VNU Journal of Economics and Business

Journal homepage: https://js.vnu.edu.vn/EAB

Original Article

The Role of Non-Credit Service in Bank Performance: Empirical Evidence in Vietnam

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Received: July 28, 2022
Revised: August 5, 2022; Accepted: August 25, 2022

Abstract: This paper examines the impact of non-credit services on Vietnamese bank performance from 2008 to 2017. The research investigates the impact of microeconomic factors, including non-interest service, capital ratio, overheads, loan assets, deposit assets, bank size, and number of ATMs. The empirical results suggest that the size of banks, non-credit services, deposit assets and overheads have been found to have a significant effect on bank performance. Moreover, our results demonstrate that income derived from non-credit services positively and significantly impacts bank performance estimated by Return on Assets (ROA) and Return on Equity (ROE). The study will address endogeneity issues through the Generalized Method of Moments (GMM) and the Two-stage least square method. Our results highlight the importance of income diversification to optimize banks' operational efficiency in the coming years. The study also explains the positive effect of non-credit services on bank performance. Bank service contributes to the diversification of a bank's products and services, thereby attracting more customers and retaining customers. Moreover, the development of non-credit products also increases a bank's position and disperses risks for the bank.

Keywords: Non-credit service, Two-stage least square, Generalize Method of Moments, financial performance, commercial banks.

1. Introduction

Recently, the technology wave is penetrating all sectors and fields of the economy, including the banking industry. The development of digital banking and other technological utilities are considered as the future trend of the industry. More and more non-credit services are being deployed by banks, such as e-wallets, payment gateways, mobile apps, or money collection, combined with other services based on bank identity accounts. These new services and utilities are introduced to attract customers and become a significant revenue source for banks.

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https://doi.org/10.25073/2588-1108/vnueab.4873

The proportion of income from bank non-credit services has increased rapidly over the years, which shows the significant development of customer service. Moreover, Vietnamese commercial banks focus on promoting the traditional business activities of the bank and compete fiercely for in-service provision. Many studies believe that non-credit services have impact on bank revenue and profit; they are important factors for customers to choose and maintain using the service of banks.

This study will overview the impact of non-credit services operations on bank overall performance. Based on empirical results, the research will give conclusions and suggestions for a bank's development plan to improve its operational efficiency.

The article's content consists of three parts: The first section after the introduction states the theoretical basis, gives an overview of the researches related to the topic and a description of the research methodology used. The second section presents the research results and discussion. Finally, the third section summarizes the conclusions drawn from the research findings and makes some recommendations.

2. Literature and hypothesis

2.1. Theoretical basis

Bank profitability measures the performance of a commercial bank. A bank's performance is based on two theories, including Market Power and Efficient Structure. The theory of Market Power is divided into two schools—Relative Market Power Theory and Structure, Behavior, Efficiency Theory. The theory of structure, behavior, efficiency states that the structure of the market affects a bank's behavior, and the behavior of the organization affects the bank's efficiency. Meanwhile, the relative-market-power theory illustrates that banks occupy large market shares, and differentiated products can competitively earn profit and exercise their market power.

Contrary to Market Power theory, the Efficient Structure theory states that the relationship between market structure and organizational performance is determined by firm performance. Accordingly, profitable organizations are firms that operate efficiently. Thus, the Market Power theory states that the core factor affecting bank performance is market factors, i.e., external factors. In contrast, the Effective Structural theory sets focus on a bank's internal factors that affect the bank's performance.

Therefore, factors affecting bank performance can be classified into two groups: the group of bank external factors and the group of bank internal factors:

i. The group of bank external factors can be listed as factors representing the economic environment, political institutions, domestic and foreign society, GDP growth, inflation, and interest rates.

ii. The group of bank internal factors includes the size of the bank (Size), the size of credit (Loan), the cost of operating (Overheads), and the capital adequacy ratio. These are the factors that reflect most the general business situation and non-credit products and services.

This paper aims to explore the impact of non-credit service on bank performance. The article will focus on the factors within a bank, the internal factors, to include in the model.

Dao Le Kieu Oanh and Pham Anh Thuy (2012) have illustrated that non-credit services increasingly account for a significant proportion of bank operations in the world. The advanced technology and new perspectives in business activities such as the "Sharing Economy" and deep cooperation in both width (between countries and regions) and depth (between service sectors in an economy) have pushed leading banks to develop services strongly. The study believed that non-credit activities brought high and stable income, with much less risk than credit activities. These banks believe that non-credit activities are supplementary to credit activities and expect to account for a higher proportion of their income.

