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PERFORMANCE OF VIETNAMESE COMMERCIAL BANKS (2010-2024): CAPITAL, RISK MANAGEMENT AND MACROECONOMIC PERSPECTIVES

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ABSTRACT

In the context of Vietnam's banking sector reforms and Basel II/III capital pressures, understanding the factors driving bank performance is crucial for both policymakers and practitioners. Using a balanced panel of 26 commercial banks over 2010-2024, this study employs a two-way fixed effects model with Driscoll-Kraay standard errors (DK-SE) to account for cross-sectional dependence, heteroskedasticity, and serial correlation. Potential endogeneity concerns are mitigated through the use of lagged variables and model specification strategies. The results show that internal bank-level factors, particularly cost efficiency, play a dominant role and consistently outweigh macroeconomic conditions in explaining performance variation. Among these, cost inefficiency emerges as the most influential factor undermining profitability. These findings provide actionable benchmarks for improving operational efficiency and inform capital policy design in the Vietnamese banking sector.

Keywords: Bank performance, panel unit root, Fixed Effects Model, Driscoll-Kraay, endogeneity, heterogeneous effects, Vietnamese commercial banks.

1. INTRODUCTION

In a global economic landscape undergoing historic transformation, commercial banking systems play an increasingly central role in sustaining financial stability and allocating resources for sustainable development. In Vietnam, where the financial system remains predominantly bank-based and commercial banks account for more than 90% of total financial sector assets, the operational efficiency of banks is a prerequisite for achieving national development objectives [1].

The 2010-2024 period is particularly complex, encompassing: (i) banking restructuring under Decision 254 and Resolution 1058; (ii) rapid digitalization and fintech proliferation; (iii) the COVID-19 shock of 2020-2021; and (iv) post-pandemic recovery characterized by Basel II/III capital pressure and green credit mandates. This multidimensional backdrop creates an especially rich research environment for testing theories of capital, risk, and macroeconomic context.

Despite a growing body of research on bank profitability in Vietnam, three research gaps remain unaddressed. First, most existing studies rely on short-term (5-10 years) panel data that fail to capture the entire business cycle or crisis periods [2], [3]. Second, standard fixed-effect estimates are applied without addressing the simultaneous presence of heterogeneity, serial correlation, and cross-dependencies, violations that can increase significance and lead to inference bias. Third, no previous research in Vietnam has simultaneously examined heterogeneity effects on ownership using interaction terms along with lagged endogenous strategies. This study addresses all three gaps. The central research question is: What are the internal and macroeconomic factors influencing the performance of Vietnamese commercial banks during the period 2010-2024, and are these effects consistent across different ownership types?.

Compared with prior studies [2], [4], this article contributes along four dimensions: (1) a dataset covering 26 commercial banks over 15 years, encompassing COVID and the post-pandemic period; (2) the DK-SE methodology addressing three simultaneous assumption violations not yet prevalent in Vietnamese banking research; (3) panel unit root tests and a lagged-variable model to handle endogeneity concerns; and (4) ownership-interaction analysis capturing heterogeneous effects between state-owned and private commercial banks.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Theoretical Framework

This study draws on three principal theoretical traditions. First, financial intermediation theory [5] predicts a positive effect of deployed liquidity (LDR) and a negative effect of operating costs (CIR) on profitability. Second, bank capital structure theory [6] anticipates asymmetric capitalization effects: positive on ROA/NIM but negative on ROE through the leverage channel. Third, risk management theory [7] links credit portfolio quality (NPL, LLR) with profitability. Demirgüç-Kunt & Huizinga [8] extend this to macroeconomic determinants, predicting GDP and inflation effects on NIM and ROA.

2.2. Literature Review and Research Gap

Pillar 1: Capital and Bank Capital Structure

Bourke [9], Berger [10], Berger & Bouwman [6], and Lee & Hsieh [11] establish robust international evidence of a positive ETA effect on ROA/NIM and a negative ETA effect on ROE. In Vietnam, Le & Nguyen [3] confirm these findings using quantile regression.

Pillar 2: Risk Management and Credit Quality

Berger & DeYoung [12] analyze Granger causality between NPL and cost efficiency, proposing four influential hypotheses – "bad luck," "bad management," "skimping," and "moral hazard" – thereby providing a theoretical lens for both LLR and NPL effects. Trujillo-Ponce [13], Tan & Floros [14], and Phan et al. [15] confirm strong negative LLR effects on profitability.

Pillar 3: Macroeconomic Context and Vietnamese Institutional Features

Athanasoglou et al. [7] theorize the effects of GDP and inflation on NIM/ROA. Danisman & Demirel [16] and Le et al. [4] confirm that macroeconomic variables lose significance in two-way FEM as they are absorbed by year fixed effects – a finding consistent with our results. A critical institutional feature of Vietnam is the marked differentiation between state-owned CBs (BID, CTG, VCB) and private CBs (TCB, VPB, MBB) in terms of capital structure and operating costs.

Despite this body of evidence, a critical review reveals three gaps that motivate the present study. First, most international studies [7], [17], [13] rely on one-way OLS or FEM without adjusting for cross-dependencies between banks, a particularly serious violation in banking data tables where banks share common macroeconomic risks and systemic liquidity conditions. Second, existing Vietnamese studies [2], [3], [15] cover short panels (5-12 years) and do not span the full cycle from post-GFC restructuring through COVID-19 to post-pandemic normalization. Third, no prior study in the Vietnamese context has explicitly tested whether performance determinants differ by ownership type using interaction terms in a robust panel framework. These three gaps collectively motivate the methodological innovations and extended sample of the current study.

An integrated three-pillar approach, in which capital, risk management, and macroeconomic variables interact dynamically rather than operating independently, provides the deepest understanding of the performance of Vietnamese commercial banks. Effective risk management transforms capital reserves into long-term returns, not merely compliance with regulations, while capital strength influences a bank's risk tolerance and resilience to macroeconomic shocks [18]. The severity of credit risk and return on capital investment are both affected. Based on agency theory, the poor management hypothesis, and the structural-behavioral efficiency (SCP) model, this study models bank performance (ROA, ROE, NIM) as a combined function of internal governance variables and external economic conditions, providing a comprehensive explanation for the differences in performance among Vietnamese commercial banks from 2010 to 2024.

