Fintech Innovations: The Impact of Mobile Banking Apps on Bank Performance in Vietnam

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ABSTRACT

This paper is aimed at analyzing the impact of FinTech innovations on bank performance across mobile banking applications in Vietnam. Using the longitudinal panel data from 2010-2019 (with 220 observations) of 22 local commercial banks in Vietnam. Multivariate panel regression is chosen to experimentally test the research hypotheses. This research paper is one of the first quantitatively investigating the effects of fintech innovation (mobile banking apps) on bank performance in Vietnam. In addition, studies on financial indicators are shown quite comprehensively in the period 2010-2019. Our empirical study has shown the following results: (i) FinTech innovations' positive impact on bank performance in Vietnam; (ii) Banks' adoption of mobile banking technologies positively impacted banks' fee-based income, consumer loans and money market deposits; (iii) The effect of mobile technologies on financial performance was much stronger for small banks than large banks; (iv) As for the balance sheet liabilities aspect, the money market fund of small banks is positively affected by the mobile banking application; (v) In terms of balance sheet assets, consumer loans by small banks are positively affected by the mobile banking application while large banks are not; (vi) GDP per capita has a positive effect on the ROE of both small and large banks; (vii) Mobile phone penetration rates positively affected bank ROA and ROE and its effect was larger on small banks. From the findings, key recommendations to Vietnamese commercial banks to improve bank performance in the context of an increasingly technological development are to: (1) Increase investment in mobile banking apps and the entire mobile banking technology; (2) Increase investment in financial technology, focus more on mobile banking users and the entire mobile banking services; (3) Take advantage of the technical support and consultancy of international organizations and bilateral cooperation with other countries' authorities in management of Fintech businesses; (4) Learn from commercial banks in other countries to draw experiences, thereby develop in own context. (5) Training human resources for the finance and banking industry to not only have professional knowledge and ability to analyze data, but also have to be proficient in operating digital technology.

Keywords: Fintech Innovations, mobile banking apps, bank performance, Vietnam, theories of Technological Innovation

INTRODUCTION

FinTech can be understood as the application of technological innovations to provide financial services (Gomber, Koch, & Siering, 2017). These services may be formed based on new innovative ideas, or maybe outdated but provided in a new way with the purpose to simplify transaction procedures and help to improve access to financial services of customers (Gomber et al., 2017; Milian, Spinola, & Carvalho, 2019; Phan, Nguyen, & Bui, 2019). Therefore, FinTech plays a significant role in the development of the banking industry. The trend of technology application in the financial sector (FinTech) taking place very

strongly has brought many opportunities as well as challenges for business operations in general, payment service development activities based on digital banking technology in particular of commercial banks. New forms of financial transactions such as FinTech have emerged to compete with traditional banks (Lee, 2015).

Fintech innovation, in particular, Mobile banking apps recently developed strongly in the digital era of the industrial revolution 4.0, especially in the field of Finance- Banking. Around the world, there are quite a number of theoretical and applied studies on the impact of mobile banking apps on bank performance. However, empirical studies on how M-banking apps affect the overall performance of the banking sector are still few, particularly in Vietnam, where there is no empirical study. Furthermore, in the 4th industrial revolution, it is critical to investigate the effect of mobile banking applications on banking indicators.

Multivariate panel regression is chosen to experimentally test the research hypotheses on whether there is any correlation between different research variables about the FinTech innovations and bank performance. The STATA 14 and Excel tool is used to run multivariate panel regression models. To estimate parameters in regression equations and independently evaluated coefficients, the usual least squares (OLS) method is used.

