JDI JOURNAL OF DEVELOPMENT AND INTEGRATION

JOURNAL OF DEVELOPMENT AND INTEGRATION
No. 79 (2024) 93-103 | jdi.uef.edu.vn

Factors affecting the profitability of commercial banks in Vietnam: Study on the role of digital transformation

Pham Nhu Phong*
Vietnam Joint Stock Commercial Bank for Industry and Trade (Vietinbank), Vietnam

KEYWORDS

Bank-Specific Factors,
Commercial Banks,
Digital Transformation,
Macroeconomic Factors,
Profitability,
Vietnam Banking Sector.

ABSTRACT

This study aims to evaluate the factors influencing the profitability of Vietnamese commercial banks in the context of witnessing economic fluctuations caused by the Covid-19 pandemic and digital transformation, which has been playing a crucial role in transforming and reshaping the operations of Vietnamese commercial banks. Using data from the financial statements of listed commercial banks (19 banks) and macroeconomic data from the World Bank (WB) during the period 2015 - 2022, the study applied a panel data regression model, specifically the fixed effects model (FEM) with the Clustered Standard Errors method (to address the shortcomings of the FEM model for panel data) to examine the relationship between bank-specific factors, macroeconomic factors, and bank profitability. The research results show that the capital adequacy ratio (CAP), economic growth (GDP), and inflation (INF) have a positive impact on bank profitability; of which, CAP has the strongest positive impact. Conversely, the loan-to-deposit ratio (LDR), liquidity (LIQ), cost-to-income ratio (CIR), and digital transformation (DT) have a negative impact on bank profitability; of which, LDR has the greatest negative impact. This study provides important insights for bank managers and policymakers. Specifically, banks should focus on strengthening their capital adequacy ratio, improving cost efficiency, and leveraging economic growth opportunities. At the same time, banks need to be cautious in managing their loan-to-deposit ratio, liquidity, and digital transformation activities to ensure sustainable profitability.

1. Introduction

The banking industry of Vietnam plays a significant role in the economy; however, the profitability of banks remains volatile and is influenced by various internal and external factors. While previous studies have examined some factors affecting bank profitability, such as size, asset quality, and risk management, a comprehensive assessment of these factors in the Vietnamese context, particularly after recent economic fluctuations caused by the COVID-19 pandemic, is still lacking. The pandemic shock has forced businesses and banks to restructure

* Corresponding author. Email: *phamnhuphong7878@gmail.com*

https://doi.org/10.61602/jdi.2024.79.11
Received: 20-Jul-24; Revised: 17-Sep-24; Accepted: 23-Sep-24; Online: 28-Nov-24
ISSN (print): 1859-428X, ISSN (online): 2815-6234

their operating models, with digital transformation emerging as an inevitable trend.

In the current context, digital transformation is reshaping bank operations and business results, bringing both positive and negative impacts. On the positive side, digital transformation supports process automation, reduces errors, and saves time, thereby improving operational efficiency (Nguyen, 2021). However, its downside is the need for significant investment in technology, infrastructure, and personnel training, which can increase operating costs (Nguyen et al., 2023).

Previous studies on the impact of digital transformation on bank profitability have some limitations in terms of measurement methods. Le and Ngo (2020) uses proxy variables such as the number of bank cards, ATMs, and POS machines, which may not fully reflect the meaning of digital transformation in the current context. Nguyen (2021) uses an ICT index but faces data continuity issues due to the pandemic. Nguyen et al. (2023) has a unique approach by considering digital transformation as a strategic direction, but it is limited in terms of the number of control variables.

Therefore, a comprehensive study is needed to assess the factors influencing the profitability of Vietnamese commercial banks, including both internal and external factors; digital transformation is considered a significant influencing factor. This study will provide evidence to help banks better understand the factors affecting profitability, thereby proposing solutions to improve operational efficiency and ensure sustainable development. To achieve this goal, the study uses a panel data regression model with data from the financial statements of Vietnamese commercial banks listed on the stock exchange from 2015 to 2022.

2. Literature review, hypotheses and model research

2.1. Theoretical framework

2.1.1. Structure - Conduct - Performance (SCP) Theory

The Structure - Conduct - Performance (SCP) theory was developed in the 1930s by Edward Mason and Joe Bain (Truong Quang Thong, 2010). SCP is a theoretical framework developed in economics to analyze the relationship between market structure, the behavior of firms in that market, and economic performance.

SCP theory refers to (1) The relationship between structure and conduct: Market structure influences the behavior of firms. (2) The relationship between conduct and performance: Firm's behavior will affect economic performance. (3) The relationship between structure and performance: Market structure can also directly affect economic performance.

In banking, SCP theory has been applied in the analysis of competition (Berger et al., 1998), understanding the impact of pricing strategies on profits (Neuberger, 1997), and assessing performance (Molyneux & Thornton, 1992).