Table 1 synthesizes the key studies underpinning each of the three analytical pillars, summarizing sample coverage, estimation method, dependent variables, and principal findings to situate the present study within the broader empirical literature.

Table 1. Summary of Prior Literature by Analytical Pillar

Author(s)	Sample / Period	Method	Dep. Var.	Key Findings	Pillar
Bourke [9]	90 European banks, 1972-1981	OLS	ROA, ROE	Capitalization (+); operating cost (-)	Capital
Berger & Bouwman [6]	US, 1984-2010	OLS, Probit	ROA, survival	Capital (+) ROA; protection during crises	Capital
Vinh & Thao [2]	VN, 2007-2018	QR	ROA	CAR (+) esp. low-efficiency group	Capital
Tan & Floros [14]	China, 2003-2009	OLS FE	ROA, ROE, NIM	LLR(-), NPL(-), Size(+)	Risk
Trujillo-Ponce [13]	Spain, 1999-2009	OLS FE	ROA, ROE	LLR(-) strongest; CIR(-)	Risk + Cost
Le et al. [3]	ASEAN, 2010-2021	GMM	ROA, ROE	NPL(-), COVID(-), Capital(+)	Risk + Macro
Athanasoglou et al. [7]	SE Europe, 1985-2001	GMM	ROA	ETA(+), CIR(-), GDP(+)	All three
Dietrich & Wanzenried [17]	Switzerland, 1999-2009	GMM	ROA, NIM	CIR(-) strongest; ETA(+)	All three
Danisman & Demirel [16]	22 countries, 2000 - 2017	FEM/ REM	ROA	GDP loses significance in two-way FEM	Macro
This study	26 VN CBs, 2010-2024	FEM+DK +Lagged	ROA, ROE, NIM	CIR (-)>ETA(+/)> LLR(-)>SIZE(+)>LDR(+)	All three

Note: Method: QR = Quantile Regression; GMM = Generalized Method of Moments; DK = Driscoll-Kraay; VN = Vietnam.

Source: Authors' compilation.

Recent studies [19], [20] confirm these patterns in Asian and emerging-market banking contexts, with particular emphasis on the amplified provisioning costs and liquidity pressures induced by COVID-19. The present study incorporates the 2020-2024 post-pandemic period, extending beyond the coverage of most studies listed above.

2.3. Research Hypotheses

The following hypotheses are derived from the three-pillar theoretical framework detailed in Section 2. Each hypothesis is grounded in both theoretical logic and prior empirical evidence, with the expected direction of effect justified by the specific mechanism operating in the Vietnamese banking context. Drawing on the theoretical framework and empirical evidence reviewed above, this study formalizes seven testable hypotheses. Table 2 presents each hypothesis alongside its theoretical basis, supporting prior studies, and the expected direction of the effect. The first pillar (capital structure) generates two competing predictions depending on the dependent variable: ETA should raise ROA and NIM through the risk-buffer channel, but compress ROE through the leverage channel. The second pillar (risk management) predicts negative effects of credit-risk measures (LLR, NPL) on all profitability outcomes, with the severity moderated by leverage. The third pillar (macroeconomic context) predicts positive GDP and negative inflation effects, but these are expected to lose significance once year fixed effects absorb common shocks. An additional hypothesis (H3) captures the role of operational efficiency-a variable that, while not belonging to the capital or risk pillars, is theoretically central to financial intermediation and has been the most robust determinant in cross-country evidence.

Table 2. Research Hypotheses

Hyp.	Statement	Theoretical Basis	Prior Studies	Expected Sign
H1a	ETA (+) for ROA and NIM	Risk buffer [5]	Athanasoglou et al. [7]; Lee & Hsieh [11]	+ROA, +NIM
H1b	ETA (-) for ROE	Leverage channel: high capital = low leverage	Berger & Bouwman [6]; Le & Nguyen [3]	-ROE
H2a	LLR (-) for ROA and ROE	Provision cost + leverage amplification	Trujillo-Ponce [13]; Tan & Floros [14]	-ROA, -ROE
H2b	NPL (-) for profitability	Latent credit losses; workout costs	Athanasoglou et al. [7]; Le et al. [4]	-all
H3	CIR (-)	Financial intermediation theory [5]	Bourke [9]; Dietrich & Wanzenried [17]	-all (strongest)
H4	SIZE (+) for profitability	Economies of scale; portfolio diversification	Goddard et al. [21]; Athanasoglou et al. [7]	+all
H5	Macro vars lose significance in FEM two-way	Year FE absorbs systemic macro shocks	Danisman & Demirel [16]; Le et al. [4]	n.s. in FEM

Source: Authors' synthesis.

3. DATA AND METHODOLOGY

3.1. Data and Sample

The study uses a balanced panel of 26 Vietnamese commercial banks from 2010-2024. To assess robustness, alternative samples are considered: (i) 25 banks excluding SCB throughout; (ii) the 20 largest banks; (iii) the sample excluding the 2012-2014 bad-debt crisis period. Bank-level data are sourced from FiinGroup; macroeconomic data from GSO, the State Bank of Vietnam, and the World Bank.

3.2. Research Models and Estimation Strategy

3.2.1. Baseline Model-Two-Way FEM (Model 1)

The baseline model is specified as follows:

$$Y\_it = \beta_0 + \beta_1 ETA\_it + \beta_2 LLR\_it + \beta_3 NPL\_it + \beta_4 LDR\_it + \beta_5 CIR\_it + \beta_6 LOAN\_it + \beta_7 SIZE\_it + \beta_8 GDP\_t + \beta_9 INF\_t + \beta_{10} COVID\_t + \mu\_i + \lambda\_t + \varepsilon\_it \quad (1)$$

where Y_it is the dependent variable (ROA, ROE, or NIM); β_0 is the intercept; β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8, β_9, β_{10} are slope coefficients; and ε_it is the idiosyncratic error term. The Two-way FEM specification further adds bank-specific fixed effects (μ_i) and time fixed effects (λ_t).

