Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.55493/5002.v15i8.5507
Vol. 15, No. 8, 1244-1256.

URL: www.aessweb.com

Factors affecting capital structure of listed joint-stock commercial banks on the Vietnamese stock market

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Article History
Received: 17 April 2025
Revised: 20 June 2025
Accepted: 9 July 2025
Published: 29 July 2025

Keywords
Business performance
Capital structure
Debt capital
Internal financial factors
Joint-stock commercial banks
Stock market.

JEL Classification:
G21; G30; G32.

ABSTRACT

The study analyzes the factors affecting the capital structure of commercial banks listed on the Vietnamese stock market from 2014 to 2024. Using a panel data set collected from 15 leading banks, the study conducts regression analysis to test the impact of internal financial factors such as bank size, solvency, profitability, profit after tax, and bank age on the ratio of total liabilities to assets (TLEV), which is used as a proxy for capital structure. These banks are among those with the largest total assets in the banking system. After data collection and processing, the research sample consists of 165 observations. Using Stata software for quantitative analysis, a regression model was constructed to determine the relationship and the extent of impact of internal factors on the capital structure of listed joint-stock commercial banks. The empirical results show that liquidity and profitability have a negative and statistically significant impact on TLEV, implying that banks with high operational efficiency and sound liquidity tend to utilize less debt. This aligns with the view that businesses prefer internal funding sources due to lower costs and reduced control risks. The study also indicates that banks with larger size and a higher proportion of fixed assets tend to have higher levels of financial leverage.

Contribution/ Originality: The study contributes to the academic literature by updating evidence from emerging markets and focusing on the banking sector, the core sector of the financial system. At the same time, the study provides useful financial management and policy implications for optimizing capital structure and enhancing the stability of the banking system.

1. INTRODUCTION

A sound capital structure plays a vital role in ensuring the stability and growth of joint-stock commercial banks (JSCBs). A well-balanced capital structure allows banks to maintain liquidity, minimize financial risk, and ensure their ability to expand operations. If the equity ratio is too low, a bank may struggle to absorb risks and become vulnerable to market fluctuations. Conversely, excessive reliance on equity capital may cause banks to miss opportunities to optimize returns through financial leverage. Furthermore, a proper capital structure enables banks to comply with capital adequacy regulations such as Basel III, thereby enhancing their credibility and gaining the trust of investors and customers. Balancing debt and equity also helps banks manage capital costs effectively and optimize profitability. In addition, a strong capital foundation facilitates credit expansion, supporting the sustainable development of the overall economy.

This study clarifies two main points:

First, the study provides empirical evidence from Vietnam a developing market on the relationship between solvency, profitability, and capital structure of commercial banks.

Second, the results indicate that solvency and profitability have an inverse effect on the ratio of total liabilities to total assets (TLEV), thereby providing practical suggestions for bank managers to balance operational efficiency and financial risks. The results confirm that commercial banks need to find a balance between equity financing and debt financing to maintain an optimal capital structure, taking advantage of financial leverage without increasing the risk of insolvency.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Literature Review

Studies on the determinants of bank capital structure have been conducted across different regions and contexts. One such study titled "Determinants of Capital Structure of Banks: Evidence from Sub-Saharan Africa" analyzes the factors influencing the capital structure of banks in the Sub-Saharan Africa region using panel data. The study considers dependent variables such as short-term debt ratio, long-term debt, and total debt, with independent variables including return on assets, total asset growth rate, corporate tax rate, interest rate, and inflation. The findings show that internal factors have a stronger impact on capital structure, whereas macro-financial factors like tax and growth have limited significance.

Konovalova (2019) investigates the relationship between liquidity and profitability using data from US commercial banks in her study "Management of Liquidity and Profitability in Commercial Banks." The study emphasizes the importance of balancing liquidity and profitability to ensure optimal financial performance.

David (2021) "Capital Structure and Profitability: Panel Data Evidence of Private Banks". This study uses panel data to explore the relationship between capital ratio and profitability in private banks. The results suggest that banks with higher capital ratios are generally more financially stable, although this might limit their growth due to restricted access to debt financing.