In terms of performance evaluation, SCP provides an analytical framework to assess the performance of banks through indicators such as ROA, ROE, and thereby helps banks adjust their business strategies accordingly (Molyneux & Thornton, 1992).

In terms of empirical studies, Gilbert (1984) reviewed studies on banks in the United States and found that 32 out of 44 studies supported SCP theory. Studies using data from banks in Europe also found support for SCP (Molyneux & Forbes, 1995; Molyneux et al., 1996).

SCP theory provides a useful tool for analyzing the relationship between market structure, firm conduct, and economic performance. The application of SCP theory in the banking and finance sector helps researchers and managers better understand how the banking market operates, thereby making sound strategic decisions.

2.1.2. Efficiency Structure (ES) Theory

Efficient Structure (ES) Theory was developed from studies in the field of industrial economics. Demsetz (1973) and Peltzman (1977) were prominent contributors to this theory. Demsetz (1973), in his research, emphasized that firms with higher efficiency would have lower costs, better competitive advantages, and hence dominate the market.

The main arguments of ES Theory can be summarized as follows: (1) efficiency leads to market structure, (2) efficiency leads to behavior,

(3) the relationship between efficiency and profit.

In the banking sector, ES Theory is applied to (1) analyze bank efficiency (Berger, 1997), (2) build a competitive strategy by optimizing operating efficiency (Maudos & Guevara, 2007), (3) develop policies to enhance operating efficiency (Hughes & Mester, 2013).

ES Theory emphasizes the role of firm efficiency in shaping market structure and competitive behavior. Applying this theory in the banking finance sector provides a better understanding of the relationship between operating efficiency and market position, thereby enabling the development of appropriate strategies and policies.

In an empirical perspective, the research of Simatele et al. (2018) integrated SCP theory and ES theory to test the relationship between market structure and profitability in the banking sector in South Africa. Simatele et al. (2018) also argued that many recent studies have tested the integration of ES theory into SCP theory in studying the relationship between structure and performance.

In general, SCP theory only focuses on external factors while ignoring the internal factors of the business. ES theory does not fully reflect external factors that affect business operational efficiency (e.g., political institutions, legal regulations, macroeconomic environment, market fluctuations...). Therefore, the research will simultaneously approach these two theories to complement each other in building arguments about the factors affecting the profitability of commercial banks.

2.1.3. Bank Profitability

Profitability is an important financial indicator that reflects the operational efficiency of a business, especially banks. According to Heibati and colleagues (2009), profitability measures the degree of success of a bank in generating profits from available resources, exceeding operating costs and meeting growth needs. In the banking sector, two common indicators used to assess profitability are return on assets (ROA) and return on equity (ROE) (Lam & Anh, 2022).

ROA indicates the bank's ability to convert the bank's assets into net income. This is a tool to measure the effectiveness of capital allocation and management of the bank's resources and to assess the profitability of assets (Lam & Anh, 2022). As Golin (2001) pointed out, ROA has emerged as a key indicator for assessing bank profitability and has become the most common indicator for measuring bank profitability in research literature (Dietrich & Wanzenried, 2014).

2.2. Brief overview of relevant empirical studies

Bank profitability has been a widely studied topic since the past. Early studies include Short (1979) and Bourke (1989), followed by a series of studies identifying factors affecting bank profitability (Dietrich & Wanzenried, 2014).

Studies by Gilbert (1984), Molyneux & Forbes (1995), Molyneux et al. (1996), Athanasoglou et al. (2006), Truong Quang Thong (2010) have used and tested SCP theory to analyze factors affecting the profitability of banks in the United States, Europe, Japan, and Vietnam.

Research by Petria et al. (2015), Le (2017), Simatele et al. (2018) approach ES theory and the integration of ES theory with other theories when analyzing the impact of factors on bank profits in Europe, Vietnam, and South Africa.

Studies by Dietrich and Wanzenried (2014), Djalilov and Piesse (2016), Le and Ngo (2020), Smolina et al. (2023), Le (2017), Vinh (2017), Le et al. (2022) use the Generalized Method of Moments (GMM) estimation method; while studies by Athanasoglou et al. (2006), Petria et al. (2015), Menicucci & Paolucci (2016), Adelopo et al. (2018), Nguyen et al. (2018), Ali and Puah (2018), Batten and Vo (2019), Nguyen (2020), Nguyen (2021), Le et al. (2023) use the panel data estimation method (FEM, REM model) to estimate the model of factors affecting bank profitability at the regional level (multiple countries in different continents) and individual countries (including Vietnam).