Revenue from credit and revenue from non-credit activities are the two primary sources of income of commercial banks. For credit activities, this is the source of income from a bank's core business activities and always accounts for a high proportion (> 80%). However, in recent years, with the explosion of the Internet, new technologies in the banking-finance sector, such as ATMs, Live Banking, and, most recently, Blockchain, have resulted in the rapid growth of bank services. Thus, income from non-credit services will account for a significant proportion of a bank's income structure.

For developed countries, the banking system is expanded notably with modern technology platforms. The increase in income from non-credit activities based on advanced technology and network of distribution channels has a positive impact on bank performance and is less controversial. However, for developing countries like Vietnam, increasing non-credit services means investing a large amount of capital in modern technology and service foundation. Non-credit can lead to positive or negative results from an efficiency perspective.

From a positive perspective, the development of non-credit services based on modern technology and an unlimited distribution channel network can bring many convenient services and new experiences to customers. Therefore, banks have advantages in attracting and retaining customers, increasing market share, growing transactions, and increasing non-credit service revenue. Moreover, better response to non-credit service needs may also be a condition for improved credit services to traditional and new customers. The benefits gained from an increase in credit and non-credit services can completely offset and outweigh the increased costs of investing in new technology platforms and expanding banks' operational efficiency.

On the other hand, if a bank focuses too much on raising non-credit income, it has to invest a large number of resources in technology and distribution channels. Therefore, increasing non-interest fees for services but reducing attention to credit services can lead to a decrease in business efficiency. The increased benefits are not enough to cover the costs. A bank may lose customers or fail to increase new credit customers, leading to a decrease in market share or even incurring bad debts due to neglect in traditional credit services' performance. Thus, the bank faces a trade-off and needs to adjust to achieve the optimal point of grace. In this article, regression models will answer the question: "How has the increase in non-credit services of commercial banks in Vietnam in the past period affected bank operational efficiency?"

We expect that Vietnamese commercial banks with higher non-interest income ratios will have better bank performance.

2.2. Literature review

There have been many studies focusing on this topic in recent years. Al-Tarawneh et al. (2017) studies the effect of bank size, loan size, operating costs, and non-interest income on Jordannian's bank returns in the period 2010-2015. The dependent variable that measures operational efficiency is used as ROA, ROE. The research shows that bank operating costs reduce profit while bank size and loan size have a positive effect on Profits and non-interest income positive effects on a bank's profit.

DeYoung and Rice (2003) studied commercial banks in the US with operating efficiency measured by ROE variable from 1989 to 2001, showing that non-interest income accounted for 40% of banks' income structure. Research indicates that well-managed banks tend to grow non-interest income more slowly, and non-interest revenue and credit income growth are concurrent, not complementary. Interchangeable and credit activity is still the main business activity, bringing the primary source of profit for the bank.

Another study focuses on commercial banks by Kenya and Oniang'o (2015) showed that non-interest income positively affects banking operations. Besides, the model also shows the impact of a bank's size and liquidity on its

performance with the dependent variable representing the bank's performance as ROA.

Sun et al. (2016) used the Threshold Effect Model for commercial bank data in China. The dependent variable measuring bank performance is ROE. For the same result, the increase in resources to improve non-interest profit makes operation efficiency better at commercial banks.

In Vietnam, Le Long Hau and Pham Xuan Quynh (2017) examine the effect of non-interest income on 26 Vietnam commercial banks' performance using the estimating method with two dependent variables expressing the bank's performance, including ROA and ROE. The author has pointed out the positive impact of non-interest income on operating efficiency. Their research included variables reflecting both banking operations and variables representing the business and macroeconomic environments, such as outstanding loans, deposits, economic growth, and inflation. Moreover, several papers analyze the impacts of non-interest income on bank profit structure, but only at the analysis level for a specific bank, not an evaluation in general.

Many papers have examined the impact of variables such as loan size, operating costs, and credit risk on the profitability of the joint stock commercial bank and bank performance in Vietnam. However, the variable that is increasingly showing a rise in both proportion and speed in commercial banks' income structure, which is non-interest income, has not been clarified and updated with the latest updates.