Koroleva, Jigeer, Miao, and Skhvediani (2021) "Determinants Affecting Profitability of State-Owned Commercial Banks: Case Study of China". In their study on state-owned commercial banks in China, they examine the effect of internal factors such as bank size, credit quality, and liquidity on profitability from 2007 to 2019. The study finds that internal factors positively affect profitability, while GDP has a negative effect. These studies emphasize the role of internal factors in enhancing equity capital.

Chen, Zhang, and Wang (2022) in their paper "Capital Structure and Performance of Commercial Banks: Evidence from Emerging Markets." This paper analyzes the relationship between capital structure and the performance of commercial banks in emerging markets, using data from banks in Southeast Asia and South Asia. The study finds that high debt ratios can reduce financial performance in the short term but support long-term growth. This has important implications for banks in the process of optimizing their capital structure.

Khan (2022) investigates "The impact of capital structure on bank performance in emerging markets: Empirical evidence from GCC countries". This study contributes to the empirical evidence on the relationship between capital structure and bank performance. It uses data from commercial banks listed on multiple stock exchanges in six Gulf Cooperation Council (GCC) countries. The study employs unbalanced panel data from 50 banks operating in these countries during the period 2012-2017, with 299 observations. Return on assets (ROA) and return on equity (ROE) are used as performance variables, while the total debt ratio serves as the explanatory variable. Bank size, income volatility, growth rate, and inflation rate are included as observed variables. The results indicate that financial leverage and control variables significantly impact bank performance.

Eltweri, Sawan, Al-Hajaya, and Badri (2024) "The Influence of Liquidity Risk on Financial Performance: A Study of the UK's Largest Commercial Banks". This study examines the impact of liquidity risk on the financial performance of the largest commercial banks in the UK, especially after Basel III regulations. The results show that

high liquidity levels may reduce banks' equity in the short term but help maintain financial stability in the long term.

The studies above provide important perspectives on the capital structure of commercial banks.

- Debt and profitability: High debt financing can increase long-term growth but reduce short-term profitability.
- Liquidity and financial performance: Maintaining high liquidity ensures bank stability but can reduce short-term profitability.
- Macroeconomic factors: GDP can have a negative impact on bank profitability, especially in developing economies.

2.2. Hypotheses

The study proposes to measure the influence of internal factors: bank size (SIZE), return on assets (ROA), solvency (CAP), net income (NI), and year of banks (YOB) on the TLEV capital structure of commercial banks.

2.2.1. Bank Size

Bank size has a significant impact on TLEV due to its access to capital and risk management. According to the economies of scale theory, banks mobilize deposits at preferential interest rates. Research by Gropp and Heider (2010) shows that large banks tend to use higher financial leverage. However, if banks expand too much, increased risks can reduce asset quality. In contrast, small banks often rely heavily on equity to ensure financial safety. Therefore, bank size can have a two-way impact on capital structure depending on each bank's capital management strategy.

The hypothesis is:

H_1: Bank size affects TLEV.

2.2.2. Solvency

Solvency reflects the availability of liquid assets to meet short-term debt obligations, which directly affects the decision to use financial leverage. According to Diamond and Rajan (2001), banks with abundant liquidity are less dependent on debt because they have sufficient capital to finance their operations. Conversely, banks with low liquidity may need to increase debt to maintain operations, thereby increasing TLEV and financial risk. The balance between liquidity and financial leverage is a crucial aspect of bank management, ensuring that banks remain highly profitable while maintaining financial stability.

The hypothesis is:

H_2: Solvency has a negative impact on TLEV.

2.2.3. Profitability

Profitability reflects the efficiency of a bank's use of capital and can influence its decision to use debt financing. According to Rajan and Zingales (1995), highly profitable firms tend to use less debt financing because they have sufficient internal capital to finance their operations. However, in the banking sector, high profits can encourage banks to increase debt to expand operations, optimizing return on equity (ROE). Berger and Di Patti (2006) also found that banks with high profitability tend to use appropriate financial leverage to maintain a competitive advantage. The relationship between TLEV and profitability is therefore not fixed but depends on the bank's financial strategy.

The hypothesis is:

H_3: Profitability has a positive effect on TLEV.

2.2.4. Net Income

According to Modigliani and Miller (1958), when corporate income tax is high, banks tend to use more debt to take advantage of the tax shield. However, Frank and Goyal (2009) show that when profits are high, banks can reduce debt financing to maintain financial stability. Therefore, the relationship between TLEV and net income depends on tax policy, financial strategy, and risk profile of each bank.