The empirical results of the above studies have similarities and also differences. The differences come from the differences in data sets, research periods (time), research contexts (country/region of research: different economic environments, different regimes, different financial market development), estimation methods, and the selection and measurement of research variables. However, there are still some common factors to classify the factors affecting bank profitability, whether the research is at the regional level

(multiple countries in different continents) or individual countries (including Vietnam).

In most studies, internal factors or bank-specific factors such as bank size, operating efficiency, asset quality, capitalization, credit risk, liquidity, etc., play a decisive role in bank profitability (for example: Menicucci & Paolucci, 2016; Almaqtari et al., 2018; Adelopo et al., 2018; Ali & Puah, 2018; Nguyen, 2020; Batten & Vo, 2019; Le et al., 2023; Dietrich & Wanzenried, 2014; Smolina et al., 2023; Petria et al., 2015; Djalilov & Piesse, 2016; Vinh, 2017; Adelopo et al., 2018; Le et al., 2022; Le, 2017; Ali & Pual, 2018; Truong Quang Thong, 2010).

Notably, an internal factor that has emerged recently is technology and digital transformation, which has been considered as a factor affecting bank profitability. Research by Le & Ngo (2020), Nguyen (2021), Nguyen et al. (2023) has provided initial evidence of the relationship between technology and digital transformation with bank profitability.

Exogenous factors determine a bank's profitability, including factors such as inflation rate, GDP growth, GDP per capita, and variables representing market characteristics (e.g., market concentration). Research by Athanasoglou et al. (2006), Petria et al. (2015), Djalilov & Piesse (2016), Le, (2017), Vinh (2017), Adelopo et al. (2018), Almaqtari et al. (2018), and Le & Ngo (2020) have found a relationship between GDP growth, inflation, market concentration, and bank profitability.

GDP growth typically has a positive impact on bank profitability, while inflation can have either a positive or negative impact depending on the research context.

The impact of market concentration on bank profitability remains controversial. Some studies show a positive impact (Athanasoglou et al., 2006), while others show a negative impact (Le, 2017; Le and Ngo, 2020).

Generally, the evolving landscape of bank profitability research reflects an increasing focus on investigating this phenomenon across diverse geographical and temporal contexts. While internal and external determinants continue to be central to these investigations, the precise influence of factors such as market concentration, however, remains a subject of ongoing scholarly debate. Furthermore, technological advancements and digital transformation in banking are rapidly emerging as a fertile ground for future research endeavors.

2.3. Research Hypothesis

Based on the inherited results of previous empirical studies, specifically: (1) internal and external factors; (2) the impact of technology and digital transformation; we propose the following factors that impact the profitability (ROA) of Vietnamese commercial banks listed on the stock market from 2015 to 2022:

ROA: ROA is measured as the ratio of net profit after tax to average total assets. This is the most common indicator for assessing bank profitability and has been used in many previous studies (Dietrich & Wanzenried, 2014; Athanasoglou et al., 2008; Batten & Vo, 2019; Le & Ngo, 2020).

SIZE: Bank size is measured by the natural logarithm of total assets. Larger banks often have economies of scale, which helps reduce costs and increase profitability (Batten & Vo, 2019; Le et al., 2023). Studies by Menicucci & Paolucci (2016), Almaqtari et al. (2018), Nguyen (2020), Batten & Vo (2019), and Le et al. (2023) all indicate that bank size has a significant (positive/negative) impact on profitability.

Hypothesis H1: Bank size has a positive/ negative impact on the profitability of commercial banks.

CAP: Capital adequacy ratio is measured as the ratio of equity capital to total assets. A high CAP indicates that the bank has a better ability to withstand risks, which allows it to engage in more profitable business activities. This variable has been shown to have a positive impact on ROA in the research of Almaqtari et al. (2018); Menicucci & Paolucci (2016); Smolina et al. (2023).

Hypothesis H2: Capital adequacy ratio has a positive impact on the profitability of commercial banks.

CREDIT RISK (CRE): Credit risk is measured by the non-performing loan ratio (NPL ratio, the ratio of non-performing loans to total outstanding loans). A high NPL ratio negatively impacts profitability due to increased credit risk provisioning costs and reduced interest income (Petria et al., 2015; Djalilov & Piesse, 2016; Vinh,

2017; Adelopo et al., 2018; Le et al., 2023).

Hypothesis H3: Credit risk has a negative impact on the profitability of commercial banks.

LENDING TO DEPOSIT RATIO (LDR): Loan-to-deposit ratio (LDR). This ratio is measured by dividing total loan outstanding by total deposits. LDR can have a positive or negative impact on profitability. Banks using more customer deposits for lending generate higher interest income, which directly increases bank profits. Conversely, an excessively high LDR can lead to increased risks (liquidity risk leading to higher funding costs; credit risk due to relaxed lending standards leading to declining credit quality and rising non-performing loans; increased operating costs due to higher interest payments to maintain a high LDR), reducing bank profitability. Petria, Capraru, and Ihnatov's (2015) research found evidence of a negative impact of LDR and ROA. In the context of research in Vietnam, Le et al. (2022) also found a negative impact of LDR and ROA.

