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## The Impact of Non-Performing Loans on the Profitability of Vietnamese Commercial Banks

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### Abstract

*This paper examines the impact of non-performing loans on the profitability of Vietnamese commercial banks by developing a panel-data analytical framework that incorporates bank-specific, macroeconomic, and technology-related determinants. The study uses annual data for 18 Vietnamese commercial banks over the period 2016–2024. Profitability is measured by return on equity (ROE), while the explanatory variables include the non-performing loan ratio (NPL), loan loss reserves (LLR), bank size (SIZE), the cost-to-income ratio (CIR), economic growth (GDP), inflation (INF), and information and communication technology adoption (ICT). The empirical strategy begins with pooled ordinary least squares, fixed effects, and random effects estimators, followed by model-selection and diagnostic tests, and then applies feasible generalized least squares to address heteroskedasticity and autocorrelation. The results show that NPL and CIR are negatively associated with ROE, whereas SIZE, GDP, and ICT exert positive effects. LLR and INF are not statistically significant in the preferred specification. These findings suggest that bank profitability in Vietnam depends not only on credit quality but also on operating efficiency, macroeconomic conditions, and technological capability. The study concludes with implications for credit-risk governance, cost discipline, and digital investment in commercial banking.*

**Keywords:** non-performing loans, profitability, ROE, commercial banks, Vietnam, panel data, ICT.

### 1. Introduction

Profitability is a core indicator of the soundness, competitiveness, and long-term sustainability of commercial banks. In emerging banking systems, profitability is especially sensitive to credit risk, operating efficiency, macroeconomic volatility, and the pace of technological transformation. Among these determinants, non-performing loans (NPLs) are widely considered one of the most

critical factors because they directly reflect asset quality and the effectiveness of credit-risk management.

An increase in NPLs weakens the earnings capacity of banks through several channels. First, impaired loans reduce interest-generating assets and limit the ability of banks to expand sound

lending. Second, rising credit risk requires banks to increase provisions and reserves, thereby reducing current profits. Third, persistently high NPL ratios may undermine market confidence, increase funding costs, and weaken the strategic flexibility of commercial banks. For these reasons, the relationship between non-performing loans and bank profitability has attracted considerable attention in both developed and developing economies.

The existing empirical literature generally reports a negative relationship between NPLs and bank profitability, although the magnitude of the effect varies across institutional settings, banking structures, and estimation methods. In addition to NPLs, profitability is also influenced by bank-specific factors such as size, provisioning behavior, and operating efficiency, as well as macroeconomic variables including economic growth and inflation. More recently, information and communication technology (ICT) has emerged as a potentially important determinant of banking performance because technological adoption may improve transaction efficiency, expand customer access, strengthen risk management, and reduce operating costs over time.

The Vietnamese banking sector provides a particularly relevant setting for re-examining these relationships. During the period 2016–2024, Vietnamese banks operated under conditions of post-restructuring adjustment, increasing supervisory pressure, post-pandemic credit-quality challenges, and accelerated digital transformation. These developments make it important to assess whether bank profitability is driven primarily by asset quality or whether technological capability and operating efficiency also play significant roles.

Against this background, this study develops a panel-data framework to analyze the impact of non-performing loans on the profitability of 18 Vietnamese listed commercial banks during 2016–2024. Specifically, the study investigates whether NPLs reduce return on equity after controlling for loan loss reserves, bank size, cost efficiency, economic growth, inflation, and ICT adoption.

This study contributes to the literature in three respects. First, it develops an analytical panel-data framework to examine the effect of non-performing loans on bank profitability while controlling for bank-specific, macroeconomic, and technology-related factors. Second, it provides updated empirical evidence for Vietnamese listed commercial banks over the period 2016–2024, a period characterized by post-pandemic adjustment, digital transformation, and changing credit-risk conditions. Third, the study extends the conventional profitability model by incorporating an information and communication technology (ICT) variable to capture differences in banks' technological adoption. By doing so, the paper emphasizes not only the economic interpretation of the results but also the analytical specification of the determinants of return on equity in an emerging banking market.

## 2. Literature review and hypothesis development

In the context where the financial–banking system plays a pivotal role in the economy, the operational efficiency of commercial banks has consistently attracted considerable attention from policymakers, researchers, and investors. In Vietnam, the process of international economic integration, together with fluctuations in the business environment, has posed significant challenges to

banking operations, among which non-performing loans (NPLs) have emerged as a critical factor directly affecting the safety and profitability of commercial banks. An increase in NPLs not only deteriorates asset quality but also adversely affects capital utilization efficiency, operating costs, and banks' competitive capacity. Against this backdrop, this study focuses on analyzing the impact of non-performing loans on the profitability of commercial banks in Vietnam, thereby providing empirical evidence and policy implications that contribute to enhancing operational efficiency and the sustainability of the banking system.