The hypothesis is:

H_4: Net income has a negative impact on TLEV.

2.2.5. Year of Banks

According to Berger and Udell (1998), older banks tend to have a higher reputation, are more likely to raise capital at lower costs, and use more debt financing. On the contrary, younger banks may have difficulty raising capital from the markets, so they have to rely more on equity. However, Degryse, Elahi, and Penas (2013) found that older banks tend to be more conservative, limiting the use of debt financing to minimize risk. Thus, the impact of bank age on TLEV may vary depending on the business strategy and financial environment of each bank.

The hypothesis is:

H_5: Bank Age has a positive effect on TLEV.

3. RESEARCH METHODS

3.1. Research Data

The study utilizes data collected from the financial statements of 15 typical joint-stock commercial banks listed on the Vietnam stock exchange from 2014 to 2024. The sample was selected based on the following criteria: (i) continuous operation and availability of complete financial statements throughout the research period, (ii) high representativeness in terms of asset size and market share, and (iii) ensuring data consistency and reliability. The dataset was established in accordance with the accounting standards system and has been audited. After collecting and processing the data, the research sample comprises 165 observations. Using Stata software for quantitative analysis, a regression model was developed to determine the relationship and the level of influence of internal factors on the capital structure of commercial banks listed on the Vietnam stock market. Among these internal factors, the study selected five independent variables with a strong theoretical and empirical basis, including: bank size, solvency, profitability, after-tax profit, and bank age. The selection of these variables aims to ensure comprehensive coverage of internal financial aspects and characteristics of the entities, thereby providing a more complete explanation of decisions regarding the capital structure in the banking industry.

3.2. Research Model

The study employs a quantitative method with a panel data regression model that allows for the simultaneous analysis of spatial (between banks) and temporal (over 11 years from 2014 to 2024) variations, thereby enhancing the reliability and generalizability of the research results. The FEM and REM models are used for estimation, and the Hausman test is applied to determine the appropriate model between fixed and random effects. To ensure the robustness and optimality of the model, diagnostics for multicollinearity and autocorrelation are conducted.

3.2.1. General Regression Model

The general form of the regression model is as follows: $Y = \beta_0 + \beta_t X_t + u_i$

Where:

Y: dependent variable; X_t: independent variable; β_0: coefficient of freedom; β_t: regression coefficient (with t ranging from 1 to n); and ui: random error.

In the context of this study, the dependent variable (Y) is the capital structure of commercial banks, represented by TLEV. The independent variables include SIZE, CAP, ROA, NI, and YOB.

3.2.2. Building and Validating Research Models

The parameters of the regression model are estimated using STATA software.

General regression model:

$$TLEV_i = \beta_0 + \beta_1 * SIZE + \beta_2 * CAP + \beta_3 * ROA + \beta_4 * NI + \beta_5 * YOB + u_i *$$

Overall regression function:

$$TLEV_i = \beta_0 + \beta_1 * SIZE + \beta_2 * CAP + \beta_3 * ROA + \beta_4 * NI + \beta_5 * YOB$$

In which:

1. Dependent variable in the TLEV model (TLEV is determined by the debt to total assets of each commercial bank in 15 commercial banks listed on the Vietnamese stock market during the period 2014–2024).

2. The group of independent variables in the model includes:

SIZE: Bank size, measured by the logarithm of total assets

CAP: Solvency, measured by the ratio of total liabilities

ROA: Profit margin, measured by the ratio of profit after tax to total assets

NI: Net income after tax, measured by the final profit after deducting all expenses

YOB: Bank age, measured by the number of years the bank has been in operation

β_i: The partial regression coefficient measuring the change in the mean value of the dependent variable TLEV when the independent variable changes by one unit and the other independent variable remains unchanged

u_i: The random error of the model

3.3. Scale Test

The statistics are presented in the table below.

Table 1. Descriptive statistics.