Hypothesis H4: The loan-to-deposit ratio (LDR) has a negative impact on the profitability of commercial banks.

LIQUIDITY (LIQ): Liquidity is measured by the ratio of liquid assets to total assets. In previous studies, the relationship between liquidity and profitability is unclear; some studies show a positive impact (Menicucci & Paolucci, 2016; Almaqtari et al., 2018; Le, 2017); while Ali & Puah's (2018) study shows no significant impact. For the Vietnamese context before 2010, Truong Quang Thong's (2010) research shows a negative impact of liquidity on the profitability of commercial banks.

Hypothesis H5: Liquidity has a positive/ negative impact on the profitability of commercial banks.

COST-TO-INCOME RATIO (CIR): Cost efficiency is measured by the cost-to-income ratio. Higher cost efficiency (lower cost-to-income ratio) helps banks reduce operating costs and increase profits (Dietrich & Wanzenried, 2014; Petria et al., 2015; Almaqtari et al., 2018; Nguyen, 2020; Batten & Vo, 2019; Le et al., 2023).

Hypothesis H6: Cost efficiency has a negative impact on the profitability of commercial banks (A high cost-to-income ratio has a negative impact on the profitability of commercial banks).

DIGITAL TRANSFORMATION (DT): Digital transformation will be measured by the frequency of keywords related to digital transformation (digital transformation, digital, digital transformation, online banking, digital banking, big data, Blockchain, Fintech, AI, artificial intelligence) in the annual reports (2015 – 2022) of commercial banks. This is a common method for measuring digital transformation (Kriebel & Debener, 2019; Verhoef et al., 2021). Digital transformation can impact bank profitability in various ways. On the one hand, it can help banks reach new customers, offer new products and services, and enhance operational efficiency, thereby increasing profits (Nguyen, 2021). Furthermore, digital transformation will help save time, optimize operational processes, and better manage risks; therefore, digital transformation will contribute to reducing operating costs, improving work efficiency, and enhancing bank performance (Nguyen et al., 2023). On the other hand, digital transformation can also increase investment and operating costs, as well as cybersecurity risks, which can negatively impact profits (Nguyen et al., 2023).

Hypothesis H7: Digital transformation has a positive/negative impact on the profitability of commercial banks.

GDP: Higher economic growth creates favorable conditions for bank operations, increases credit demand, and improves asset quality, thereby positively impacting profits (Petria et al., 2015; Djalilov & Piesse, 2016; Le, 2017; Vinh, 2017; Adelopo et al., 2018; Le & Ngo, 2020).

Hypothesis H8: Economic growth has a positive impact on the profitability of commercial banks.

INFLATION: Inflation can have either a positive or negative impact on bank profits depending on its level and the bank's ability to pass on inflation costs to customers (Athanasoglou et al., 2006; Djalilov & Piesse, 2016; Le, 2017; Vinh, 2017; Almaqtari et al., 2018; Le & Ngo, 2020).

Hypothesis H9: Inflation has a positive/negative impact on the profitability of commercial banks.

2.4. Research Model

Based on the proposed research hypotheses, the research model of factors affecting the profitability of Vietnamese commercial banks in the period 2015-2022 is as follows:

Table 1. Description of variables used in the model

Variables	Description	Calculation Method	References	Expected Sign
ROA	Return on Assets	Net Income/Average Total Assets	Dietrich & Wanzenried (2014), Athanasoglou et al. (2008), Batten & Vo (2019), Le & Ngo (2020)	
SIZE	Bank Size	Natural logarithm of total assets	Menicucci & Paolucci (2016), Almaqtari et al. (2018), Nguyen (2020), Batten & Vo (2019), Le et al. (2023)	+/-
Capital Adequacy Ratio (CAP)	Bank capital adequacy ratio	Equity/Total Assets	Almaqtari et al. (2018), Menicucci & Paolucci (2016), Smolina et al. (2023)	+
Commercial Real Estate (CRE)	Bank credit risk (non-performing loan ratio)	Non-performing loans/Total outstanding loans	Petria et al. (2015), Djalilov & Piesse (2016), Vinh (2017), Adelopo et al. (2018), Le et al. (2023)	-
Loan-to-Deposit Ratio (LDR)	Loan-to-deposit ratio	Total outstanding loans/ Total deposits	Petria, Capraru and Ihnatov (2015), Le et al. (2022)	-
Liquidity (LIQ)	Bank liquidity	Liquid assets (cash, bank deposits, liquid securities)/ Total assets	Menicucci & Paolucci (2016), Almaqtari et al. (2018), Le (2017), Truong Quang Thong, (2010)	+/-
Cost-to-Income Ratio (CIR)	Bank cost efficiency (management efficiency)	Cost-to-income ratio	Dietrich & Wanzenried (2014), Petria et al. (2015), Almaqtari et al. (2018), Nguyen (2020), Batten & Vo (2019), Le et al. (2023)	-
DIGITAL TRANSFORMATION (DT)	Digital transformation	Digital transformation is measured by the frequency of keywords related to digital transformation in annual reports	Nguyen et al. (2023)	+/-
Gross Domestic Product (GDP)	Economic growth	Average GDP growth (year) per capita (%)	Petria et al. (2015), Djalilov & Piesse (2016), Le (2017), Vinh (2017), Adelopo et al. (2018), Le & Ngo (2020)	+
INFLATION	Inflation	Consumer Price Index (%)	Athanasoglou et al. (2006), Djalilov & Piesse (2016), Le (2017), Vinh (2017), Almaqtari et al. (2018), Le & Ngo (2020)	+/-