Non-performing loans are widely regarded as a key factor that directly reflects the level of credit risk and exerts a significant influence on the profitability of commercial banks. Consequently, the relationship between non-performing loans and bank profitability has attracted substantial attention in numerous empirical studies across different banking systems. Early studies consistently document an inverse relationship between non-performing loans and bank profitability. Banker et al. (2010), using panel data from 14 commercial banks in South Korea over the period 1995–2005, find that the non-performing loan ratio has a significantly negative impact on bank performance. Their findings emphasize that ineffective control of non-performing loans leads to declining profitability and heightened lending risk. Similarly, Andries (2011), analyzing banking data from Central and Eastern European countries during 2004–2009, confirms a statistically significant negative relationship between non-performing loans and bank profitability, and identifies non-performing loan control as a core policy measure for improving bank performance. In developing economies, empirical evidence further reinforces the adverse effects of non-performing loans on bank profitability. Kargi (2011), examining Nigerian commercial banks over the period 2004–2008, concludes that non-performing loans significantly reduce bank profitability. Likewise, Kaaya and Pastory (2013), employing panel data from 11 Tanzanian banks between 2005 and 2011, show that credit risk—proxied by the non-performing loan ratio—has a significantly negative effect on profitability, while bank size exerts a positive influence. Their regression results indicate that a substantial proportion of profit variation is explained by credit risk factors. Gizaw et al. (2015) extend this line of inquiry to Ethiopia using data from eight commercial banks over the period 2003–2012. The results demonstrate that the non-performing loan ratio has a negative effect on return on assets (ROA), a commonly used measure of bank profitability. The study also highlights the importance of credit risk management practices, such as loan loss provisioning, in mitigating the adverse impact of non-performing loans on profits. Similarly, Artenisa et al. (2023), based on data from 35 commercial banks in Cambodia during 2017–2022, confirm that non-performing loans constitute a key determinant of bank profitability, even after controlling for macroeconomic conditions and bank-specific characteristics. Consistent findings are reported by Odebode et al. (2024) for Nigeria, where non-performing loans are shown to have a significantly negative effect on return on equity (ROE).

Applying various regression techniques, Noman et al. (2015) identify a robust inverse relationship between non-performing loans and bank profitability in Bangladesh over the period 2003–2013. Their findings are in line with earlier studies (Bourke, 1989; Molyneux & Thornton, 1992; Poudel, 2012), suggesting that the negative impact of non-performing loans on profitability is relatively consistent across different institutional and economic

contexts. In addition, Kingu et al. (2018) report that a 1% increase in the non-performing loan ratio leads to an approximate 0.19% decline in ROE for banks in Tanzania. Bhattarai (2018) also finds a significant negative relationship between non-performing loans and ROE, alongside the effects of capital adequacy and liquidity ratios. Furthermore, studies by Patwary and Tasneem (2019) and Girma (2018) reaffirm that non-performing loans erode interest income—the primary source of revenue and profitability for commercial banks. Overall, the body of empirical evidence consistently indicates that non-performing loans exert a pronounced and persistent negative effect on the profitability of commercial banks. This implies that effective control and management of non-performing loans play a critical role in enhancing bank profitability and ensuring the financial stability of the banking system.

The relationship between non-performing loans and bank profitability has been extensively examined in the banking literature. Most studies argue that a higher NPL ratio reduces profitability because deteriorating asset quality lowers interest income and increases credit-risk costs. This negative relationship has been documented across a wide range of countries and banking systems. From a theoretical perspective, when the proportion of bad loans rises, banks face lower effective returns on their loan portfolios and must devote more resources to monitoring, provisioning, and recovery activities. Therefore, the following hypothesis is proposed:

**H1:** Non-performing loans have a negative effect on bank profitability.

Loan loss reserves are another relevant determinant of bank performance. Higher reserves may indicate prudent risk management, but they also reflect expected losses and may reduce current profitability. In banking systems where provisioning standards are regulated and relatively stable, the impact of reserves on profitability may be weaker or statistically insignificant. Nevertheless, the expected relationship is generally negative. Thus:

**H2:** Loan loss reserves have a negative effect on bank profitability.

Bank size is often associated with economies of scale, stronger market power, broader diversification, and better access to funding sources. Larger banks may also be better positioned to invest in technology, risk management systems, and organizational efficiency. Although excessive size can sometimes create inefficiencies, most studies report a positive relationship between size and profitability. Hence:

**H3:** Bank size has a positive effect on bank profitability.

The cost-to-income ratio is commonly used as an indicator of operating efficiency. A higher ratio implies that a larger share of income is absorbed by operating costs, thereby reducing profitability. Efficient cost control, by contrast, supports earnings growth and enhances competitive performance. Therefore:

**H4:** The cost-to-income ratio has a negative effect on bank profitability.

Macroeconomic conditions also affect banking performance. Economic growth typically improves borrowers' repayment ability, increases credit demand, and expands financial intermediation, which should support profitability. Inflation, however, may have either a positive or negative effect depending on whether banks can correctly anticipate it and adjust interest rates and costs accordingly. Accordingly:

**H5:** Economic growth has a positive effect on bank profitability.

**H6:** Inflation affects bank profitability, but the expected sign is ambiguous.

Finally, technological adoption has become increasingly important in modern banking. ICT may raise profitability by improving service efficiency, reducing transaction costs, strengthening internal information flows, and enhancing the quality of customer interaction. As banks become more digitalized, technological capability may contribute directly to higher financial performance. Therefore:

**H7:** ICT adoption has a positive effect on bank profitability.

### 3. Research Methodology

#### 3.1. Model Specification

Building on prior studies of bank profitability and credit risk, the empirical model is specified as follows:

$$ROE_{i,t} = \beta_0 + \beta_1 NPL_{i,t} + \beta_2 LLR_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CIR_{i,t} + \beta_5 GDP_t + \beta_6 INF_t + \beta_7 ICT_{i,t} + \epsilon_{i,t}$$

Where:

- $\beta_0$ : the intercept term
- $\beta_1 - \beta_7$ : the regression coefficients
- $\epsilon_{i,t}$ : the stochastic error term, assumed to be normally distributed and varying across banks  $i$  and time  $t$
- $i$ : the index for individual banks
- $t$ : the time (year) index
- NPL: the non-performing loan ratio of commercial banks
- LLR: the loan loss reserve ratio of commercial banks
- SIZE: bank size
- CIR: cost efficiency, proxied by the cost-to-income ratio
- GDP: the economic growth rate
- INF: the inflation rate
- ICT: the information and communication technology (ICT) adoption

#### 3.2. Variable Measurement

##### Dependent Variable

To measure the profitability of the commercial banking system, this study employs return on equity (ROE) as the dependent variable. Consistent with previous studies such as Said and Tumin (2011), Elouali and Oubdi (2018), Dr. Sajid Saeed (2014), and Bilal et al. (2013), ROE is widely used as a proxy for bank profitability. Return on equity (ROE) is calculated as follows:

$$ROE = \frac{\text{Net profit after tax}}{\text{Average shareholders' equity}} * 100\%$$

ROE is regarded as an indicator of how efficiently a bank utilizes its equity capital, reflecting the amount of net profit generated from each unit of shareholders' equity. A positive ROE indicates profitable operations, whereas a negative ROE reflects losses in banking activities. Accordingly, ROE has been extensively applied in empirical studies to measure bank profitability (Koroleva et al., 2021; Riaz & Mehar, 2013; Rodríguez, 2015)

##### Independent Variables

- Non-performing loan indicator: The non-performing loan ratio (NPL) is calculated as the ratio of total non-performing loans to total outstanding loans:

$$NPL = \frac{\text{Total non-performing loans}}{\text{Total outstanding loans}} * 100\%$$

This ratio is used to assess the credit quality of commercial banks and reflects their level of credit risk exposure. An increase in the NPL ratio requires banks to set aside higher loan loss provisions, which in turn raises operating costs and adversely affects bank

profitability. A high level of non-performing loans indicates a greater risk of losses arising from uncollectible loans. Numerous empirical studies have documented a negative relationship between the non-performing loan ratio and the profitability of commercial banks, including Bilal et al. (2014) and Abdelaziz (2020).

**Bank size (SIZE) is measured as the natural logarithm of total assets:**

$$SIZE = \ln(\text{total assets})$$

Measured by the natural logarithm of total assets, this variable captures bank size. Larger banks tend to enjoy significant advantages in business operations, as they are better positioned to exploit economies of scale, optimize resource utilization, and access broader market opportunities. As a result, banks with larger asset bases generally achieve higher profitability. Empirical evidence from previous studies, including Koroleva et al. (2021), Flamini et al. (2009), and Riaz and Mehar (2013), consistently indicates a positive relationship between bank size and bank profitability..

**Loan loss reserve ratio (LLR):**

$$LLR = \frac{\text{Loan loss provisions}}{\text{Total outstanding loans}} * 100\%$$

This ratio reflects the extent of credit risk provisioning by banks. Loan loss provisions are established to cover potential losses arising from non-performing and doubtful loans. An increase in provisioning indicates higher perceived credit risk in banks' loan portfolios. According to Quagliariello (2006), banks determine the level of provisions based on their assessment of credit risk; as credit risk increases, provisioning rises accordingly, leading to higher operating costs and, consequently, lower profitability. Therefore, the loan loss reserve ratio is expected to be negatively associated with bank profitability. Empirical evidence from Koroleva et al. (2021) supports this expectation, showing that LLR exerts a negative effect on return on equity (ROE).

**Cost efficiency (CIR)**

Cost efficiency is measured by the cost-to-income ratio (CIR), defined as operating expenses divided by operating income:

$$CIR = \frac{\text{Operating expenses}}{\text{Operating income}} * 100\%$$

A higher CIR indicates lower operational efficiency, as higher operating costs relative to income adversely affect bank profitability. Conversely, effective control of operating expenses and cost optimization contribute to improved profitability. Empirical evidence consistently documents a negative relationship between the cost-to-income ratio and bank profitability (Heffernan & Fu, 2008; Athanasoglou et al., 2008; Halil Emre, 2012; Elouali & Oubdi, 2018).