Variable	N	Minimum	Maximum	Mean	Std. deviation
TLEV	165	0.829	0.959	0.916	0.029
SIZE	165	7.566	9.441	8.530	0.421
CAP	165	1.042	1.206	1.092	0.036
ROA	165	-0.043	0.032	0.011	0.009
NI	165	0.000	7.529	6.317	1.163
YOB	165	1.230	1.826	1.463	0.137

The data in Table 1 show that:

The financial leverage ratio (TLEV) is quite high and fluctuates little. The small standard deviation indicates a low level of variation among banks.

The size of commercial banks (SIZE) shows a moderate level of variation.

The solvency (CAP) is quite even.

The return on assets (ROA) indicates that some enterprises are loss-making. The standard deviation shows that the variation in return on assets among banks is not significant.

Net income (NI) fluctuates a lot, including some enterprises with no profit after tax. The standard deviation shows a fairly high level of variation among banks.

The number of years in operation of the bank (YOB) indicates that the ages of the banks are not significantly different.

General conclusion: Variables such as TLEV, CAP, and ROA have small standard deviations, indicating that the data are quite consistent. The NI variable exhibits the greatest variation, reflecting significant differences in net profit among banks. These descriptive indices demonstrate that the research data are highly reliable.

4. RESEARCH RESULTS

The study develops a regression equation to evaluate the impact of internal factors on the capital structure of listed joint-stock commercial banks. After estimating the model, necessary tests should be conducted to assess its suitability and reliability.

Specifically, the study tests the significance of the regression coefficients βi to determine whether the independent variable has a significant impact on the dependent variable. At the same time, the adjusted coefficient of determination R^2 (Adjusted R Square) will be used to assess the model's level of explanation for the fluctuations of the dependent variable. Additionally, to ensure the accuracy of the results, the study examines the technical issues of the model: autocorrelation and heteroskedasticity. This helps determine whether the model violates econometric assumptions, thereby providing appropriate adjustment directions.

4.1. Empirical Results

Run the model with Stata software according to the panel data the results are:

Table 2. Regression with fixed effects.

R-squared:
Within = 0.858
Between = 0.859
Overall = 0.858
F(5,145) = 11998.800
corr(u_i, Xb) = 0.2647 Prob > F = 0.0000

TLEV	Coefficient	Std. error	T	P>|t|	[95% conf. interval]	
SIZE	0.001	0.001	0.980	0.326	-0.001	0.003
CAP	-0.795	0.004	-207.660	0.000	-0.802	-0.787
ROA	-0.045	0.019	-2.400	0.018	-0.823	-0.008
NI	0.000	0.000	0.390	0.697	-0.000	0.000
YOB	-0.003	0.004	-0.570	0.569	-0.012	0.007
_cons	1.779	0.005	349.560	0.000	1.769	1.789

The model applies fixed effects regression.

F(5,145) = 11998.800, Prob > F = 0.0000. The model is statistically significant overall.

Analysis of independent variables of Fixed Effect regression.

SIZE (0.00115, p = 0.326). Not statistically significant (p > 0.05)

CAP (-0.795, p = 0.000). The negative effect is very strong and statistically significant. When CAP increases by 1 unit, TLEV decreases by an average of 0.7947 units..

ROA (-0.045, p = 0.018). The effect is negative and statistically significant. When ROA increases by 1 unit, TLEV decreases by an average of 0.0452 units.

NI (0.00007, p = 0.697) and YOB (-0.003, p = 0.569). Not statistically significant.

The data in Table 3 shows that: Prob > F = 0.0000. The model is statistically significant overall.

Analysis of independent variables of Random Effect regression:

SIZE (0.001, p = 0.326). Not statistically significant (p > 0.05). SIZE does not significantly affect TLEV.

CAP (-0.796, p = 0.000) shows a very strong and statistically significant negative effect. When CAP increases by 1 unit, TLEV decreases by an average of 0.7961 units.

ROA (-0.047, p = 0.018) shows a negative and statistically significant effect. When ROA increases by 1 unit, TLEV decreases by an average of 0.047 units.

NI (0.00000792, p = 0.697) and YOB (0.000377, p = 0.569). Not statistically significant; no significant effect on TLEV.

Table 3. Regression results with random effect.