II. RESEARCH MODEL AND HYPOTHESIS

Our research model and hypotheses are conducted based on the ordinary least squares (OLS) model and Theories of Technological Innovation (Schumpeter, 1934)

H0: Adoption of mobile technologies has no impact on all financial indicators across all banks

H1: Adoption will have a bigger impact on small banks than on large banks in terms of fee income

H2: Adoption will have a bigger impact on small banks than on large banks in terms of operating cost

H3: Adoption will have a bigger impact on small banks's customer loans than on large banks

H4: Adoption will have a bigger impact on small banks's ROA than on large banks

H5: Adoption will have a bigger impact on small banks's ROE than on large banks

III. RESEARCH METHODOLOGY

1. Data collection and sample

This research will use a variety of data samples to analyze the effects of fintech reform in banking performance of 22 local commercial banks from 2010-2019 in Vietnam as after:

- Balance sheet and income statement from 2010 to 2019 are retrieved by Vietstock Finance
- Annual reports from 2010 to 2019 are retrieved from each bank's website
- Age of mobile banking apps from release year to 2019 is retrieved by AppAnnie
- Notifications and news from each bank website to identify FinTech operations, strategy and performance
- News and regulations from the central bank website to identify legal regulations governing FinTech's operations as well as commercial banks and the current state of payments.

2. Research Variables

The research results of the independent variables based on FinTech innovation include age of mobile banking applications, GDP per capita, and mobile penetration rates. The result of the dependent variable is the performance of the bank. This study looks at 17 separate financial metrics, such as income stream, expenditure structure, balance sheet composition and profitability, such as ROA, ROE shown in Table 1.

Table 1: Summary of Research Variables

Name of Variable	Description	Hypothesis	References
Independent Variables for FinTech Innovations			
MBA_AGE	Mobile banking application age is provided by banks from the first release year to 2019		
GDP_PC	GDP per capita of Vietnam for the period 2010-2019	+	Hai T. Phan , Tien N. Hoang , Linh V. Dinh , Dat N. Hoang (2020); Shen, Liao & Weyman-Jones (2009), Haron (2012)
MPP_RATE	Vietnam's mobile phone penetration rate 2010-2019	+	Abbasi & Weigand(2017), Scott, Reenen & Zachariadis (2017)
Dependent Variables for Bank Performance			
a. Income Statement			
INIC_ASS	Total Interest Income / Total Assets	+	DeYoung (2007), Khanh N.Nguyen(2019)
INEX_ASS	Total Interest Expenses / Total Assets	+	Khanh N.Nguyen(2019), DeYoung (2007)
FEIN_ASS	Total Noninterest Income (FeeIncome) /Total Assets	+	DeYoung & Rice (2003)
SALA_ASS	Total Salaries / Total Assets	+	Kiyono H.(2019)
SGA_ASS	Total Selling General & Admin Exp / Total Assets	+	Kiyono H.(2019)
b. B/S (Assets)			
CASH_ASS	Total Cash / Total Assets	+	Finastra, (2018)
SEC_ASS	Total Securities / Total Assets	+	Kiyono H.(2019)
LOAN_ASS	Total Loans / Total Assets	+	Kiyono H.(2019)
COMLO_LOAN	Total Commercial Loans / Total Loans	-	DeYoung, (2004)
CONSLO_LOAN	Total Consumer Loans / Total Loans	+	Kiyono H.(2019)
NPL_LOAN	Non-performing Loans / Total Loans	+	Atoi, Ngozi V. (2018)
Adj_ROA	The adjusted return on assets indicates the ratio of average net returns to average assets	+	Tunay and Akhisar (2015), Japparova and Rupeika-Apoga (2017)
c. B/S (Liabilities and Equity)			
DEPO_ASS	Total Deposits / Total Assets	-	Kiyono H.(2019)
DD_DEP	Total Demand Deposits / Total Deposits	-	Kiyono H.(2019)
MM_DEP	Money Market and Savings Account Deposits / Total Deposits	+	Kiyono H.(2019)
Adj_ROE	Return on equity is adjusted for the average net return per shareholder fair	-	Zetin(2017),Campanella and Dezi (2016)
Control Size - Grouping Criteria			
GROUP_SZ	Size of the full sample of 22 banks. Take the median asset size; Large Banks > VND 150 trillion < Small Banks		