$$ROA_{it} = \beta_{0i} + \beta_1.SIZE_{it} + \beta_2.CAP_{it} + \beta_3.CRE_{it} + \beta_4.LDR_{it} + \beta_5.LIQ_{it} + \beta_6.CIR_{it} + \beta_7.DT_{it} + \beta_8.GDP_{it} + \beta_9.INF_{it} + \varepsilon_{it}$$

Where:

ROA_{it}: Return on assets of bank i at time t;

$SIZE_{it}$: Size of bank i at time t, CAP_{it}: Capital adequacy ratio of bank i at time t, CRE_{it}: Credit risk of bank i at time t, LDR_{it}: Loan-to-deposit ratio of bank i at time t, LIQ_{it}: Liquidity of bank i at time t, CIR_{it}: Cost-to-income ratio of bank i at time t, DT_{it}: Digital transformation of bank i at time t, GDP_{it}: Economic growth at time t, INF_{it}: Inflation at time t;

εit: Random error.

3. Research Methodology

3.1. Research process and objective

The data used in this study was collected from audited financial statements of Vietnamese commercial banks (FS) listed on the stock market (19 banks) from 2015 to 2022. GDP and INF data were collected from the World Bank database. Digital Transformation (DT) data was collected from annual reports of commercial banks (2015 - 2022).

3.2. Data Analysis Method

For panel data (static), three common estimation methods are employed for model estimation: Pooled Ordinary Least Squares (OLS) regression, Fixed Effects Model (FEM), and Random Effects Model (REM).

To select the appropriate model, we will conduct the Breusch and Pagan Lagrangian multiplier test (to choose between REM and

Table 2. Descriptive statistics of variables used in the study (World Bank)

Variable	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
ROA	150	1.357	0.922	0.001	4.108
SIZE	150	19.420	0.882	17.691	21.475
CAP	150	0.083	0.032	0.037	0.220
CRE	150	0.015	0.017	-0.014	0.158
LDR	150	0.934	0.171	0.449	1.469
LIQ	150	36.365	12.102	1.865	72.281
CIR	150	78.208	12.876	36.071	99.932
DT	150	25.740	36.921	0.000	160.000
GDP	150	5.150	1.966	1.699	7.229
INF	150	2.673	0.934	0.631	3.540

Table 3. Correlation Matrix and VIF among variables

	ROA	GDP	INF	LDR	DT	Size	CAP	CRE	LIQ	CIR	VIF
ROA	1										
GDP	-0.0709	1									1.11
INF	0.1774	0.1654	1								1.11
LDR	0.4718	-0.1052	0.1961	1							2.54
DT	0.3109	-0.2339	0.0473	0.477	1						2.07
Size	0.0939	-0.1187	0.1338	0.2937	0.5403	1					1.98
CAP	0.6001	-0.0695	-0.0037	0.3616	0.2557	-0.0938	1				1.53
CRE	-0.0269	0.068	-0.0685	0.0959	-0.0414	-0.0621	0.1909	1			1.13
LIQ	-0.142	0.0782	-0.1368	-0.6048	-0.1979	-0.3995	-0.1292	-0.118	1		2.27
CIR	-0.9075	0.1018	-0.1101	-0.3191	-0.3448	-0.1774	-0.3814	0.1498	-0.0784	1	1.61

OLS), the F-test (to choose between FEM and OLS), and the Hausman test (to choose between FEM and REM). Once the suitable estimation method is identified, the Wooldridge test, the Wald test, etc., will be performed to detect any model misspecifications (autocorrelation, heteroscedasticity). In the presence of such issues, we will address them using appropriate estimation techniques (depending on the data characteristics and the specific misspecification) to ensure the robustness of the estimated coefficients.