R-squared:
Within = 0.858
Between = 0.859
Overall = 0.858 Wald chi2(5) = 70191.940
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0000

TLEV	Coefficient	Std. error	Z	P>|z|	[95% conf. interval]	
SIZE	0.001	0.001	1.070	0.326	-0.001	0.002
CAP	-0.796	0.003	-226.150	0.000	-0.803	-0.789
ROA	-0.047	0.017	-2.670	0.018	-0.081	-0.012
NI	0.000	0.000	0.050	0.697	-0.000	0 .000
YOB	0.000	0.002	0.170	0.569	-0.004	0.005
_cons	1.779	0.005	392.060	0.000	1.771	1.789

4.2. Using the Hausman Test to Select Models

4.2.1. Testing Paired Hypotheses

H_0: There is no correlation between the explanatory variables and the random component (choose random effect).

H_1: There is a correlation between the explanatory variables and the random component (Choose Fixed Effect).

Table 4. Hausman test results.

Coefficients:				
Variable	(b)	B	(b – B)	Sqrt(diag(V_b-V_B))
	Fe	Re	Difference	Std.err.
SIZE	0.001	0.001	0.000	0.001
CAP	-0.795	-0.796	0.001	0.002
ROA	-0.045	-0.047	0.002	0.007
NI	0.001	7.921	6.340	8.031
YOB	-0.002	0.000	-0.003	0.004

Note: b = Consistent under H0 and Ha; obtained from xtreg.
B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Table 4 Hausman test indicates: the difference in coefficients is not systematic.

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 7.08.

Prob > chi2 = 0.2149.

Chi-square (chi2(5)) = 7.08; P-value = 0.2149

P-value > 0.05. There is not enough evidence to reject the hypothesis Ho. The random effect model REM is appropriate.

The data in Table 5 shows that:

SIZE is strongly correlated with NI (0.683) and YOB (0.762), statistically significant at the NI level of 0.01.

CAP is strongly correlated with ROA (0.616) and NI (0.278), both of which are statistically significant.

ROA is significantly correlated with NI (0.699) and CAP (0.616) is correlated with YOB (0.377).

YOB is strongly correlated with SIZE (0.762) but negatively correlated with CAP (-0.193) at the 0.05 level of significance.

Table 5. Analysis of correlation coefficient matrix between variables.

Variable		SIZE	CAP	ROA	NI	YOB
SIZE	Pearson correlation	1.000	-0.009	0.333**	0.683**	0.762**
	Sig. (2-tailed)		0.907	0.000	0.000	0.000
	N	165	165	165	165	165
CAP	Pearson correlation	-0.009	1.000	0.616**	0.278**	-0.193*
	Sig. (2-tailed)	0.907		0.000	0.000	0.013
	N	165	165	165	165	165
ROA	Pearson correlation	0.333**	0.616**	1.000	0.699**	0.060
	Sig. (2-tailed)	0.000	0.000		0.000	0.447
	N	165	165	165	165	165
NI	Pearson correlation	0.683**	0.278**	0.699**	1.000	0.377**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	N	165	165	165	165	165
YOB	Pearson correlation	0.762**	-0.193*	0.060	0.377**	1.000
	Sig. (2-tailed)	0.000	0.013	0.447	0.000	
	N	165	165	165	165	165

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Check the variance inflation factor (VIF) to better assess multicollinearity.

Table 6. VIF coefficient analysis results.

Variable		Tolerance	VIF
1	SIZE	0.235	4.257
	CAP	0.553	1.808
	ROA	0.312	3.207
	NI	0.275	3.641
	YOB	0.365	2.743

Note: Dependent variable: TLEV.

Table 6 presents the Tolerance and VIF values:

SIZE has Tolerance 0.235 (> 0.1), which meets the requirements; VIF = 4.257 (< 5) is quite high but does not exceed the threshold of serious multicollinearity.

NI has Tolerance 0.275, which meets the requirements; VIF = 3.641, indicating multicollinearity, needs to be monitored.

YOB, CAP and ROA show no signs of multicollinearity or non-serious multicollinearity, acceptable.

Conclusion: There are no signs of serious multicollinearity among the independent variables in the model because all VIF values are < 5 and Tolerance > 0.1. In which the SIZE variable has the highest VIF of 4.257. CAP is the variable with the lowest level of multicollinearity, with VIF = 1.808, showing that it is quite independent from the other variables.

Additional multicollinearity diagnostics to assess the independence of variables in addition to the VIF and Tolerance indices.