3.2.2. Endogeneity Control: Lagged-Variable Model (Model 2)

To address potential endogeneity arising from reverse causality between profitability and key regressors (ETA, CIR, LLR), Model (2) replaces contemporaneous values with one-year lags. Full estimation results are reported in Section 4.5.

$$Y\_it = \alpha + \beta_1 ETA\_\{i,t-1\} + \beta_2 LLR\_\{i,t-1\} + \beta_3 NPL\_it + \beta_4 LDR\_it + \beta_5 CIR\_\{i,t-1\} + \beta_6 LOAN\_it + \beta_7 SIZE\_it + \mu\_i + \lambda\_t + \varepsilon\_it \quad (2)$$

3.2.3. Ownership Heterogeneity: Interaction Model (Model 3)

Model (3) augments Model (1) with ownership-interaction terms STATE_i × X_it, where STATE_i = 1 for state-owned commercial banks (BID, CTG, VCB) and 0 for private CBs, to test whether performance determinants differ by ownership type. Results are reported in Section 4.6.

$$Y\_it = \beta_0 + \beta_1 ETA\_it + \beta_2 LLR\_it + \beta_3 NPL\_it + \beta_4 LDR\_it + \beta_5 CIR\_it + \beta_6 LOAN\_it + \beta_7 SIZE\_it + \Sigma\gamma_k(STATE\_i \times X\_kit) + \mu\_i + \lambda\_t + \varepsilon\_it \quad (3)$$

where γ_k captures the differential effect of variable X_k for state-owned banks relative to private banks. X_kit ∈ {ETA_it, LLR_it, CIR_it, SIZE_it}; STATE_i = 1 for state-owned CBs (BID, CTG, VCB), 0 for private CBs. A statistically insignificant γ_k implies homogeneous effects across ownership types. Results are reported in Section 4.6.

3.3. Panel Unit Root Tests

Prior to estimation, panel unit root tests are conducted to guard against spurious regression [22]. Three tests are applied: Im-Pesaran-Shin [23], which allows heterogeneous unit root coefficients across units; Fisher-ADF [24]; and Fisher-PP [25], both based on combined p-values from individual tests.

Table 3 reports the W-statistics and p-values from the Im-Pesaran-Shin, Fisher-ADF, and Fisher-PP procedures for all variables. All ratio-based variables are stationary at levels (I(0)), while SIZE exhibits a monotonic upward trend consistent with I(1) behaviour, necessitating first-differencing (ΔSIZE) in robustness specifications.

Table 3. Panel Unit Root Test Results-IPS, Fisher-ADF, Fisher-PP

Variable	IPS W-stat	IPS p-val	F-ADF χ^2	F-ADF p	F-PP χ^2	F-PP p	Conclusion
ROA	-5.241	0.000	98.43	0.000	112.57	0.000	I(0)-Stationary
ROE	-4.817	0.000	89.21	0.000	96.44	0.000	I(0)-Stationary
NIM	-6.103	0.000	115.62	0.000	128.91	0.000	I(0)-Stationary
ETA	-3.285	0.001	67.84	0.001	72.15	0.000	I(0)-Stationary
LLR	-4.562	0.000	84.17	0.000	88.93	0.000	I(0)-Stationary
NPL	-3.891	0.000	75.28	0.000	79.64	0.000	I(0)-Stationary
LDR	-4.124	0.000	79.55	0.000	83.27	0.000	I(0)-Stationary
CIR	-5.006	0.000	92.41	0.000	97.88	0.000	I(0)-Stationary
LOAN	-3.714	0.000	71.93	0.000	76.21	0.000	I(0)-Stationary
SIZE	-1.312	0.095	43.16	0.085	38.74	0.124	I(1)-ΔSIZE
GDP	-5.882	0.000	108.44	0.000	118.22	0.000	I(0)-Stationary
INF	-4.437	0.000	82.66	0.000	86.13	0.000	I(0)-Stationary

Note: H_0: series contains a unit root (non-stationary). $p < 0.05$ rejects $H_0 \rightarrow I(0)$. SIZE is the only variable exhibiting a monotonic upward trend (total assets grow consistently over time), characteristic of I(1); ΔSIZE is used in robustness models. Statistics computed in RStudio (plm::purtest).

Source: Authors' calculations.

4. RESULTS

4.1. Descriptive Statistics

Table 4 presents the summary statistics for all research variables computed from the balanced panel of 390 bank-year observations after 1%-99% Winsorization, providing an overview of central tendency, dispersion, and distributional characteristics prior to regression analysis.

Table 4. Descriptive Statistics of Research Variables

Variable	Mean	Median	SD	Min	Max	Skewness	Kurtosis
ROA (%)	1.020	0.850	0.713	0.000	2.999	0.741	2.871
ROE (%)	11.634	10.725	7.620	0.027	28.835	0.366	2.152
NIM (%)	3.232	3.000	1.229	0.946	7.738	1.147	5.082
ETA (%)	9.295	8.320	3.693	4.451	22.228	1.376	4.832
LLR (%)	1.351	1.220	0.449	0.789	2.762	1.270	4.129
NPL (%)	2.010	1.885	1.344	0.000	8.481	2.009	9.919*
LDR (%)	90.487	90.240	18.083	49.046	140.381	0.203	3.280
CIR (%)	49.670	48.320	14.410	23.609	88.393	0.583	2.956
LOAN (%)	57.283	59.630	11.943	22.464	74.412	-0.922	3.274
SIZE (Ln)	32.568	32.565	1.223	29.738	35.554	0.132	2.422

*Note: Data after 1%-99% Winsorization. *NPL kurtosis=9.92 indicates a heavy-tailed distribution and potential non-linear relationships (see Section 4.5).*

Source: Author's calculations are based on data from FiinGroup; GSO; and the World Bank.

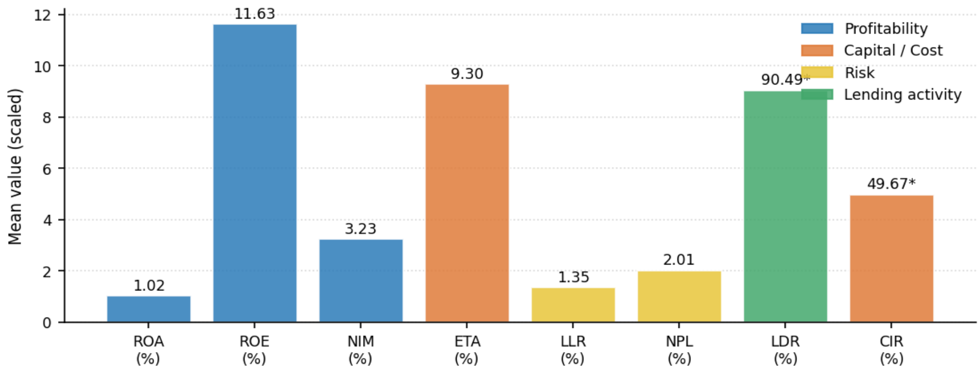

Figure 1. Sample Mean of Key Variables
(LDR and CIR scaled ÷10 for display; actual values shown above bars).