**Macroeconomic variable**

Economic growth (GDP) is measured by the annual GDP growth rate, calculated as:

$$GDP = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} * 100\%$$

Higher economic growth reflects a strong expansion of the economy, which increases credit demand from households and firms. This enables banks to expand lending activities, thereby enhancing cash flows, interest income, and non-interest income. Moreover, during periods of economic growth, higher income levels improve borrowers' repayment capacity, potentially reducing non-performing loans. Most prior empirical studies document a positive relationship between economic growth and bank profitability, including Flamini et al. (2009), Riaz and Mehar (2013), and Rodríguez (2014).

**Inflation rate (INF)** is measured by the annual growth rate of inflation, calculated as:

$$INF = \frac{INF_t - INF_{t-1}}{INF_{t-1}} * 100\%$$

Inflation exerts a significant influence on banking activities, particularly on the profitability of commercial banks. The direction and magnitude of this effect largely depend on banks' ability to accurately anticipate inflation trends. When inflation is expected, banks can proactively adjust lending and deposit interest rates, thereby enhancing profitability. Conversely, unexpected inflation may delay interest rate adjustments, causing operating costs to rise faster than revenues and adversely affecting bank performance (Halil Emre, 2012). Empirical evidence on the inflation-profitability relationship remains mixed. Several studies report a significantly negative impact of inflation on bank profitability (Francis, 2013; Rahman et al., 2015), whereas others find a positive association, suggesting that higher inflation may increase bank profits and improve profitability (Athanasoglou et al., 2008; Gul et al., 2011; Alexiou & Sofoklis, 2009).

**Information and Communication Technology (ICT) variable**

$$ICT = \frac{1}{4} \times (I_{HTKT} + I_{HTNL} + I_{UDNB} + I_{DVTT})$$

This approach allows for the assessment of the level of ICT adoption at a specific point in time and facilitates comparisons across banks. However, the index is essentially static and does not capture dynamic changes in banks' investment, development, or application of ICT over time. Therefore, in this study, the following specification is employed:

$$ICT = \frac{ICT_t - ICT_{t-1}}{ICT_{t-1}} * 100\%$$

Measuring ICT adoption based on its relative change (%) over time provides a clearer reflection of banks' investment intensity, technological improvements, or reductions in ICT spending across years. This dynamic approach is also consistent with the study's objective of assessing the impact of ICT adoption on bank profitability.

The variables included in the model are summarized in Table 1, which comprises the following:

**Table 1. Description of Variables in the Model**

Category	Variable	Symbol	Measurement	Expected Sign	Previous Studies
Dependent variable		ROE	$\frac{\text{Net profit after tax}}{\text{Average shareholders' equity}} * 100\%$		Nor Hayati Ahmad & Mohamad Akbar Noor Mohamad Noor (2011); Ekaterina Koroleva et al.

					(2021); Samina Riaz & Ayub Mehar (2013); Rubén Chavarín Rodríguez (2015)	
Independent variables	Non-performing loan indicator	NPL	$\frac{\text{Non-performing loans}}{\text{Total outstanding loans}} * 100\%$	-	Bilal et al. (2014); Abdelaziz (2020); Đặng Thị Minh Nguyệt et al. (2022)	
	Bank-specific variables	SIZE	Ln (total assets)	+	Ekaterina Koroleva et al. (2021); Valentina Flamini et al. (2009); Samina Riaz & Ayub Mehar (2013); Panayiotis P. Athanasoglou et al. (2005); Tu Le (2017); Rubén Chavarín Rodríguez (2015)	
		LLR		$\frac{\text{Loan loss provisions}}{\text{Total outstanding loans}} * 100\%$	-	Ekaterina Koroleva et al. (2021); Panayiotis P. Athanasoglou et al. (2005); Rubén Chavarín Rodríguez (2015)
		CIR		$\frac{\text{Operating expenses}}{\text{Operating income}} * 100\%$	-	Elouali Jaouad & Oubdi Lahsen (2018);
	Macroeconomic variables	GDP		$\frac{\text{GDP}_t - \text{GDP}_{t-1}}{\text{GDP}_{t-1}} * 100\%$	+	Ofosu (2016); Trujillo-Ponce (2013); Ekaterina Koroleva et al. (2021); Asli Demirguc-Kunt & Harry; Huizingal (2003)
		INF		$\frac{\text{INF}_t - \text{INF}_{t-1}}{\text{INF}_{t-1}} * 100\%$	+	Gul et al. (2011); Valentina Flamini et al. (2009); Athanasoglou et al. (2008); Alexiou & Sofoklis (2009); Francis (2013); Rahman et al. (2015); Poposka, K. (2009).
	Information and Communication Technology (ICT) variable	ICT		$\frac{\text{ICT}_t - \text{ICT}_{t-1}}{\text{ICT}_{t-1}} * 100\%$	+	Swierczek, F. W., & Shrestha, P. K. (2003); Shu et al. (2005)