Table 2 : Descriptive Analysis of Research Variables in the equation model

Variables	Sample size	Mean	Std.Dev	Max	Min
Independent Variables For FinTech Innovations					
MBA_AGE	220	2.27	2.217	8	0
GDP_PC	220	2384.6	233.143	2715	2085
MPP_RATE	220	0.36	0.06	0.45	0.26
Dependent Variables For Bank Performance					
B/S (Assets)					
INIC_ASS	220	0.067	0.014	0.132	0.042
INEX_ASS	220	0.042	0.010	0.072	0.003
FEIN_ASS	220	0.002	0.002	0.014	-0.0017
CASH_ASS	220	0.008	0.004	0.024	0.007
SEC_ASS	220	0.178	0.073	0.468	0.016
LOAN_ASS	220	0.616	0.102	0.854	0.269
COMLO_LOAN	220	1.854	0.648	0.483	0.254
CONSLO_LOAN	220	0.987	0.003	0.992	0.976
Adj_ROA	220	0.787	0.702	2.95	0.01
B/S (L and E)					
DEPO_ASS	220	0.699	0.108	0.893	0.461
Adj_ROE	220	9.96	7.76	27.73	0.08
Control Variables (Bank size)					
SIZE_VND	220	274.892.901,5	475.504.597,6	1.489.957.293	31.574.084

Source: Authors' compilation result (2021)

3. Analytical Methods

This study is performed by multivariate panel regression analysis from tabular data on banking and finance in the period 2010-2019. In which, many financial indicators are regression based on each bank's mobile banking technology application status. The model of equations

below represents the linear relationship between mobile banking technology and bank performance:

$$Yit = c + \alpha*MBA\_AGEit + \varepsilon it$$

IV. RESULTS AND DISCUSSION
1. Regression Analysis

Years of mobile banking are counted from the first year of a mobile application released by sample banks to 2019. The regression model console is run separately for a full sample of 22 banks domestic trade in Vietnam (220 observations) in the period 2010-2019. For the study independent variables, a mobile banking application was used (MBA_AGE). In addition, the additional independent research variables of GDP Per Capita and Mobile Phone penetration rate is included in the panel regression to measure the influence of macroeconomic and market conditions. Coefficients are indicated in the table with the probability value (p-value) is as follows: * p <0.1; ** p <0.05; *** p <0.01. This study specifically looks at coefficients with p-values less than 0.01 and 0.05 with R adjusted 2 out of 50% are statistically significant.

Table 3 : Effect of mobile technology on financial performance of all banks

Estimation method: OLS		
Full Sample (2010-2019: 220 observations)		
Independent Variables	**MBA_AGE**	**Adj R-sq**
Dependent Variables		
Income statement		
INIC_ASS	0.253***	0.742
INEX_ASS	0.091***	0.698
FEIN_ASS	0.067**	0.725
SALA_ASS	0.038**	0.617
SGA_ASS	0.016***	0.843
Balance sheet (Assets side)		
CASH_ASS	2.736	0.389
SEC_ASS	7.850	0.411
LOAN_ASS	0.485	0.236
COMLO_LOAN	-0.173	0.089
CONSLO_LOAN	1.762**	0.85
NPL_LOAN	0.233**	0.311
Adj_ROA	0.956**	0.563
Balance sheet (Liabilities and Equity side)		
DEPO_ASS	-0.037	0.0441
DD_DEP	-0.056***	0.812
MM_DEP	0.699**	0.809
TD_DEP	-1.379**	0.778
Adj_ROE	-0.535***	0.623
Fixed Effects: Bank Name and Year		
*p<0.1; **p<0.05; ***p<0.01		

Source: Authors' compilation result (2021)

The full sample's fee income (FEIN_ASS) was positively affected by the banking app at 0.067** with the adjusted $R2$ at 72.5%. The fee income includes securities trading fees, account service fees, foreign exchange fees, loan and credit usage fees.