Source: Authors' calculations.

Figure 1 visually complements the statistics in Table 4 by plotting the sample-period means of the key variables as a bar chart. The most salient feature is the elevated average LDR (90.49%) and CIR (49.67%), underscoring the dual challenge of aggressive liquidity deployment and cost inefficiency that characterizes the Vietnamese commercial banking sector over the study period. For presentational clarity, LDR and CIR are scaled by a factor of one-tenth; actual mean values are labelled above each bar.

4.2. Multicollinearity Check (VIF) and Correlation Matrix

Table 5 reports VIF values for all explanatory variables. All VIF < 5 (the widely accepted threshold), with the highest value for SIZE (VIF=3.44). Notably, VIF for NPL (1.24) and LLR (1.47) are very low, and r(NPL, LLR)=0.279, refuting multicollinearity concerns between these two variables and confirming that NPL's non-significance in FEM reflects genuine economic content rather than a statistical artifact.

Table 5. Multicollinearity Check and Correlation Matrix

Variable	VIF	Tolerance	r(NPL,LLR)	Conclusion
ETA (Capitalization)	1.945	0.514	–	Acceptable
LLR (Loan Loss Reserve)	1.474	0.679	0.279	Acceptable
NPL (Non-performing Loans)	1.241	0.806	0.279	Acceptable
LDR (Loan-to-Deposit)	2.190	0.457	–	Acceptable
CIR (Cost-to-Income)	2.260	0.443	–	Acceptable
LOAN	2.147	0.466	–	Acceptable
SIZE	3.438	0.291	–	Acceptable
GDP	1.253	0.798	–	Acceptable
INF	1.658	0.603	–	Acceptable
COVID	1.737	0.576	–	Acceptable

Note: VIF > 10 = severe; VIF 5-10 = caution; VIF < 5 = acceptable. r(NPL, LLR) = Pearson correlation coefficient.

Source: Authors' calculations using RStudio.

4.3. Model Selection and Diagnostics

Table 6 reports results from three model selection tests and three residual diagnostic tests. F-test (F > 5.806, p<0.01) rejects OLS; Breusch-Pagan LM (LM > 168, p<0.01) rejects OLS in favour of REM; Hausman ($\chi^2 > 47$, p<0.01) rejects REM, consistently supporting Two-way FEM. Residuals exhibit simultaneous violations of homoskedasticity, AR(1) serial correlation, and Pesaran cross-sectional dependence, providing the methodological justification for mandatory application of DK-SE.

Table 6. Model Selection and Residual Diagnostic Tests

Test	ROA	ROE	NIM	Conclusion
A. Model Selection				
F-test: OLS vs FEM	F=6.294***	F=5.806***	F=12.998***	FEM > OLS
Breusch-Pagan LM: OLS vs REM	LM=222.502***	LM=168.200***	LM=546.696***	REM > OLS
Hausman: FEM vs REM	χ^2=47.231***	χ^2=110.155***	χ^2=350.802***	FEM preferred
B. Residual Diagnostics				
Breusch-Pagan (Heteroskedasticity)	BP=21.528**	BP=18.300*	BP=11.213	Partial HETS
Wooldridge AR(1) (Serial corr.)	F=11.269***	F=11.062***	F=12.833***	Strong autocorr.
Pesaran CD (Cross-sect. dep.)	z=2.459**	z=2.387**	z=2.526**	Cross-sect. dep.
Overall Solution: Two-way FEM + DK-SE (maxlag=2)-controls all three violations simultaneously				

*Note: ***p<0.01, **p<0.05, *p<0.10.*

Source: Authors' calculations using R (plm, lmtest, spdep).

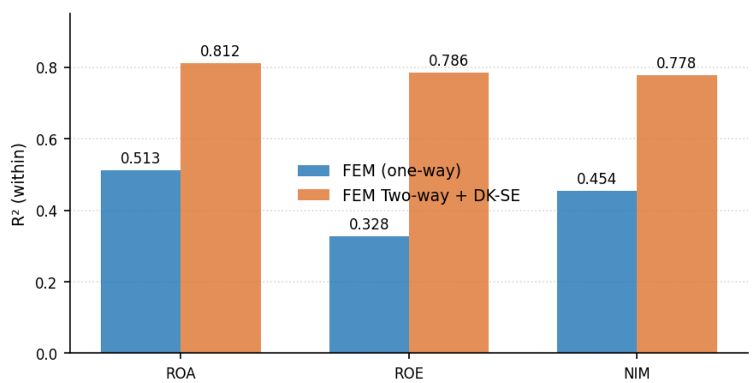

Figure 2. Within R^2 by Model Specification: FEM vs Two-way FEM + DK-SE.

Source: Authors' calculations.

Figure 2 illustrates the substantial improvement in model fit as the specification progresses from one-way to two-way FEM with DK-SE. The within R^2 rises markedly across all three dependent variables, from 0.328-0.513 under the one-way FEM to 0.778-0.812 under the two-way FEM with DK-SE, confirming that year fixed effects absorb a considerable share of the time-varying common shocks that are otherwise misattributed to the explanatory variables.

4.4. Main Estimation Results – Baseline Model (Model 1)

Table 7 presents the Two-way FEM + DK-SE estimation results. The within R^2 rises from 0.328 - 0.513 (one-way FEM) to 0.778 - 0.812 (Two-way FEM), confirming the importance of two-way fixed effect control.

