech input-output structure is very important for Internet banks. At the same time, we should attach importance to the leading role of fintech innovation, establish a fintech innovation strategy, realize value creation by relying on technological innovation, re-create business models through fintech, and achieve industrial goals by means of internet finance, thus gradually realizing the transformation to intelligent banking.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Li Yuman analyzed the data and model. Revising and replenishing conclusion conclusions. Zhang Rubing collected data, build model and draw conclusions. All authors wrote the paper and had approved the final version.

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Li Yuman was born in Henan, China in May 1975. She is now a lecturer at the College of Economics and Management, Beijing Information Science and Technology University. She has got the master of management. Her research field is in internet finance and securities investment. As a tutor, she led students to win the second prize in the 2020 "ICBC Cup" National College Students' financial science and technology innovation competition.

Zhang Rubing was born in Henan, China. She is now studing at the College of Economics and Management, Beijing Information Science and Technology University. She is the class organization committee member. She has participated in the 2019 Beijing Huaxia marathon volunteer activity and won a national scholarship.