4. Research Results and Discussion

4.1. Descriptive statistics of research variables

The descriptive statistics of the variables in the model in Table 2 show:

The average ROA is 1.357%, ranging from a low of 0.001% to a high of 4.108%. This indicates a significant difference in profitability between banks in the research sample.

The average size (Size) of banks is 19.42, with relatively small dispersion (standard deviation 0.882). The capital adequacy ratio (CAP) and non-performing loan ratio (CRE) have average values of 0.083 and 0.015, respectively, with low standard deviations. The loan-to-deposit ratio (LDR) has an average value of 0.934, ranging from 0.449 to 1.469.

The liquidity ratio (LIQ) and cost-to-income ratio (CIR) have average values of 36.365% and 78.208%, respectively, with a fairly wide range.

The level of digital transformation (DT) has an average value of 25.74, but has a large standard deviation (36.921), indicating a significant difference in the level of interest in digital transformation between banks in the research sample.

Economic growth (GDP) has an average value

Table 4. Results of the tests of the panel data model

Test statistic	Test statistic value	p-value	Conclusion
Cross-section F test	F = 10.32	0.0000	FEM model is more appropriate than Pooled OLS
LM – Breusch and pagan Lagrangian Multiplier test	Chi-square = 76.69	0.0000	REM model is more appropriate than Pooled OLS
Hausman test	Chi-square = 29.88	0.0005	FEM model is more appropriate than REM

Table 5. Results of autocorrelation and variance test of the FEM model

Test	Test statistic value	p-value	Conclusion
Wooldridge test	F = 22.346	0.0002	Autocorrelation
Modified Wald test	Chi-square = 2339.16	0.0000	Heteroscedasticity

Table 6. FEM Model Estimation Results using Clustered Standard Errors Method

ROA	Coef.	Std. Err.	t	P > t	[95% Conf.	Interval]
Size	0.159941	0.101937	1.57	0.1340	-0.05422	0.374103
CAP	4.167435	0.772007	5.4	0.0000	2.545508	5.789362
CRE	-0.5036221	0.509146	-0.99	0.3360	-1.5733	0.566054
LDR	-0.605779	0.233905	-2.59	0.0180	-1.0972	-0.11436
LIQ	-0.0239505	0.006501	-3.68	0.0020	-0.03761	-0.01029
CIR	-0.0629216	0.001783	-35.3	0.0000	-0.06667	-0.05918
DT	-0.0018611	0.000771	-2.41	0.0270	-0.00348	-0.00024
GDP	0.0160538	0.006958	2.31	0.0330	0.001435	0.030673
INF	0.0348608	0.015723	2.22	0.0400	0.001828	0.067893
_cons	4.142568	1.989913	2.08	0.0520	-0.03808	8.32322
F (9,18)	266.45***					
Odd(ui, Xb)	-0.0723***					

*Note: *** indicates the 1% significance level; the significance level for interpreting the estimation results is chosen as 5%.*

of 5.15% and average inflation (INF) is 2.673%, indicating a stable macroeconomic environment during the research period.

4.2. Correlation Matrix and VIF among variables

According to Vo Xuan Vinh (2014), the correlation coefficient between independent (explanatory) variables is less than 0.8 (in absolute value terms) then the problem of multicollinearity is not a problem of concern in the regression model. The results in Table 3 show that the correlation coefficients between the explanatory variables are all less than 0.8 (in absolute value terms). Furthermore, the variance inflation factor (VIF) of the variables is all less than 10, so it is possible to conclude that the phenomenon of multicollinearity does not seriously affect the estimation results of the model (Vuong Duc Hoang Quan, 2014).

4.3. Regression results

The test results in Table 4 show that the FEM model is a suitable model used to estimate the regression model.

Estimating the FEM model and performing the test of variance of changing errors, autocorrelation test. The results in Table 5 show that the FEM model has a phenomenon of changing error variance and autocorrelation.

For panel data with the number of cross-sectional units (N) > time series (T), the Clustered Standard Errors estimation method is an effective method to overcome the phenomenon of changing error variance and autocorrelation (Cameron et al., 2005; Wooldridge, 2010). Therefore, the study will use this method to improve the accuracy of the estimates.

The results in Table 6 show that the coefficients of bank size (SIZE) and credit risk (CRE) are not

statistically significant (p-value > 0.05). This suggests that bank size and credit risk do not have an impact on the profitability (ROA) of banks in the research sample.

Capital adequacy ratio (CAP), GDP growth (GDP), and inflation (INF) have a positive impact on bank profitability (the coefficients of CAP, GDP, and INF are greater than 0 and statistically significant (p-value < 0.05).

Loan-to-deposit ratio (LDR), liquidity (LIQ), and cost-to-income ratio (CIR) have a negative impact on bank profitability (the coefficients of LDR, LIQ, and CIR are less than 0 and statistically significant (p-value < 0.05).