3. Methodology

3.1. Sample

Our sample includes 39 commercial banks in Vietnam during the 2008-2017 period. Data are collected from audited financial statements, bank annual reports, the banker and SNL financial database. These data are all secondary data, ensuring the integrity of the data for the model's input.

The data on the variables serving in the model, including the derivative variables, are collected from commercial banks' financial statements and annual reports. Specifically, the research paper has collected non-credit interest data from the business activity reports, operating costs, return on, and return on assets. From the data on the balance sheet report, the model's remaining variables are collected, such as equity, size, and loan. Information is collected from official sources of banks.

3.2. Empirical model

In order to examine the impact of income from non-credit services on Vietnam banks' performance, we propose the following models:

Empirical Model

$$ROA_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t}$$

$$ROE_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t}$$

The dependent variables of the two models, Return on Assets (ROA) and Return on Equity (ROE), are chosen as the dependent variables to evaluate bank performance. The independent variables include the variable income from non-credit services (NonInterestincome), the Bank's equity ratio (Capital ratio), Operating expenses (Overheads), Loan assets (Loan Asset), Deposit asset, Number of ATMs (Total ATM), Size of the Bank (Bank Size).

Data used to research the impact of income from non-credit services on Vietnamese banks' performance in the 2008-2017 period are panel data. For regression analysis, the author uses the fixed effect model (FEM) and the random effect model (REM). The author first estimates the two

above FEM and REM models. The author instead uses the Hausman test to compare the FEM or REM versions. The results of the Hausman test show that two models have Prob: chi2 = 0.0000 < 0.05, so Fixed Effects Models (FEM) are more suitable than the Random Effect Model (REM). The study, therefore, uses the FEM model using the STATA 14 method to check the impact of income from non-credit services on Vietnamese banks' performance.

Table 1: Variables and measurement

Variable	Measurement
Return on Asset (ROA)	Return on assets, calculated as profit divided by total assets
Return on Equity (ROE)	Return on equity, which is calculated by profit divided by equity
Non-interest income	Income from non-credit services, which is calculated as income from non-credit service divided by total assets
Capital ratio	Capital adequacy ratio is calculated by equity divided by total assets
Overheads	Bank operating costs over total asset
Loan Asset	The indicator represents the size of a bank's loan, calculated by its total loan size divided by its total assets
Deposit asset	Deposit asset is calculated by total deposits divided by total assets
Amount of ATM (Total atm)	Number of ATMs
Bank Size	Natural logarithm of total bank size

Source: Propose by authors based on previous studies.

Table 2: Summary statistics

	Obs.	**St.Dev**	**Mean**	**Min**	**p25**	**Median**	**p75**	**max**
ROA	323	0.69	0.91	0.02	0.34	0.77	1.34	2.64
ROE	323	7.21	9.43	0.25	3.57	7.70	14.14	28.03
NonInterestincome	322	0.66	1.86	0.75	1.42	1.80	2.12	5.93
Loan asset	355	0.13	0.53	0.26	0.44	0.55	0.64	0.75
Deposit asset	363	0.13	0.63	0.29	0.54	0.64	0.72	0.87
Total ATM	390	1.39	5.42	3.3	4.3	5.06	6.91	7.87
Bank size	364	1.33	18.05	14.4	17.18	18.08	18.95	20.73
Capital ratio	390	0.16	0.28	0.09	0.12	0.19	0.46	0.46
Overheads	364	0.31	0.37	-0.87	0.26	0.40	0.55	0.90

Note: This table illustrates the summary statistics of dependent and independent variables including Number of Observations; Standard Deviation; Mean; Min; values of four quantiles; Max.
Source: Author's Stata computation.

4. Empirical results

4.1. Descriptive statistics and correlation analysis

The summary statistics table includes number of observations, mean, median, standard deviation, minimum value and maximum value of the variables in the research model.

Table 2 shows that the average ROA value for Vietnamese banks is 0.91 per cent for the period 2008 to 2017; while the mean ROE value is 9.43 per cent. That means that the average profit after tax is 0.91 dong when the company spends 100 dong of assets. Additionally, the total net profit of 100 VND invested in the company would be VND 9.43. The average value of the NonInterestincome statistic is 0.66, which means

the average income from non-credit service in the period 2008-2017 is 0.66% of their total company assets. The average value of the capital ratio is 0.28, meaning that equity divided by total assets is 28%.