Source: Compiled by the author

### 3.3. Data

This study uses annual panel data for 18 Vietnamese commercial banks listed on the Ho Chi Minh Stock Exchange over the period 2016–2024, producing 162 bank-year observations. Bank-specific variables are collected from audited consolidated financial statements and annual reports of the sampled banks. Macroeconomic variables are obtained from international databases such as the World Bank and the International Monetary Fund. Data related to ICT adoption are compiled from official institutional sources and banks' annual reports. The selected sample provides sufficient cross-sectional and time variation to estimate the proposed panel model.

### 3.4. Estimation Strategy

The empirical analysis is conducted using STATA. The study first estimates pooled OLS, fixed effects (FE), and random effects (RE) models. Next, the F-test is used to compare pooled OLS with FE, and the Hausman test is employed to choose between FE and RE. After selecting the preferred baseline specification, diagnostic tests are performed for heteroskedasticity and autocorrelation. Because these defects are detected in the selected model, feasible generalized least squares (FGLS) is applied to obtain more efficient estimates under heteroskedasticity and serial correlation. In this paper, the FE model serves as the main reference specification, while FGLS is used as a corrective estimator after the econometric defects have been identified.

## 4. Empirical Results and Discussion

### 4.1. Descriptive Statistics

**Table 2. Descriptive Statistics of the Variables Used in the Model**

Variable	Obs	Mean	Std.Dev.	Min	Max
ROE	162	.1484025	.0696796	.003	.3033

NPL	162	.0181789	.0104262	.0047045	.0699765
LLR	162	0.0079012	.0988658	0.3	1.24
SIZE	162	19.69747	.8967153	17.71642	21.55655
CIR	162	.4428639	.1396126	.2271	1.3501
GDP	162	.1326016	.7424775	-.6100543	2.13285
INF	162	.3414053	1.200825	-.8536585	3.5
ICT	162	.011839	.2171321	-.4337845	1.217077

Source: Compiled by the author

The descriptive statistics indicate that the mean ROE of the sampled banks is 0.1484, equivalent to approximately 14.84%, which suggests that Vietnamese listed commercial banks maintained a moderate level of profitability over the study period. The mean NPL ratio is 0.0182, implying that non-performing loans account for about 1.82% of total loans on average. Bank size, measured as the natural logarithm of total assets, has a mean of 19.6975, with values ranging from 17.7164 to 21.5566, indicating substantial variation across banks. The average CIR is 0.4429, meaning that operating expenses represent approximately 44.29%

of operating income on average. GDP, inflation, and ICT also display noticeable variation over time, supporting their inclusion in the empirical model. A point that requires caution is the LLR variable, which exhibits a mean slightly below zero in the original dataset. This pattern suggests that the construction and coding of LLR should be carefully rechecked before final submission, because a reserve-based ratio is not typically expected to be negative. The interpretation of the LLR coefficient should therefore remain cautious unless the underlying definition is verified against the raw data..

#### 4.2. Correlation Analysis and Multicollinearity

**Table 3. Correlation Matrix of the Variables in the Model**

	ROE	NPL	LLR	SIZE	CIR	GDP	INF	ICT
ROE	1.000							
NPL	-0.3331	1.000						
LLR	0.0173	-0.0744	1.000					
SIZE	0.2499	-0.2004	0.0858	1.000				
CIR	-0.5444	0.1401	-0.0307	-0.4980	1.000			
GDP	0.1460	-0.0369	-0.0847	0.0887	-0.1259	1.000		
INF	-0.1644	0.0859	-0.0118	-0.0996	0.1156	0.1318	1.000	
ICT	0.2326	-0.0921	0.0502	0.0017	-0.1698	-0.0319	-0.1876	1.000

Source: Compiled by the author

The correlation matrix shows that the pairwise correlations among the explanatory variables are relatively low and remain below the commonly used threshold of 0.8. This suggests that severe multicollinearity is unlikely to be a concern. The variance inflation

factor results further confirm this conclusion, with a mean VIF of 1.16, which is well below the conventional threshold of 5. Therefore, the explanatory variables are sufficiently independent for regression analysis, and the estimated coefficients are unlikely to be substantially distorted by multicollinearity.