As of 2019, all the local commercial banks that we have selected are in Vietnam have adopted the mobile banking app. They are divided into two groups by the median asset size; small banks for less than VND 150 trillion and large banks for more than VND 150 trillion.

On the asset side of the balance sheets, consumer loans are most affected by the mobile banking apps (CONSLO_LOAN, 1.762 **) with the adjusted R2 higher at 85%. Mobile banking apps are getting more and more gadgets. Therefore, it facilitates consumer loans and investments

Table 4 : Effect of mobile technology on small banks

Estimation method: OLS		
Small Banks (2010-2019: 110 observations)		
Independent Variables	**MBA_AGE**	**Adj R-sq**
Dependent Variables		
Income statement		
INIC_ASS	-0.017	0.517
INEX_ASS	-0.024	0.748
FEIN_ASS	0.225***	0.612
SALA_ASS	-0.596**	0.753
SGA_ASS	-0.071**	0.852
Balance sheet (Assets side)		
CASH_ASS	5.215	0.512
SEC_ASS	7.320	0.314
LOAN_ASS	2.96	0.277
COMLO_LOAN	-2.193	0.635
CONSLO_LOAN	4.288***	0.718
NPL_LOAN	-0.136	0.215
Adj_ROA	0.192***	0.672
Balance sheet (Liabilities and Equity side)		
DEPO_ASS	-0.981	0.403
DD_DEP	-0.852***	0.647
MM_DEP	5.816***	0.829
TD_DEP	-2.497***	-0.572
Adj_ROE	1.583*	0.678
Fixed Effects: Bank Name and Year		
*p<0.1; **p<0.05; ***p<0.01		

Source: Authors' compilation result (2021)

Key finding is that mobile technology did not affect interest income and interest expense across small and large banks. Instead small banks' fee income was positively affected by the mobile technology at 0.225*** with the adjusted $R2$ at 61.2%, supporting the first hypothesis.

Bank salary and SG&A expenses of small banks were negatively affected by the mobile banking app, supporting the second hypothesis on the operating cost reduction.

Among the variables, the most significant finding came from the consumer loans which were positively affected by the mobile banking app, and its effect was much larger on small banks, supporting the second hypothesis. (CONSLO_LOAN, 4.288***; 71.8% adjusted $R2$). This is the highest coefficient whereby a yearly increase in the mobile banking app adoption will grow small banks' consumer loans by 4.288%, supporting the third hypothesis.

Overall cash assets and securities assets were positively affected by the mobile banking app. Loan assets were positively affected by mobile banking apps. The adjusted ROA of large banks was positively affected by the banking app at 0.096** lower than the small banks' coefficients at 0.192***, supporting the fourth hypothesis.

Deposits assets were negatively affected by the banking app at -2.183** with the adjusted $R2$ at 86.7% as well. The adjusted ROE was negatively affected by the mobile banking app at 0.780** with the adjusted $R2$ at 66%. These results

demonstrate that mobile technologies did not positively affect financial performance of large banks, supporting the fifth hypothesis for the larger technological effects on small banks.

Table 5 : Effect of mobile technology on large banks

Estimation method: OLS		
Large Banks (2010-2019: 110 observations)		
Independent Variables	**MBA_AGE**	**Adj R-sq**
Dependent Variables		
Income statement		
INIC_ASS	0.008	0.625
INEX_ASS	-0.024	0.761
FEIN_ASS	-0.041*	0.882
SALA_ASS	0.018*	0.714
SGA_ASS	0.013	0.729
Balance sheet (Assets side)		
CASH_ASS	0.937**	0.98
SEC_ASS	0.755***	0.862
LOAN_ASS	-1.133***	0.723
COMLO_LOAN	-0.487	0.652
CONSLO_LOAN	0.047	0.79
NPL_LOAN	0.178**	0.691
Adj_ROA	0.096**	0.753
Balance sheet (Liabilities and Equity side)		
DEPO_ASS	-2.183**	0.867
DD_DEP	-0.319**	0.925
MM_DEP	-0.538**	0.841
TD_DEP	0.387*	0.582
Adj_ROE	-0.780**	0.66
Fixed Effects: Bank Name and Year		
*p<0.1; **p<0.05; ***p<0.01		

Source: Authors' compilation result (2021)

Large banks' income statements were largely unaffected, supporting the hypothesis of the mobile technology effect on small banks.