Table 3 depicts the pairwise correlations between variables in model 1 and model 2. As can be seen from the table, all the correlation values remain lower than 0.8, implying the model does not experience a multi-collinearity issue.

Table 3: Pairwise correlations

Panel A: Correlation matrix in the first regression

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1] ROA	1.000							
[2] NII	0.248***	1.000						
[3] loan_asset	-0.107*	0.105*	1.000					
[4] deposit_asset	-0.282***	-0.082	0.549***	1.000				
[5] total_atm	0.029	-0.071	0.294***	0.245***	1.000			
[6] bank_size	-0.120**	-0.163***	0.297***	0.460***	0.512***	1.000		
[7] capital_ratio	0.025	0.099*	-0.050	-0.212***	-0.133***	-0.385***	1.000	
[8] Overhead	-0.482***	0.236***	0.122**	0.146***	-0.213***	0.064	0.049	1.000

Panel B: Correlation matrix in the second regression

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1] ROE	1.000							
[2] NII	0.062	1.000						
[3] loan_asset	0.048	0.105*	1.000					
[4] deposit_asset	-0.068	-0.082	0.549***	1.000				
[5] total_atm	0.313***	-0.071	0.294***	0.245***	1.000			
[6] bank_size	0.339***	-0.163***	0.297***	0.460***	0.512***	1.000		
[7] capital_ratio	-0.208***	0.099*	-0.050	-0.212***	-0.133***	-0.385***	1.000	
[8] Overhead	-0.434***	0.236***	0.122**	0.146***	-0.213***	0.064	0.049	1.000

Note: This table reports the correlation matrix of all variables in the models. The main variables are ROA and ROE measured by net income divided by total asset and total equity respectively. Other variables are Noninterestincome, capital ratio, overheads, Bank size, total ATM, deposit assets and loan assets. *, **, *** represents for significance at the 10%, 5%, and 1% levels respectively.
Source: Author's Stata computation.

4.2. The impact of income from non-credit service on bank performance

The impact of non-credit service on bank performance is illustrated in the following table.

Table 4: The impact of Noninterestincome on bank performance

Variables	(1)	(2)
	ROA	ROE
NonInterestincome	*0.321***	*3.283****
	(0.147)	*(1.108)*
loan_asset	0.206	5.290
	(0.597)	*(6.828)*
deposit_asset	-1.462***	-7.962
	(0.467)	*(4.926)*
total_atm	-0.030	-0.280
	(0.032)	*(0.414)*

bank_size	0.311**	7.672***
	(0.151)	*(1.647)*
capital_ratio	0.316	0.206
	(0.270)	*(3.193)*
overhead	-0.828***	-5.563***
	(0.254)	*(2.006)*
_cons	-3.504	-118.465***
	(2.794)	*(29.476)*
Obs.	316	316
R-squared	0.576	0.562
Year dummy	Yes	Yes

Note: This table reports the impact of income from non-credit service on operational efficiency using fixed effect models. The main dependent variables are ROA and ROE measured by net income divided by total asset and total equity respectively. Control variables are Noninterestincome, capital ratio, overheads, Bank size, total ATM, deposit assets and loan assets. *, **, *** represents for significance at the 10%, 5%, and 1% respectively.
Source: Author's Stata computation.

With the empirical model:

$$ROA_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t}$$

We have:

$$ROA_{i,t} = -3.504 + 0.321\ NonInterestincome_{i,t} + 0.316\ Capital\ ratio_{i,t} + (-0.828)\ Overheads_{i,t} + 0.206\ Loan\ asset_{i,t} + 0.311\ Bank\ Size_{i,t} + (-0.03) Total\ ATM_{i,t} + (-1.462) Deposit\ asset_{i,t}$$

With the empirical model:

$$ROE_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t}$$

We have:

$$ROE_{i,t} = -118.465 + 3.283\ NonInterestincome_{i,t} + 0.206\ Capital\ ratio_{i,t} + (-5.563) Overheads_{i,t} + 5.29\ Loan\ asset_{i,t} + 7.672\ Bank\ Size_{i,t} + (-0.280) Total\ ATM_{i,t} + (-7.962) Deposit\ asset_{i,t}$$

Illustrated in The impact of non-credit service on bank performance is illustrated in the following table.