**Table 4. Results of the Multicollinearity Test**

Variable	VIF	1/VIF
CIR	1.40	0.712879
SIZE	1.39	0.718064
ICT	1.08	0.923577
INF	1.07	0.930600

NPL	1.06	0.944298
GDP	1.05	0.951399
LLR	1.02	0.977966
Mean VIF	1.16	

Source: Compiled by the author

### 4.3. Regression Analysis

#### 4.3.1. Estimation of Regression Models

The regression results from pooled OLS, FE, and RE indicate broadly consistent coefficient signs for the key variables. In all three models, NPL and CIR show negative coefficients, while

SIZE is positive in FE and RE. The FE model is selected as the most appropriate baseline specification based on the F-test and Hausman test results. Subsequent diagnostic tests reveal the presence of both heteroskedasticity and autocorrelation, thereby justifying the use of FGLS as a corrective estimator

**Table 5. Summary of Regression Results for the Estimated Models**

Independent Variables	ROE		
	OLS model	FEM model	REM model
	Coefficient	Coefficient	Coefficient
NPL	-1.7122***	-1.7423***	-1.6326***
LLR	-0.0071	0.0243	0.0157
SIZE	-0.0052	0.0558***	0.0235***
CIR	-0.2506***	-0.0979***	-0.1599***
GDP	0.0087	0.0054	0.0078*
INF	-0.0047	-0.0026	-0.0041
ICT	0.0359*	0.0159	0.0277*
_cons	0.3935***	-0.8761***	-0.2143

(\*\*\*), (\*\*), and (\*) respectively indicate the levels of statistical significance 1%, 5% and 10%

Source: Compiled by the author

The corrected FGLS results indicate that NPL has a negative and statistically significant coefficient, confirming that higher credit risk reduces bank profitability. SIZE has a positive and statistically significant effect on ROE, suggesting that larger banks tend to achieve stronger profitability. CIR is negative and significant, indicating that weaker cost efficiency reduces returns to equity holders. GDP also exerts a positive and significant effect, implying that favorable macroeconomic conditions support bank profitability. ICT is positive and significant, suggesting that technological adoption contributes positively to performance. By contrast, LLR and INF do not show statistically significant effects in the preferred specification.

#### 4.3.2. Tests for Selecting the Appropriate Regression Model

All three regression models—OLS, FEM, and REM—reflect the direction of the effects of the independent variables on the dependent variable. To determine the most appropriate model, the author conducts the F-test and the Hausman test (Table 6). The results indicate that the FEM is the most suitable model.

**Table 6. Results of the F-test and Hausman Test**

	P-value	Selected Model
F-test	0.0000	FEM
Hausman test	0.0053	FEM

Source: Compiled by the author

#### Diagnostic Tests for Model Defects

After identifying the FEM as the most appropriate model, the author further examines potential model defects in the selected specification. In particular, tests for heteroskedasticity and autocorrelation are conducted.

**Table 7. Results of the Heteroskedasticity Test**

Test	Test statistic	P-value
Heteroskedasticity Test	1149.73	0.0000
Autocorrelation Test	3.422	0.0017

**Source: Compiled by the author**

From the diagnostic tests above, it can be observed that the selected FEM exhibits both autocorrelation and heteroskedasticity with respect to ROE. Therefore, to address these problems and improve the efficiency of the model, the author applies the FGLS (Feasible Generalized Least Squares) estimation method. The results are presented in the following table:

**Table 8. Correcting the Defects of the FEM Model Using GLS Estimation**

Variable	ROE
	Coefficient
NPL	-1.2310***
LLR	0.0197
SIZE	0.0250***
CIR	-0.1096***
GDP	0.0093***
INF	-0.0017
ICT	0.0252**
_cons	-0.2873***

(\*\*\*), (\*\*), và (\*) respectively indicate the levels of statistical significance 1%, 5% and 10%

**Source: Compiled by the author**

**4.4. Discussion**

Through the collection, processing, and analysis of the dataset using STATA software, the author examines the impact of non-performing loans on the profitability of Vietnamese commercial banks during the period 2016–2024. The findings are as follows:

**Non-performing loan ratio (NPL):**

The results show that the non-performing loan ratio has a negative effect on ROE. Holding other factors constant, a one-unit increase in this ratio leads to a 1.2310-unit decrease in ROE at the 1% significance level. This result mainly stems from the deterioration in credit quality, which reduces interest income while increasing loan loss provision expenses. As non-performing loans rise, a larger proportion of loans becomes difficult to recover or incapable of generating returns, thereby causing a decline in interest income, which is the primary source of revenue for banks. At the same time, banks are required to make higher provisions to cover credit risk, leading to an increase in operating costs and a substantial contraction in net profit. This estimation result is consistent with the findings of Bilal et al. (2014) and Dang Thi Minh Nguyet et al. (2022).