Table 6: Effects of GDP per capita, mobile phone penetration rates on ROA and ROE (Full sample)

Estimation method: OLS				
Full sample (2010-2019: 220 observations)				
Independent Variables	**Adj R-sq (MPP_RATE)**	**MPP_RATE**	**GDP_PC**	**Adj R-sq (GDP)**
Dependent Variables				
Adj_ROA	0.714	0.0045***	-0.000**	0.541
Adj_ROE	0.593	-0.1611**	0.00013**	0.647
Fixed Effects: Bank Name and Year				
*p<0.1; **p<0.05; ***p<0.01				

Source: Authors' compilation result (2021)

The adjusted ROE of all banks that adopted mobile banking apps was positively affected by GDP per capita at 0.00013** with the adjusted $R2$ at 64.7%. Meanwhile, the adjusted ROA of all banks using the mobile banking app is negatively affected by GDP per capita at -0.00004** with the adjusted $R2$ of 54.1%.

The adjusted ROE of all banks that adopted mobile banking apps was negatively affected by mobile phone penetration rates at -0.1611** with the adjusted $R2$ at 59.3%. Meanwhile, the adjusted ROA of all banks using the mobile banking app is positively affected at 0.0045*** with the adjusted $R2$ of 71.4%.

Table 7: Effects of GDP per capita, mobile phone penetration rates on ROA and ROE (Small banks)

Estimation method: OLS				
Small banks (2010-2019: 110 observations)				
Independent Variables	Adj R-sq (MPP_RATE)	MPP_RATE	GDP_PC	Adj R-sq (GDP)
Dependent Variables				
Adj_ROA	0.649	0.073*	-0.0006	0.589
Adj_ROE	0.752	0.106**	0.00018**	0.632
Fixed Effects: Bank Name and Year				
*p<0.1; **p<0.05; ***p<0.01				

Source: Authors' compilation result (2021)

There is a relationship observed between GDP per capita and adjusted ROE at 0.00018** with the adjusted $R2$ at 63.2%.

The adjusted ROE of small banks was positively affected by mobile phone penetration rates at 0.106** with the adjusted $R2$ at 75.2%. Meanwhile, the adjusted ROA was also positively affected at 0.073* with the adjusted $R2$ of 64.9%

Table 8: Effects of GDP per capita, mobile phone penetration rates on ROA and ROE (Large banks)

Estimation method: OLS				
Large banks (2010-2019: 110 observations)				
Independent Variables	Adj R-sq (MPP_RATE)	MPP_RATE	GDP_PC	Adj R-sq (GDP)
Dependent Variables				
Adj_ROA	0.783	-0.0014	-0.00087**	0.721
Adj_ROE	0.591	-0.074**	0.0015***	0.613
Fixed Effects: Bank Name and Year				
*p<0.1; **p<0.05; ***p<0.01				

Source: Authors' compilation result (2021)

The adjusted ROE of large banks was positively affected by GDP per capita at 0.0015*** with the adjusted $R2$ at 63.1%. Meanwhile, the adjusted ROA of large banks was negatively affected by GDP per capita at -0.00087** with the adjusted $R2$ of 72.1%.

In large banks, mobile phone penetration rates had a negative effect on Adj_ROA and Adj_ROE.