Table 4:

Non-interest income

Income from non-credit service (α_1) in model 1 is 0.321 at a significance level of 1%. The coefficient of the Noninterestincome variable in model 2 is 3.283 at 10% significance. Therefore, income from non-credit service has a positive and statistically significant effect on two indicators which measure the bank's performance, namely, asset earnings and equity earnings of commercial banks in Vietnam. This means that, as a bank's income from non-credit service rises, operational efficiency always improves.

Loan assets

Coefficients of the Loan assets variable in model 1 and model 2 have the values of 0.206 and 5.290 with a significance level of 1% and 10%, respectively. Nevertheless, Loan asset has no significant impact on business performance of Vietnamese commercial banks.

Deposit assets

Beta coefficients of the variable of Deposit asset in model 1 and model 2 are both negative values. The Beta coefficient on the effect of deposit assets on ROA is -1.462, with a high significance level of 1%. However, the Beta coefficient of deposit assets effect on ROE is 7.962 but not statistically significant. This result shows that Deposit assets have a negative effect on income on assets of Vietnamese commercial banks, but not enough grounds to confirm the effect of deposit assets on owner equity.

The number of ATMs

The coefficients of ATMs in model 1 and 2 are negative and not statistically significant with a negative value of 0.030 and 0.280 with a significance level of 1% and 10%, respectively. Therefore, there is no evidence to show that the number of ATMs has any impact on Vietnamese commercial banks.

Bank size

The coefficient of Bank size in model 1 is 0.311 at a significance level of 1%. The coefficient of the Bank sizevariable in model 2 is 7.672 at 10% significance. Therefore, Bank size has a positive and statistically significant impact on two indicators which measure the bank's performance, namely, asset earnings and equity earnings of commercial banks in Vietnam. It means that, as the bank size expands, operational efficiency always improves.

Capital ratio

Capital ratio has positive Beta coefficients (0.316 and 0.206) and has no statistical significance of 1% in the two above models. Therefore, there is no evidence that capital ratio affects bank performance.

Overheads

The Beta coefficient of overheads in model 1 is -0.828 at a significance level of 1%. The coefficient of the Overheads' variable in model 2 is -5.563 at 10% significance. Therefore, overheads have a negative and statistically significant effect on ROA and ROE. This means that as a bank's overheads increase, operational efficiency always improves.

4. Conclusions

According to the model's result, to increase the operational efficiency of commercial banks, we can summarize that an increase in non-interest income is one of the important indicators to help Vietnamese banks improve operational efficiency. The coefficients of non-interest income in both models clearly show the effect of this variable on bank performance.

Furthermore, in the study of Dao Le Kieu Oanh and Pham Anh Thuy (2012), non-credit service is a very important factor in the operation and development of a bank. The research paper gives some main reasons to prove this point, such as: Non-credit service contributes to the diversification of a bank's products and services and thereby attracts more customers and retains customers. The development of non-credit products also increases the position of banks and disperses risks for a bank. Developing non-credit services will help the organization's income rise and expand opportunities to cooperate and work with other organizations. Besides, the banking services help customers save time, feel more comfortable, and they do not need to go to branches and transaction offices as much as before.

The results from the implementation model in the article show the importance and impact of non-credit services on the profitability and performance of commercial banks in Vietnam.

5. Robustness test

5.1. Two-stage least square

We capture possible endogeneity issues due to causal relationship between bank operational efficiency and NonInterestincome as follows:

$$ROA_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t} \quad (1)$$

$$NonInterestincome_{i,t} = \alpha_0 + \alpha_1 ROA_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t} \quad (2)$$

$$ROE_{i,t} = \alpha_0 + \alpha_1 NonInterestincome_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t} \quad (3)$$

$$NonInterestincome_{i,t} = \alpha_0 + \alpha_1 ROE_{i,t} + \alpha_2 Capital\ ratio_{i,t} + \alpha_3 Overheads_{i,t} + \alpha_4 Loan\ asset_{i,t} + \alpha_5 Bank\ Size_{i,t} + \alpha_6 Total\ ATM_{i,t} + \alpha_7 Deposit\ asset_{i,t} \quad (4)$$