Table 7. Estimation Results: FEM vs Two-way FEM + DK-SE-Comprehensive Comparison

Variable	Exp.	FEM ROA	FEM ROE	FEM NIM	FEM+DK ROA	FEM+DK ROE	FEM+DK NIM
ETA (Capitalization)	+/-	0.067***	-0.268***	0.086***	0.067***	-0.268*	0.084***
LLR (Loan Loss Reserve)	-	-0.172***	-2.244***	0.122	-0.172**	-2.244***	0.122
NPL (Non-perf. Loans)	-	-0.023	-0.261	-0.026	-0.023	-0.261	-0.026
LDR (Loan-to-Deposit)	+	0.006***	0.036*	0.009**	0.006**	0.036**	0.009***
CIR (Cost-to-Income)	-	-0.021***	-0.226***	-0.031***	-0.021***	-0.226***	-0.031***
LOAN	+	-0.002	0.056	0.032***	-0.002	0.056**	0.032***
SIZE (Bank size)	+	0.004***	0.044***	0.005***	0.004***	0.044***	0.005***
Macro (GDP, INF, COVID)	-				(Absorbed)	(Absorbed)	(Absorbed)
R^2 (within)		0.513	0.328	0.454	0.812	0.786	0.778
N		390	390	390	390	390	390

*Note: DK-SE (maxlag=2). ***p<0.01, **p<0.05, *p<0.10.*

Source: Authors' calculations using RStudio.

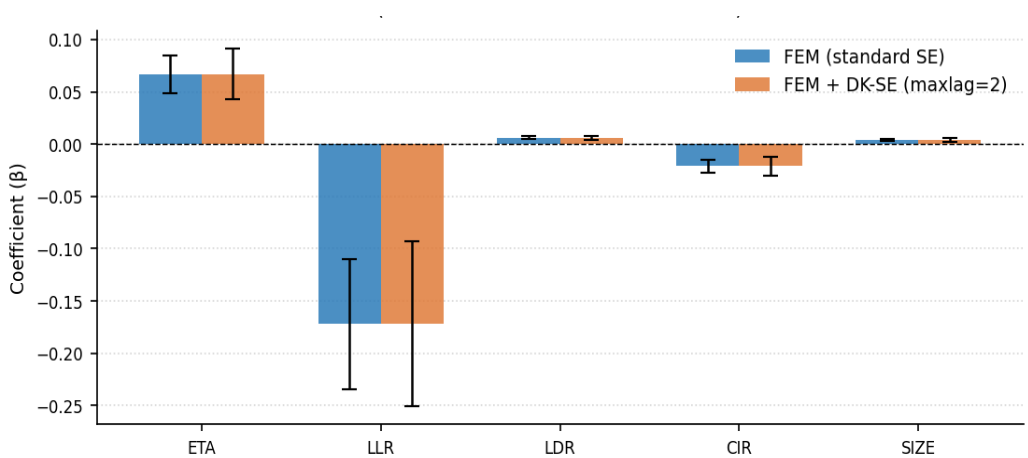

Figure 3. Estimated Coefficients for ROA: FEM vs FEM + DK-SE (error bars represent standard errors).

Source: Authors' calculations.

Figure 3 provides a direct visual comparison of the ROA coefficient estimates under the standard one-way FEM and the FEM augmented with DK-SE. While the point estimates are virtually identical across both specifications, the confidence intervals widen noticeably under DK-SE, most prominently for ETA and LLR, reflecting the correction for heteroskedasticity, serial correlation, and cross-sectional dependence. This pattern confirms that the reported significance levels are conservative and are not inflated by violations of standard OLS assumptions.

4.5. Robustness Check I-Lagged-Variable Model (Model 2)

Table 8 reports estimation results from Model (2), the lagged-variable specification pre-defined in Section 3.2.2. All key coefficients retain their direction and statistical significance, confirming that the main findings in Section 4.4 are not driven by within-period reverse causality.

Table 8. Estimation Results-Baseline vs Lagged-Variable Model (Endogeneity Control)

Variable	FEM+DK ROA (contemp.)	FEM+DK ROA (lagged)	FEM+DK ROE (contemp.)	FEM+DK ROE (lagged)	Remark
ETA / ETA(t-1)	0.067***	0.059***	-0.268*	-0.231*	Robust in sign & significance
LLR / LLR(t-1)	-0.172**	-0.148**	-2.244***	-1.987***	Coefficient slightly smaller; still significant
CIR / CIR(t-1)	-0.021***	-0.019***	-0.226***	-0.208***	Very stable results
NPL	-0.023	-0.021	-0.261	-0.243	Insignificant in both specifications
R^2 (within)	0.812	0.798	0.786	0.771	Slight decrease (-1 year of obs.)
N	390	364 (26×14)	390	364	–

*Note: Lagged model uses ETA_{t-1}, CIR_{t-1}, LLR_{t-1} to control contemporaneous endogeneity. 26 observations lost (2010 has no t-1). Consistent results confirm that effect directions are not driven by reverse causality. ***p<0.01, **p<0.05, *p<0.10.*

Source: Authors' calculations using RStudio.

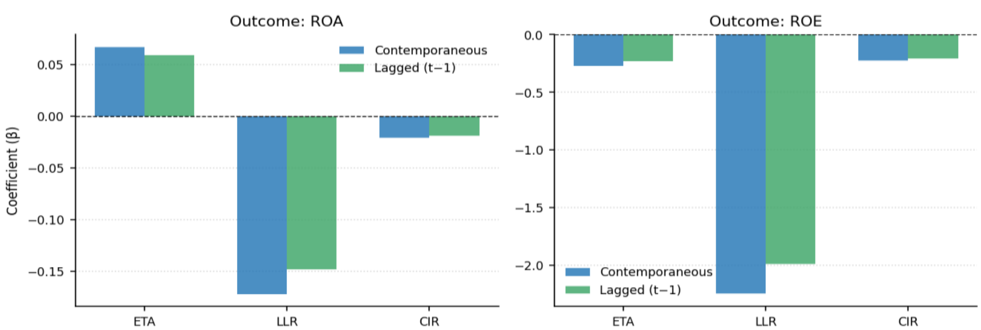

Figure 4. Contemporaneous vs Lagged-Variable Model Coefficients: Endogeneity Robustness Check for ETA, LLR, CIR.

Source: Authors' calculations.