For digital transformation (DT), the coefficient of DT is less than 0 and statistically significant (p-value < 0.05). This indicates that digital transformation has a small negative impact on bank profitability.

4.4. Discussion of the research results

The results show that bank size (SIZE) does not have an impact on ROA (p-value = 0.134). Although not statistically significant, the estimated coefficient of the bank size variable is positive (> 0), which suggests that larger banks may have scale advantages that contribute to increased profitability.

The coefficient of CAP (Capital adequacy ratio) is highly statistically significant and shows a significant positive impact on ROA (p-value = 0.000). This is consistent with the research of Almaqtari et al. (2018) and Menicucci & Paolucci (2016), who confirm that a high equity ratio helps banks better withstand risk and achieve higher profits. In the context of Vietnam, this result reflects the reality that banks with high equity ratios tend to operate more stably and efficiently, thanks to their better risk management capabilities and strong financial position (Nguyen Minh Sang, 2021).

Credit risk (CRE) is not statistically significant in the model (p-value = 0.336). This is not consistent with many previous studies such as Petria et al. (2015) and Djalilov & Piesse (2016), who point out that credit risk often has a negative impact on profitability. During the research period (2015–2022), Vietnamese commercial banks basically had good control over non-performing loans (Tran Huy Tung & Le Thi Minh Ngoc, 2022). Therefore, the variation of credit risk (NPL) during this period did not significantly explain the profitability of commercial banks.

The coefficient of LDR (Loan-to-deposit ratio) shows a negative and statistically significant impact on ROA (p-value = 0.018). This is consistent with the research of Petria et al. (2015) and Le et al. (2022), who point out that when banks increase their loan-to-deposit ratio, profits may decrease due to associated risks such as liquidity and credit risk. This result reflects that Vietnamese banks need to be cautious in balancing their loan-to-deposit ratio to avoid risks that could affect profitability.

The results show that liquidity (LIQ) has a significant negative impact on ROA (p-value = 0.002), a result consistent with the research of Truong Quang Thong (2010). This may be due to the high opportunity cost of maintaining liquid assets and the negative impact on profitability. This result suggests that banks need to optimize liquidity management to ensure efficient use of capital.

The coefficient of CIR (cost-to-income ratio) is highly statistically significant and shows a negative impact on ROA (p-value = 0.000), a result consistent with previous studies such as Almaqtari et al. (2018) and Nguyen (2020). This result also confirms that efficient cost management is a key factor in helping banks increase profits. This is particularly important in the context of increasing competition in the banking industry in Vietnam, where efficient cost management can create a competitive advantage.

Digital transformation (DT) has a small but statistically significant negative impact on ROA (p-value = 0.027), a finding consistent with Nguyen et al. (2023). In recent years, commercial banks in Vietnam have been focusing on investment activities to innovate technology, develop new sales channels through technology platforms, and are gradually digitizing their core services with the goal of enhancing customer experiences, increasing market share, increasing profits, and enhancing competitiveness (Nguyen & Le, 2023). It can be seen that the cost of investment in digital transformation is accounting for a significant proportion of the cost structure of banks. This leads to the fact that in the early stages of digital

transformation, due to the large initial investment costs, digital transformation will negatively affect the profitability of banks. However, in the long term, digital transformation can bring greater benefits if banks have a reasonable strategy to leverage new technologies and manage related risks.

The GDP coefficient is statistically significant and has a positive impact on ROA (p-value = 0.033), reflecting that higher economic growth improves bank profitability. This finding aligns with previous studies such as Petria et al. (2015) and Djalilov & Piesse (2016). Economic growth creates a favorable environment for bank operations, increasing credit demand and improving asset quality.

The Inflation (INF) coefficient is statistically significant and shows a positive impact on ROA (p-value = 0.040), a finding consistent with the research of Djalilov & Piesse (2016) and Le (2017). This could be attributed to the bank's ability to pass on inflation costs to customers, maintaining profit margins in an inflationary environment.

5. Conclusion and Policy Implications

5.1. Conclusion

The findings of this study provide important insights into the factors influencing the profitability of commercial banks in Vietnam during the period 2015-2022. Key findings include the importance of capital adequacy ratio, economic growth, and inflation control in improving ROA. At the same time, the study also highlights challenges related to loan-to-deposit ratio, liquidity, cost management efficiency, and digital transformation, suggesting that banks should carefully consider these factors when implementing related strategies.

These results not only contribute to the existing economic theory but also provide a basis for further research and banking management practices in Vietnam. Bank managers can use these results to adjust strategies to optimize profits, while researchers can further explore other factors affecting bank performance in different contexts.

5.2. Policy Implications

Based on the research results, we propose some specific policy recommendations to improve the profitability of Vietnamese commercial banks, as follows:

Increase Capital Adequacy Ratio (CAP): Banks should maintain and increase capital adequacy ratios to enhance risk resilience and ensure financial stability.