Table 5: Two-stage least square

Variables	**ROA**		**ROE**	
	(1) **Fixed effect**	**(2)** **2SLS**	**(3)** **Fixed effect**	**(4)** **2SLS**
NonInterestincome	0.321**	0.363***	3.283***	2.407***
	(0.147)	*(0.053)*	*(1.108)*	*(0.613)*
loan_asset	0.206	-0.205	5.290	0.961
	(0.597)	*(0.321)*	*(6.828)*	*(3.117)*
deposit_asset	-1.462***	-0.282	-7.962	-4.217
	(0.467)	*(0.347)*	*(4.926)*	*(3.237)*
total_atm	-0.030	-0.015	-0.280	0.084
	(0.032)	*(0.034)*	*(0.414)*	*(0.355)*
bank_size	0.311**	0.026	7.672***	1.780***
	(0.151)	*(0.031)*	*(1.647)*	*(0.362)*
capital_ratio	0.316	0.154	0.206	-2.027
	(0.270)	*(0.227)*	*(3.193)*	*(2.098)*
overhead	-0.828***	-1.681***	-5.563***	-13.103***
	(0.254)	*(0.360)*	*(2.006)*	*(3.279)*
_cons	-3.504	0.817	-118.465***	-17.782**
	(2.794)	*(0.615)*	*(29.476)*	*(7.186)*
Obs.	316	235	316	235
R-squared	0.576	0.477	0.562	0.556
Year dummy	Yes	Yes	Yes	Yes

Note: This table reports the impact of income from non-credit service on operational efficiency using two-stage least square. The main dependent variables are ROA and ROE measured by net income divided by total asset and total equity respectively. Control variables are Noninterestincome, capital ratio, overheads, Bank size, total ATM, deposit assets and loan assets. Model (1) and (3) apply fixed effect model with confirmation of Hausman test. Model (2) and (4) apply two-stage least square. Standard errors are robust and clustered at firm level. *, **, *** represents significance at the 10%, 5%, and 1% levels respectively.

Source: Author's Stata computation.

Income from non-credit service has a positive and statistically significant impact on two indicators, which measure the bank's performance, namely asset earnings and equity earnings of commercial banks in Vietnam. This means that, as the bank's income from non-credit service rises, operational efficiency always improves.

5.2. Generalized method of moments

This research uses a two-step generalized method of moments (GMM) estimator to study the effect of non-interest income on bank performance. Arellano and Bond (1991) acquired GMM with consideration to the difference of the variables and they take the instruments to resolve any endogeneity issue. Moreover, Arellano and Bover (1995) and Blundell and Bond (1998) employed system GMM to tackle weak instruments issue. Lagged value of dependent variables is included to capture the dynamic nature of these variables and the potential endogeneity issue.

$$ROA_{i,t} = \alpha_0 + \alpha_1 ROA_{i,t-1} + \alpha_3 NonInterestincome_{i,t} + \alpha_3\, Capital\ ratio_{i,t} + \alpha_4\, Overheads_{i,t} + \alpha_5\, Loan\ asset_{i,t} + \alpha_6\, Bank\ Size_{i,t} + \alpha_7\, Total\ ATM_{i,t} + \alpha_8\, Deposit\ asset_{i,t} + \epsilon_{i,t}$$

$$ROE_{i,t} = \alpha_0 + \alpha_1 ROE_{i,t-1}\ \alpha_2 NonInterestincome_{i,t} + \alpha_3 Capital\ ratio_{i,t} + \alpha_4 Overheads_{i,t} + \alpha_5 Loan\ asset_{i,t} + \alpha_6 Bank\ Size_{i,t} + \alpha_7\, Total\ ATM_{i,t} + \alpha_8\, Deposit\ asset_{i,t} + \epsilon_{i,t}$$

We checked the model specification using the Hansen test and Arellano and Bond's test for zero correlation.

Table 6: Generalized method of moments (GMM)