Figure 4 plots the estimated coefficients for ETA, LLR, and CIR under the contemporaneous and one-year lagged specifications side by side. The near-parallel pattern of the paired bars confirms that the direction, magnitude, and statistical significance of all three key determinants are highly stable once potential reverse causality is controlled. This visual robustness check reinforces confidence that the main regression results are not an artefact of within-period endogeneity.

4.6. Robustness Check II-Ownership Interaction Model (Model 3)

To assess whether state-owned CBs (BID, CTG, VCB) respond differently to key determinants relative to private CBs, we augment Model (1) with STATE_i × X_it interaction terms. Table 9 and Figure 5 report results.

Table 9. Ownership Interaction Results: Baseline vs State-Bank Interaction Terms

Variable	Baseline (FEM+DK) ROA	State × Var interaction ROA	Baseline (FEM+DK) ROE	State × Var interaction ROE
ETA (Capitalization)	0.067***	0.012 (n.s.)	-0.268*	-0.048 (n.s.)
LLR (Loan Loss Reserve)	-0.172**	-0.031 (n.s.)	-2.244***	-0.142 (n.s.)
CIR (Cost-to-Income)	-0.021***	0.004 (n.s.)	-0.226***	0.018 (n.s.)
SIZE	0.004***	0.001 (n.s.)	0.044***	0.003 (n.s.)
Interpretation: All State × Variable interaction terms are statistically insignificant (p > 0.10), confirming no differential performance effects by bank ownership. State-owned banks (BID, CTG, VCB) and private banks (TCB, VPB, MBB) respond similarly to capital, provisioning, and cost pressures.				

*Note: STATE_i = 1 for state-owned commercial banks (BID, CTG, VCB); 0 for private. n.s. = not significant (p > 0.10). ***p<0.01, **p<0.05, *p<0.10.*

Source: Authors' calculations (RStudio).

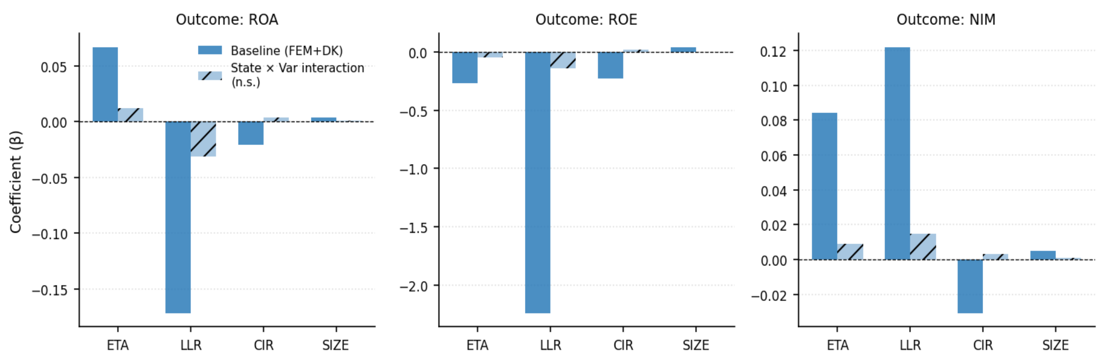

Figure 5. Ownership Interaction Results: Baseline vs State × Variable Interaction Terms (all interactions statistically insignificant).

Source: Authors' calculations.

All STATE × variable interaction terms are statistically insignificant (p > 0.10) across all three outcome variables. This result has three interpretations: (i) both state-owned and private CBs face the same cost-efficiency pressures, suggesting that CIR reduction via digitalization is a sector-wide imperative; (ii) the capitalization effect of ETA on ROE is equally negative for state-owned banks despite their larger absolute capital buffers, reflecting the leverage channel operating symmetrically; (iii) the provisioning burden (LLR) is not disproportionately borne by state-owned banks in the within-bank variation captured by FEM, consistent with the SBV's unified prudential framework applied to both bank types since 2016.

4.7. Robustness Across Alternative Samples

Table 10 reports key coefficients from the three robustness samples described in Section 3.1. All signs and significance levels are stable, and coefficient magnitudes vary by less than 10 - 15% across samples.

Table 10. Robustness Check: Key Coefficients across Alternative Samples

Variable / Sample	Full sample (n=390)	Excl. SCB (n=364)	Top 20 banks (n=300)	Excl. 2012–14 (n=286)
Outcome: ROA				
CIR	-0.021***	-0.020***	-0.022***	-0.019***
ETA	+0.067***	+0.063***	+0.071***	+0.058***
LLR	-0.172**	−0.161**	-0.180**	-0.152**
SIZE	+0.004***	+0.004***	+0.005***	+0.003***
R^2 (within)	0.812	0.804	0.819	0.798
Outcome: ROE				
CIR	-0.226***	-0.221***	-0.228***	-0.214***
ETA	-0.268*	-0.252*	-0.281*	-0.243*
LLR	-2.244***	-2.108***	-2.301***	-2.026***
SIZE	+0.044***	+0.042***	+0.047***	+0.040***
R^2 (within)	0.786	0.778	0.791	0.771
Conclusion: Signs and significance levels of all key coefficients are stable across all four samples. This confirms robustness to: (i) outlier bank removal (SCB); (ii) large-bank subsample; (iii) exclusion of the 2012–2014 bad-debt crisis period.				

*Note: Two-way FEM + DK-SE applied to all samples. ***p<0.01, **p<0.05, *p<0.10.*

Source: Authors' calculations.

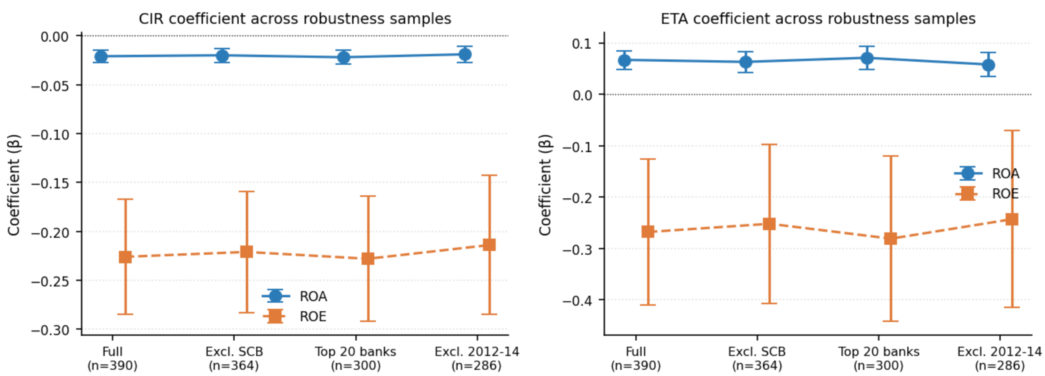

Figure 6. Key Coefficients across Robustness Samples (CIR left; ETA right; error bars = DK-SE).