A high non-performing loan ratio can create numerous problems for banks, as delays in debt repayment often hinder future credit approvals, thereby triggering a second round of debt accumulation. When the non-performing loan ratio increases, banks tend to become more cautious in extending new credit due to concerns over potential capital losses. This, in turn, makes it more difficult for firms and individuals to access financing, thereby weakening

the growth momentum of the economy. Moreover, a rising level of non-performing loans may undermine investors' and customers' confidence in a bank's financial soundness. Credit institutions with high non-performing loan ratios are often perceived as riskier, which makes it more difficult for them to mobilize funds from the market. As confidence deteriorates and the cost of capital rises, banks face greater pressure in maintaining liquidity and in effectively implementing their long-term development strategies

In addition, since the aftermath of the Covid-19 pandemic, although the economy has shown signs of recovery, many uncertainties still persist in both the Vietnamese economy in particular and the global economy in general. Therefore, when a bank's ratio of non-performing loans to total outstanding credit rises, the risk of capital loss also increases, especially under the current challenging economic conditions, where many firms are facing severe difficulties or even bankruptcy. In such circumstances, debt recovery becomes more difficult, thereby exerting a negative impact on the bank's profitability. Hence, controlling and reducing non-performing loans is a crucial factor in ensuring the stability and sustainable development of banks.

**Information and Communication Technology (ICT)**

The empirical results indicate that ICT has a positive impact on the profitability of commercial banks, as reflected in its positive relationship with ROE, with regression coefficients of 0.0125 and 0.0252, respectively, at the 5% significance level. This finding confirms that technology adoption not only helps banks improve productivity but also contributes significantly to profits and overall business performance. This result is consistent with the conclusions of previous studies such as Fredric and Shrestha (2003), and Shu et al. (2005), thereby reinforcing the view that technology enhances banking operations by reducing costs, improving service quality, and strengthening competitiveness. According to Shu et al. (2005) technology enables banks to save time for both customers and employees, thereby lowering operating costs, streamlining transaction processes, and improving labor productivity. In addition, technology not only helps banks reduce personnel expenses but also optimizes management procedures, minimizes errors in information processing, and increases the speed of customer response. Fredric and Shrestha (2003) and Shu et al. (2005) also emphasize that technology enables banks to enhance their risk management capacity while improving service quality, thereby increasing customer satisfaction and creating a sustainable competitive advantage in the long run.

One of the most prominent advantages of adopting technology in banking operations is its ability to attract low-cost funds. This advantage is achieved through the optimization of operating costs, the acceleration of transaction processing, and the provision of greater convenience for customers. As service delivery processes become increasingly automated, customers are able to access banking products more easily, thereby stimulating demand, expanding the customer base, and increasing banks' revenues. Moreover, in the context of an increasingly robust digital transformation, technology also enhances banks' competitiveness through continuous improvements in financial products and services. Investments in core banking systems, the deployment of Big Data analytics, and the application of artificial intelligence (AI) not only enable banks to identify high-risk loans at an early stage but also improve the effectiveness of risk management and optimize business performance. For example, Big Data allows banks to collect, process, and analyze information from multiple

sources, thereby enabling more accurate assessments of customers' financial capacity and credit behavior. On this basis, banks can identify potential customer segments, classify risk profiles, and formulate appropriate credit strategies.

#### **Bank Size (SIZE)**

The empirical results indicate that, at the 1% significance level, bank size (SIZE) has a positive effect on ROE, with a coefficient of 0.0250. This finding implies that an increase in bank size contributes to improving the profitability of commercial banks. This result is consistent with prior studies, such as those of Samina Riaz and Ayub Mehar (2013) and Rubén Chavarrín Rodríguez (2015), thereby providing further empirical support for the positive role of size in enhancing bank performance. In practice, larger banks often possess stronger financial capacity, greater competitive advantages, and better adaptability to market fluctuations than smaller banks. A larger scale enables banks to access funding sources at lower costs, expand their operational networks, diversify products and services, and reach a broader range of customer segments. As a result, banks are better positioned to promote credit growth, strengthen their deposit mobilization capacity, and improve profitability. Moreover, larger banks are typically in a better position to invest in modern technology, enhance governance capacity, strengthen risk management, and optimize operational processes. These advantages contribute to more efficient resource utilization and improved profitability. The reality of the Vietnamese banking sector also provides clear evidence for this relationship, as the most profitable commercial banks in recent years have largely been large-scale institutions such as Vietcombank, BIDV, VietinBank, ACB, and Techcombank.

#### **Economic Growth (GDP)**

The empirical results show that economic growth (GDP growth) has a positive effect on ROE, with regression coefficients of 0.009 and 0.0093, both statistically significant at the 1% level. This finding is consistent with the author's initial expectation and aligns with previous studies such as Ofori (2016), Trujillo-Ponce (2013), and Nguyễn Thị Hồng Vinh and Lê Phan Thị Diệu Thảo (2016). These results provide further evidence that stable economic growth creates favorable conditions for banking operations and enhances bank profitability.

From a theoretical perspective, when the economy expands, firms tend to increase their production and business activities, which in turn raises the demand for external financing. Under such conditions, commercial banks are able to expand their lending activities, thereby increasing interest income as well as revenues derived from credit-related services. At the same time, a favorable economic environment improves borrowers' financial capacity and debt repayment ability, which helps reduce non-performing loans, improve asset quality, and ultimately strengthen bank profitability.