Manage Cost to Income Ratio (CIR) Effectively: Strengthen control over operating costs and optimize management processes to reduce the cost-to-income ratio. Leverage technology and automation to enhance operational efficiency.

Control Loan to Deposit Ratio (LDR): Ensure that the loan-to-deposit ratio is at a reasonable level to avoid liquidity and credit risks. Consider diversifying the product and service portfolio to mitigate credit risk.

Manage Liquidity (LIQ): Optimize liquidity management, ensuring adequate liquidity to meet short-term needs without increasing opportunity costs. Utilize modern liquidity management tools to optimize the use of liquid assets.

Promote Digital Transformation (DT): Invest in digital transformation with a clear strategy, ensuring effective use of technology and managing cybersecurity risks. Train staff and improve technology infrastructure to maximize the benefits of digital transformation.

Leverage Economic Growth (GDP) and Control Inflation (INF): Take advantage of the high economic growth and controlled inflation environment to expand business operations and improve asset quality. Adjust business strategies in line with macroeconomic conditions.

5.3. Limitations and Future Research Directions

Alongside its contributions, this research also has some limitations:

Firstly, the study only uses ROA (return on assets) to measure profitability, not incorporating other profitability metrics such as ROE (return on equity), NIM (net interest margin), and EVA (economic value added). Future research should combine these profitability metrics to gain a multi-dimensional perspective on bank profitability.

Secondly, the research independently examines the impact of factors on bank profitability, without considering the interactive effects of some factors on bank profitability. For example, the interactive

effect of bank size on credit/liquidity risk or the interactive effect of digital transformation on cost management efficiency on bank profitability. Subsequent studies need to analyze the interactive relationship between different factors and how they jointly affect bank profitability.

Thirdly, the research has not considered the role of internal factors such as management competence, the role of board members, bank ownership structure; and macroeconomic factors such as interest rates, exchange rates on bank profitability. This is a direction for further research.

Fourthly, the sample only includes 19 listed commercial banks, limiting its generalizability. Future research should expand the sample to include unlisted commercial banks to ensure the comprehensiveness of the research issue.

REFERENCES

Athanasoglou, P. P., Delis, M., & Staikouras, C. (2006). Determinants of bank profitability in the South Eastern European region. *Journal of Financial Decision Marking*, 2(2).

Batten, J.A., & Vo, X.V. (2019). Determinants of Bank Profitability - Evidence from Vietnam. *Emerging Markets Finance and Trade*, 55, 1417 - 1428.

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press.

Dietrich, A., & Wanzenried, G. (2014). The determinants of commercial banking profitability in low-, middle-, and high-income countries. *The Quarterly Review of Economics and Finance*, 54(3), 337-354.

Kriebel, J., & Debener, J. (2019). The Effect of digital transformation on bank performance. *SSRN Electronic Journal*. https://doi.org/10.2139/SSRN. 3461594.

Le, T. D., & Ngo, T. (2020). The determinants of bank profitability: A cross-country analysis. *Central Bank Review*, 20(2), 65-73.

Menicucci, E., & Paolucci, G. (2016). The determinants of bank profitability: empirical evidence from European banking sector. *Journal of Financial Reporting and Accounting*, 14, 86-115.

Molyneux, P., & Forbes, W. (1995). Market structure and performance in European banking. *Applied Economics*, 27(2), 155-159. https://doi.org/10.1080/00036849500000018.

Nguyen-Thi-Huong, L., Nguyen-Viet, H., Nguyen-Phuong, A., & Van Nguyen, D. (2023). How does digital transformation impact bank performance? *Cogent Economics & Finance*, 11(1), 2217582.

Nguyen, Van Thuy. (2021). ICT and bank performance: empirical evidence from Vietnam. *The journal of contemporary issues in business and government*, 27(2), 4149-4153.

Nguyen, V. (2020). Determinants of Vietnamese Bank Profitability: A note. *International Journal of Business Management and Economic Review*, 03(1), 180-186.

Petria, N., Capraru, B., & Ihnatov, I. (2015). Determinants of banks' profitability: evidence from EU 27 banking systems. *Procedia economics and finance*, 20, 518-524.

Truong Quang Thong (2010). *Analysis of the Performance of Vietnamese Commercial Banks: An Empirical Study of the S-C-P Model*. Phuong Dong Publishing House.

Vinh, N. T. H. (2017). The impact of non-performing loans on bank profitability and lending behavior: Evidence from Vietnam. *Journal of Economic Development*, 24(3), 27-44.

World Bank (2024). *World Bank Open Data*. Accessed at https://data.worldbank.org/country/viet-nam?view=chart. Accessed on 30 June 2024.