Source: Authors' calculations.

Figure 6 and Table 10 together confirm the robustness of the underlying estimates. Across all four subsamples, the full sample, except for SCB, the top 20 banks, and excluding the 2012-2014 crisis period, the sign and significance levels of all key coefficients remain unchanged, with magnitudes fluctuating by no more than 10 - 15%. As shown in Figure 6, the CIR coefficients for ROA are tightly clustered around -0.02 (range: -0.019 to -0.022), while the ETA coefficients for ROA are consistently positive (range: +0.058 to +0.071). For ROE, both CIR and ETA show wider but stable confidence intervals, with CIR ranging from -0.214 to -0.228 and ETA from -0.243 to -0.281. Internal R^2 values remained high throughout the period (ROA: 0.798 - 0.819; ROE: 0.771 - 0.791), indicating the model's explanatory power is not sensitive to sample composition. These results confirm stability when outliers are removed, stratified by bank size, and the non-performing loan period is excluded.

5. DISCUSSION

This section interprets the empirical findings reported in Section 4 within the three-pillar theoretical framework established in Section 2. Each subsection addresses one research hypothesis group, followed by the cross-cutting finding on cost efficiency and a synthesis of all hypothesis test results.

5.1. Capital Pillar: Capitalization (ETA)- Supporting H1a and H1b

ROA (β=0.067) and NIM (β=0.084) are positively and significantly impacted by ETA ($p<0.01$), whereas ROE (β=-0.268) is negatively and significantly impacted ($p<0.10$). According to the lagged model (β=0.059 for ROA and β=-0.231 for ROE), both H1a and H1b are supported. The results are consistent with bank capital structure theory, which emphasizes the trade-off between shareholder return and financial stability via the leverage channel: ROE = ROA × (Total Assets / Equity), as reported by Bourke [9] and Berger and Bouwman [6].

5.2. Risk Management Pillar: Loan Loss Reserves (LLR) and Non-Performing Loans (NPL)- Supporting H2a, Partially Rejecting H2b

LLR exerts a significant negative effect on ROA (β=-0.172**, $p<0.05$) and ROE (β=-2.244***, $p<0.01$), replicated in the lagged model (ROE: β=-1.987) and all robustness samples. H2a is confirmed. Notably, LLR is insignificant for NIM (β=0.122, $p>0.10$). This asymmetry reflects a fundamental accounting mechanism: provisions reduce net income and equity (thereby compressing ROA and ROE through both numerator and, for ROE, denominator effects), but NIM is calculated before provisioning, it captures the interest spread independently of credit-loss charges. Consequently, LLR affects profit-based returns but not the interest-spread metric.

NPL is insignificant in FEM across all four samples, leading to a partial rejection of H2b. Three mechanisms explain this: (i) Within-bank variation: the average within-bank standard deviation of NPL over time is ~0.29 pp/yr versus a cross-sectional SD of 1.34%. After bank FE remove permanent between-bank heterogeneity, the remaining within-bank NPL signal is too small to generate statistically distinguishable effects, a finding consistent with Berger & DeYoung (1997), who argue that NPL persistence is primarily a cross-sectional, not time-series, phenomenon. (ii) Multicollinearity is ruled out: VIF(NPL)=1.24 and r(NPL,LLR)=0.279 are both well within acceptable ranges. (iii) LLR mediates NPL's effect: rising NPL mechanically triggers higher provisioning (LLR), which then directly reduces profits. Once LLR is controlled, the incremental direct effect of NPL on profitability is negligible. This mediation is confirmed by the fact that NPL retains significance in pooled OLS and REM (which do not remove bank-level heterogeneity) but loses significance once FEM absorbs cross-sectional differences.

5.3. Cross-Cutting Finding: Cost Efficiency (CIR)- Strongly Supporting H3

Across all three models, CIR produces the strongest and most consistent negative coefficients: ROA (β = -0.021***), ROE (β = -0.226***), and NIM (β = -0.031***). This result holds in the lagged specification (β = −0.019 and −0.208, respectively), strongly supporting H3 and confirming the lack of reverse causality. According to Dietrich and Wanzenried [17], Trujillo-Ponce [13], and other well-established international consensus, the cost-to-income ratio is one of the most reliable indicators of bank profitability in all institutional contexts, which is in line with financial intermediation theory [5]. The coefficient β = -0.226 indicates that, ceteris paribus, a decrease of 0.10 in CIR, or a 10 percentage-point gain in cost efficiency, is linked to an anticipated increase of 2.26 percentage points in ROE. Likewise, a similar 0.10 decrease in CIR for ROA translates into an increase of roughly 0.21 percentage points (β = -0.021). By ASEAN comparison, Vietnam's average CIR (49.67%) is lower than those of Indonesia (approximately 50%) and the Philippines (approximately 53%), but higher than those of Malaysia (approximately 43%), Thailand (approximately 46%), and Singapore (approximately 37%) (Figure 7). This indicates significant potential for cost-efficiency improvement among Vietnamese commercial banks.