In addition to its impact on lending activities, GDP growth also stimulates demand for other financial services, including payments, guarantees, foreign exchange transactions, and modern banking services. This enables banks to generate more fee-based and commission income, thereby diversifying their income structure and improving overall profitability. In general, economic growth exerts a positive influence on bank profitability. However, in order to fully benefit from favorable macroeconomic conditions, banks still need to maintain prudent credit management strategies, ensure asset quality, and strengthen risk management capacity to support sustainable development.

#### **Cost to Income Ratio (CIR)**

The empirical results indicate that CIR has a negative relationship with the variables measuring the profitability of commercial banks, with statistical significance at the 1% level. This finding implies that banks with better cost control tend to operate more efficiently. Holding other factors constant, a one-unit increase in CIR reduces ROE by 0.1096 units. This result is fully consistent with the author's initial expectation and further supports the argument that effective cost management enhances bank profitability, whereas poor cost control may reduce profits due to the excessive burden of operating expenses (Teshome et al., 2018). This finding is also in line with previous studies by Elouali Jaouad and Oubdi Lahsen (2018) and Nguyễn Thị Thanh Bình et al. (2021). Although the expansion of banking operations may lead to an increase in operating expenses, and potentially in income as well, if the growth rate of costs exceeds that of income, the CIR will rise, reflecting inefficiency in cost management.

A high CIR indicates ineffective cost control, which may stem from various factors such as high personnel expenses, inefficient investments, unreasonable operating costs, or rising provisioning expenses. In such circumstances, banks may experience declining profits, which can negatively affect their reinvestment capacity and constrain future business expansion. In the long run, if this situation is not properly controlled, banks may lose their competitiveness, particularly in the context of an increasingly competitive financial market and narrowing profit margins. Therefore, in order to improve profitability, banks need to focus on strict cost management, optimize operational processes, and apply advanced technologies to enhance efficiency.

#### **Loan Loss Reserves Ratio (LLR)**

According to the empirical results, the loan loss reserves ratio (LLR) is not statistically significant with respect to ROE, suggesting that LLR does not have a clear impact on bank profitability in the model. This finding rejects the author's initial hypothesis and is inconsistent with the views of Ekaterina Koroleva et al. (2021), Panayiotis P. Athanoglou et al. (2005), and Rubén Chavarrín Rodríguez (2015). In the context of the Vietnamese banking system, which is subject to relatively strict regulatory supervision, many banks tend to maintain relatively stable provisioning policies with limited variation over time. When the degree of fluctuation in an independent variable is low, the ability to detect a statistically significant relationship with the dependent variable is also reduced.

#### **Inflation (INF)**

Inflation is not statistically significant with respect to ROE, implying that inflation does not have a significant effect on the profitability of commercial banks. This result rejects the author's initial hypothesis and is inconsistent with the findings of Gul et al. (2011), Valentina Flamini et al. (2009), and Harry Huizinga (1998). However, it is consistent with the studies of Aremu et al. (2013) and Alper and Anbar (2011). This outcome may be explained by the distinct characteristics of the Vietnamese economy compared to those of other countries. Factors such as the high degree of economic openness, dependence on imports and exports, and the domestic market's strong sensitivity to external shocks expose Vietnam to unstable inflationary pressures. In recent years, the monetary policy management of the State Bank of Vietnam has been characterized by flexibility and strong intervention aimed at addressing short-term fluctuations, rather than pursuing long-term stability objectives as is often the case in

developed economies. As a result, the macroeconomic environment in Vietnam has frequently changed, causing factors such as inflation to exert an inconsistent effect on bank profitability across different research periods.

## 5. Conclusion and implications

This study examines the impact of non-performing loans on the profitability of Vietnamese commercial banks using annual panel data for 18 listed banks over the period 2016–2024. After estimating pooled OLS, FE, and RE models and applying model-selection and diagnostic tests, the analysis uses FGLS to correct for heteroskedasticity and autocorrelation in the preferred specification. The empirical results show that non-performing loans and the cost-to-income ratio are negatively associated with return on equity, while bank size, economic growth, and ICT adoption are positively associated with profitability. Loan loss reserves and inflation do not have statistically significant effects in the preferred model.

These findings imply that bank profitability in Vietnam depends not only on credit quality but also on operating efficiency, macroeconomic support, and technological capability. From a managerial perspective, Vietnamese commercial banks should strengthen credit appraisal, post-lending supervision, and early-warning mechanisms to reduce the emergence and persistence of non-performing loans. They should also enhance cost discipline by streamlining internal processes and improving operating efficiency. In addition, selective and well-governed investment in digital infrastructure and technological systems may help banks improve both service quality and profitability.

This study has several limitations. First, the sample covers only listed commercial banks and therefore may not fully represent the entire Vietnamese banking system. Second, the ICT variable is measured through a proxy and may not capture all dimensions of digital transformation. Third, the model does not completely eliminate the possibility of reverse causality between credit risk and profitability. Accordingly, future research may extend the analysis by using alternative profitability indicators, more direct measures of digital investment, and dynamic panel estimators to better address endogeneity.

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