	(1)	(2)	(3)	(4)
Variables	ROA	ROA	ROE	ROE
L.ROA		0.368**		
		(0.160)		
L.ROE				0.270
				(0.198)
NonInterestincome	0.321**	0.800***	3.283***	9.078***
	(0.147)	(0.237)	(1.108)	(2.528)
loan_asset	0.206	-1.920	5.290	-15.33
	(0.597)	(1.243)	(6.828)	(17.01)
deposit_asset	-1.462***	0.406	-7.962	7.575
	(0.467)	(0.790)	(4.926)	(10.52)
total_atm	-0.0296	-0.182	-0.280	-1.901
	(0.0315)	(0.267)	(0.414)	(3.536)
bank_size	0.311**	0.718***	7.672***	7.811***
	(0.151)	(0.186)	(1.647)	(2.869)
capital_ratio	0.316	0.00834	0.206	4.023
	(0.270)	(0.266)	(3.193)	(5.088)
Overhead	-0.828***	-1.643***	-5.563***	-14.36***
	(0.254)	(0.427)	(2.006)	(4.651)
Constant	-3.504	-11.60***	-118.5***	-133.9***
	(2.794)	(3.410)	(29.48)	(49.06)
Hansen test(p-value)	.	0.524	.	0.267
AR2(p-value)	.	0.168	.	0.812
Observations	316	276	316	276
R-squared	0.576	.	0.562	.

Note: This table reports the impact of non-credit service on operational efficiency using GMM. The main dependent variables are ROA and ROE measured by net income divided by total asset and total equity respectively. Control variables are Noninterestincome, capital ratio, overheads, Bank size, total ATM, deposit assets and loan assets. Model (1) and (3) apply fixed effect model with confirmation of the Hausman test. Model

(2) and (4) apply GMM. Standard errors are robust and clustered at firm level. Standard errors are reported in parentheses. *, **, *** represents for significance at the 10%, 5%, and 1% levels respectively.
Source: Author's Stata computation.

Income from non-credit service has a positive and statistically significant impact on two indicators, which measure the bank's performance, namely asset earnings and equity earnings of commercial banks in Vietnam. It means that, as the bank's non-interest income rises, bank performance always improves.

6. Recommendations

6.1. Recommendation for income from non-credit services

Vietnamese commercial banks should invest in technology and banking infrastructure to reduce processing time, transactions and make customers feel comfortable. It is necessary to improve the protection of customers' information and accounts. Therefore, commercial banks can avoid and limit unauthorized intrusion and loss of customer accounts. Moreover, reducing the time customers spend at transaction offices and branches when not needed has a vital role in attracting and retaining customers.

Vietnamese commercial banks need to pay attention to enhancing their links with third parties to bring more products and convenience to customers. The business environment has changed notably. New economic organizations have emerged, such as payment gateways, sharing applications, i.e., Grab, Bee, and booking applications.

Credit institutions, especially management, need to raise awareness of the role of non-credit products and service development in contributing to the organization's overall business performance and efficiency. Thus, organizations need to plan to control the bank's income ratio and avoid dependence on revenue from single-credit activities to minimize risks and diversify income sources.

It's important to innovate business operations, always looking for ways to meet customers' service needs, making a more positive difference compared to other organizations. There is a need to plan an investment strategy and execute it methodically with non-credit operations.

6.2. Investment and development trends that banks in Vietnam should apply

Fintech companies have made a certain mark on the market. Companies with intermediary payment platforms with payment gateways such as Paypal, Onepay, 1Pay and Momo are now associated with many parties accepting payment services. When using these companies' services, customers do not need to perform too many procedures anymore; all of these steps can be automated and affect banks' operations.

Fintech companies are bank competitors; they bring both opportunities and challenges to banks. Banks can cooperate with payment partners to provide a comprehensive service to customers from purchase to payment.

Vietnamese commercial banks also need to research and apply new technologies and new ways of operation to avoid risks from organizations operating in lending, similar to banks' credit operations. Banks with a capital advantage operating history have advantages to cooperate with third parties to improve the quality of services provided to customers or to invest in direct competitive development.

Instead of expanding branches and transaction offices, banks should develop digital banking systems. With the investment in digital banking, rented offices, and locations managed by a centralized arrangement can easily reach customers, , and can operate more smoothly than the traditional pattern.

In addition, manual processing jobs such as loan approvals for customers are now integrated for automated execution on organizations'

requests. This reduces risks and errors in the process of application, verification, and disbursement and saves a lot of time in these steps.

Currently, many new business models in the world can compete directly with the operations of banks— such as the P2P peer-to-peer lending platform in China (Alipay). These companies, with large financial resources invested and applying technological advancements, will perform a comprehensive customer assessment through credit information such as transaction history and income. However, there is also other non-credit information to disburse loans to customers. The intermediary payment service providers will provide a diversified payment platform with many partners; many providers can profit from the payment segment of commercial banks. Along with the rapid development of technology, more and more institutions can threaten a bank's operation.

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