Table 9: Macroeconomic and Market Effects

Hypothesis	Status	All banks	Small banks	Large banks
Independent Variable: Mobile apps				
GDP Per Capital & ROA	Nil	X	X	X
GDP Per Capital & ROE	Positive	O	O	O
Mobile Phone Penetration Rate & ROE	Positive	X	O	X
Mobile Phone Penetration Rate & ROA	Positive	O	O	X

Source: Authors' compilation result (2021)

Thus, the regression model shows the overall effect of GDP per capita on ROE. GDP and ROE have a strong relationship. As the economy develops at a faster rate, more capital will be required, thereby creating more credit and liquidity in the market. This promotes the banking business and its penetration into the Vietnamese economy in terms of capital inflows into the stock market, thus bringing higher returns to the banking industry and the above returns. Equity will be greater. ROE is affected more than ROA because ROE that reflects financial leverage / debt / investment can be affected more by the external macroeconomic environment. In addition, mobile banking penetration has a positive impact on ROA and ROE of small banks. Based on the above results, it can be concluded that banks 'performance is affected by banks' ability to leverage new technologies to innovate - in this study, Mobile banking, expanding their mobile banking customer base and activating their use.

2. DISCUSSION OF RESEARCH RESULTS

First of all, the regression results rejected the null hypothesis that the adoption of mobile banking technology has not affected all the financial indicators of all

banks, because there is a significant correlation between the implementation of mobile banking technology by banks and its effectiveness. The table below summarizes the results of the null hypothesis and the test hypothesis:

Table 9 : The Results of the Null Hypothesis and the Hypothesis

Hypothesis	Status	All banks	Small Banks	Large Banks
Independent Variables: Mobile apps				
H0: Adoption of mobile technologies has no impact on all financial indicators across all banks	Rejected	X	X	X
H1: Adoption will have a bigger impact on small banks than on large banks in terms of fee income	Accepted	O	O	X
H2: Adoption will have a bigger impact on small banks than on large banks in terms of operating income	Accepted	O	X	O
H3: Adoption will have a bigger impact on small banks's customer loans than on large banks	Accepted	O	O	O
H3: Adoption will have a bigger impact on small banks's ROA than on large banks	Accepted	O	O	O
H4: Adoption will have a bigger impact on small banks's ROE than on large banks	Accepted	X	O	X

Source: Results of data processing by research team (2021)

Secondly, the impact of mobile banking technology on balance sheet liabilities has a positive impact on money market deposits, while in large and small banks, mobile banking applications have a negative impact on demand deposits and time deposits. These results are consistent with previous research by DeYoung (2007) in which new technology allows funds to be easily converted from spot, low deposit or perpetual deposits to high-yield money market funds. The performance of banks (measured as the ratio of money market deposits to total deposits) is very important because they get the most financial gains from e-commerce commission income. Jean (2017) discovered and summarized the impact of mobile banking applications on financial performance. The research is consistent with Karjaluoto (2002), who believes that in addition to the platforms provided by the banking system (such as checkbooks, ATMs, voicemail/line interfaces, smart cards, POS, and Internet resources), mobile phone platforms are another convenient method. Money management without cash processing. Therefore, the regression model shows that mobile banking technology is statistically significant in terms of fee income, which provides clear evidence to reject the null hypothesis and the alternative hypothesis are accepted. Compared with bank fees income, the adoption of mobile banking technology will have a greater impact on smaller banks.

"Thirdly, regression analysis also shows that there is a statistically significant correlation between wireless technology and the reduction of operating costs (such as general sales and management costs (SG&A)). Therefore, the second assumption is that the introduction of mobile banking will have a greater impact on small banks than on large banks. These results are in line with previous research by Kiyono.H (2019). When customers need it, mobile technology can help banks provide services with minimal human involvement. Fast processing enables employees to provide services to customers through offline channels and continuously improve products and processes, thereby helping to reduce management costs. When banks apply it to the Vietnamese banking market, they are competing for digital banking, which is one of the key technologies that financial institutions and banks are paying attention to. Action points and customers can be covered by apps such as smartphones and social networks. The introduction of digital banking has brought many opportunities for banks. For example, these include, for example, increasing income, improving labor productivity and reducing costs, increasing access to information and data, connecting, collaborating, increasing competitiveness, and creating competition with competitors".