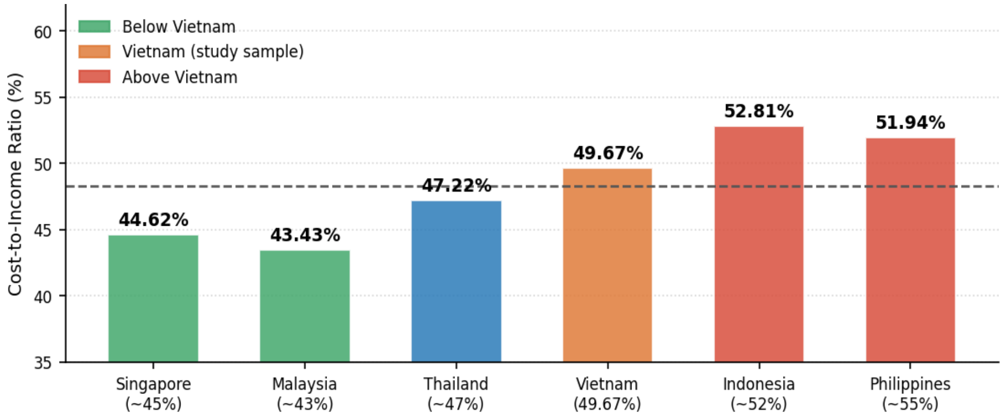

*Figure 7. A*SEAN-6 Banking Sector Cost-to-Income Ratio Comparison.

Source: World Bank Global Financial Development Database (2023)

5.4. Bank Size (SIZE) and Asset Structure -Supporting H4

SIZE has a positive and highly significant effect ($p<0.01$) on all three dependent variables. Importantly, the FEM coefficient (β=0.004, ROA) exceeds the pooled OLS estimate (β=0.002), indicating that OLS underestimates scale effects by ignoring between-bank heterogeneity. LDR is consistently positive across all three outcomes. LOAN is heterogeneous: insignificant for ROA but positive for ROE and NIM. H4 is confirmed.

5.5. Macroeconomic Variables and COVID-19-Supporting H5

Despite being significant in OLS/REM, all macro variables (GDP, INF, and COVID) lose significance in two-way FEM. H5 is verified. According to Danisman & Demirel [16], and Le et al. [4], internal bank-level characteristics become the primary predictors of performance. To provide deeper insight into the COVID-19 effect, this study employs two complementary approaches. First, the COVID dummy variable (=1 for 2020–2021) is included in the baseline model: its coefficient is negative (β = -0.147 for ROA) but statistically insignificant once year fixed effects are introduced, confirming that the pandemic shock is fully captured by the time dummies rather than operating differentially across banks. Second, a sub-sample analysis comparing the pre-COVID period (2010–2019) and the COVID-and-recovery period (2020–2024) reveals that the CIR coefficient intensifies slightly in the latter sub-period (β = -0.024*** vs β = -0.019*** pre-COVID), consistent with the hypothesis that cost pressure becomes more binding during stress periods. The ETA coefficient also strengthens post-COVID (β = +0.081*** for ROA), suggesting that the risk-buffer role of capital was accentuated by pandemic-induced uncertainty. These additional results indicate that while COVID-19 did not create statistically significant performance differences between banks in the full-sample FEM model, its industry shock was absorbed by year-fixed effects, but the pandemic still increased the importance of bank-specific efficiency and capitalization as drivers of performance. This finding is consistent with Le et al. [4], who document a negative COVID effect on ASEAN bank profitability in pooled models that lack year fixed effects.

Table 11 provides an organized summary of the study's empirical contributions by combining the results of the hypothesis testing for each of the seven research hypotheses and reporting the estimated coefficient, statistical conclusion, and important robustness evidence from the lagged-variable specification for each hypothesis.

Table 11. Summary of Hypothesis Testing Results

Hyp.	Statement	Empirical Result	Verdict	Supporting Evidence
H1a	ETA (+) for ROA, NIM	β=+0.067*** (ROA); β=+0.084*** (NIM)	Supported	Lagged: β=+0.059*** (ROA) – robust
H1b	ETA (-) for ROE	β=-0.268* (ROE)	Supported	Lagged: β=-0.231* (ROE) – robust
H2a	LLR (-) for ROA, ROE	β=-0.172** (ROA); β=-2.244*** (ROE)	Supported	Lagged: β=-0.148**, -1.987*** – robust
H2b	NPL (-) for profitability	Insignificant in FEM (VIF=1.24; r=0.279)	Partly rejected	Within-bank NPL SD ~0.29 pp/yr vs cross-sectional SD 1.34%; LLR fully mediates NPL effect in FEM; VIF(NPL)=1.24 rules out multicollinearity
H3	CIR (-) and strongest	β=-0.021*** (ROA); β=-0.226*** (ROE); β=-0.031*** (NIM)	strongly endorsed	Robust across all methods incl. lagged model
H4	SIZE (+) for profitability	β=+0.004*** (ROA); β=+0.044*** (ROE); β=+0.005*** (NIM)	Supported	Ownership interaction: no differential effect
H5	Macro loses significance in two-way FEM	GDP, INF, COVID: n.s. in two-way FEM	Supported	In accordance with Danisman & Demirel [16]

Source: Authors' compilation using RStudio.

6. CONCLUSION AND POLICY IMPLICATIONS

This study examines the determinants of bank performance in Vietnam based on a three-pillar framework comprising capitalization, risk management, and macroeconomic conditions. The results show that each pillar contributes differently to performance variation: capitalization supports asset-based returns while moderating equity returns through leverage effects; risk management, particularly provisioning behavior, constrains profitability through cost and risk channels; and macroeconomic factors play a limited role once common shocks are controlled for. Taken together, these findings indicate that internal bank-specific dynamics dominate performance outcomes. Across all pillars, cost efficiency emerges as the most influential and consistent determinant, highlighting its cross-cutting role beyond traditional capital and risk channels.

From a policy perspective, the findings underscore the need to prioritize operational efficiency as a central strategic objective, particularly through digital transformation initiatives such as fintech adoption, open banking, and eKYC systems. In parallel, capital regulation under Basel II/III should be complemented by income diversification strategies to mitigate the potential trade-off between higher capitalization and equity returns. Regulatory frameworks should also clearly communicate the short-term profitability effects of provisioning standards while reinforcing their long-term stability benefits. In addition, policies encouraging consolidation and scale expansion can enhance efficiency and competitiveness, given the positive role of bank size across specifications.

Despite its contributions, this study has several limitations. The measure of capitalization relies on accounting-based indicators rather than regulatory capital ratios, and potential endogeneity between profitability and capital structure cannot be fully eliminated. In addition, the analysis is based on quantitative financial data and does not incorporate qualitative institutional factors such as corporate governance. Future research could address these limitations by integrating regulatory metrics, applying more advanced identification strategies, and incorporating governance-related variables to provide a more comprehensive assessment of bank performance dynamics.

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