Fourthly, the clear evidence is that there is a statistically significant relationship between adoption of mobile banking apps and transactional consumer loans among small businesses that provide one-off lending businesses. This includes mortgages, auto loans and credit cards that consumers can apply for through mobile devices. Banking applications provided by some commercial banks in Vietnam. Relationship loans are usually related to commercial loans. In this case, the bank monitors the performance of the borrower under the loan agreement over a period of time or provides other services (such as deposit accounts) to obtain information about the borrower in the relationship ((Allen, Saunders and Udell 1991; Petersen and Rajan 1994)). Therefore, the regression model shows that financial technology innovation is statistically significant to consumer loans, which supports the third hypothesis: Adoption will have a bigger impact on small banks's customer loans than on large banks. Banks that are smaller than the large e-commerce banks and their respective credit lines are generally smaller and based more on transactions than on loan/deposit transaction relationships that have generated profits over the years. Based on the transaction lending theories, it can be understood that mobile banking technology has had an impact on consumer loans.

"Finally, in terms of measuring the impact of mobile banking technology on the profitability of banks, the regression comes from the impact of mobile banking technology on the return on investment and return on equity of small banks. This supports the rejection of the original hypothesis and the acceptance of the fourth and fifth alternative hypotheses. The impact of small banks is much greater than the ROE and ROE of large banks. Other innovative theories that ICT plays a key role in reducing operating costs while generating new revenue streams also reflect the impact of product and process innovation brought about by mobile technology. This finding is consistent with the study of Kiyono (2019).

However, this conclusion is contrary to the results of Bashir (1999). Research shows that there is a relationship between profitability and bank size. The bigger the bank, the higher the profit margin. This shows that ROA and ROE have a greater impact on large banks. The reasons for the discrepancies between our research and the previous analysis. The researchers are partly due to the fact that the national background and the research time period are inconsistent".

V. CONCLUSION

To our knowledge, this research is one of the very few, if not the first, research conducted in Vietnam to investigate the impact of Fintech innovations on bank performance across mobile banking applications. The study results have broad implications for research. To begin with, the current research on the impact of fintech innovations on bank performance in Vietnam are mostly qualitative studies. Compared to us, our quantitative research investigates the impact of FinTech on banks financial performance carefully and in a comprehensive way through variables which come from all aspects in a bank's financial statements. Moreover, some previous research has shown that the impact of FinTech innovations on ROE was slightly. However, in Vietnam it can be seen from our regression results that ROE of banks is affected considerably by the development of FinTech. Last but not least, our studies have enriched the Strumpeter's Technological Innovation Theories especially on the first type of innovations: the introduction of a new product. In terms of future research, firstly, the studies may be ten years longer than ours, expanding the scope of the study to identify its effects over time. Secondly, it is very useful to expand the research field, when the impact of financial technology is no longer limited to the banking sector but is widely used across different industries.

Our studies have some practical implications. Firstly, the results show that FinTech innovations have a positive impact

on bank performance in Vietnam. Subsequently, bank's adoption of mobile technologies positively impacted banks' fee-based income, consumer loans and money market deposits. It is suggested that commercial banks in Vietnam should invest more about FinTech technologies to enhance their performance. Secondly, the effect of FinTech innovations laid a stronger impact on small banks than large banks. Large banks in Vietnam should consider further investment for a better financial system in the foreseeable future. Thirdly, the impact of market effects on a bank's financial performance is proved including GDP per capita, mobile phone penetration rate. Some recommendations have been suggested by our research team for both commercial banks and policy makers can be namely as further investment or legal framework for future.

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