Table 7. Collinearity diagnostics[a].

Condition index	(Constant)	SIZE	CAP	ROA	NI	YOB
1.000	0.000	0.000	0.000	0.000	0.000	0.000
4.268	0.000	0.000	0.000	0.310	0.000	0.000
21.002	0.000	0.000	0.010	0.210	0.470	0.000
33.177	0.000	0.000	0.010	0.150	0.240	0.420
104.064	0.000	0.730	0.250	0.110	0.270	0.540
155.401	0.990	0.270	0.730	0.210	0.020	0.040

Note: a. Dependent variable: TLEV

Table 7 provides the condition index analysis to assess multicollinearity:

Dimension1 and 2 (Condition Index = 1.000 and 4.268): No signs of multicollinearity.

Dimension 3 (Condition Index = 21.002): Signs of moderate multicollinearity.

Dimension 4 (Condition Index = 33.177): Strong multicollinearity. ROA (0.150), NI (0.240) and YOB (0.420) all have significant variance ratios. This suggests that ROA and YOB may have a close relationship.

Dimension 5 (Condition Index = 104.064): Severe multicollinearity. SIZE (0.730) and YOB (0.540) have very high variance ratios. This suggests that SIZE and YOB are likely to cause serious multicollinearity problems.

Dimension 6 (Condition Index = 155.401): Extremely severe multicollinearity. CAP (0.730) and SIZE (0.270) have high variance ratios. This is a clear sign of strong multicollinearity between CAP and SIZE. Thus, severe multicollinearity occurs in Dimensions 5 and 6 with Dimension 5. The correlation between SIZE and YOB causes the problem; Dimension 6 is particularly severe between CAP and SIZE.

To optimize the model, remove the SIZE variable from the model to eliminate severe multicollinearity.

Table 8. Model summary.

Test R^2				
Model	**R**	**R squared**	**Adjusted R-squared**	**Std. error of the estimate**
1	0.855[a]	0.854	0.854	0.001

Note: a. Predictors: (Constant), YOB, ROA, CAP, NI.
R^2 = 0.854 is unchanged, showing that the new model after removing the SIZE variable is more reasonable.

Table 8 presents: R^2 = 0.854. It remains unchanged, indicating that the new model, after removal, is more reasonable.

Table 9. The Anova[a].

Test Anova[a]						
Model		**Sum of squares**	**Df**	**Mean square**	**F**	**Sig.**
1	Regression	0.139	4	0.035	22808.027	0.000[b]
	Residual	0.000	160	0.000		
	Total	0.139	164			

Note: a. Dependent variable: TLEV.
b. Predictors: (Constant), YOB, ROA, CAP, NI.
Sig.<0.05 shows that the new model is still statistically significant.

Table 9 presents the ANOVA results, showing that the model is statistically significant (p<0.001).

Table 10. Coefficients[a].

Model		**95.0% confidence interval for B**	
		Lower bound	**Upper bound**
1	(Constant)	1.776	1.792
	CAP	-0.805	-0.790
	ROA	-0.073	0.006
	NI	0.000	0.000
	YOB	0.002	0.005

Note: a. Dependent variable: TLEV

Table 10 presents the estimated coefficients and 95% confidence intervals. After removing the SIZE variable, the model was adjusted and stabilized for multicollinearity.

4.2.2 Additional Analysis

Table 11. Autocorrelation test.

R-squared:
Within = 0.854
Between = 0.854
Overall = 0.854
Wald chi2(6) = 56041.680
corr(u_i, Xb) = 0 (assumed) Prob > chi2 = 0.0000

TLEV	Coefficient	Std. error	Z	P>|z|	[95% conf. Interval]	
SIZE	0.002	0.001	2.570	0.010	0.000	0.003
CAP	-0.801	0.004	-219.830	0.000	-0.808	-0.794
ROA	-0.034	0.013	-2.580	0.010	-0.059	-0.008
NI	-0.000	0.000	-1.170	0.241	-0.000	0.000
YOB	-0.001	0.004	-0.480	0.634	-0.005	0 .003
_cons	1.779	0.005	330.980	0.000	1.769	1.790

Table 11 shows that:

SIZE (p = 0.010) → significant (p < 0.05)

CAP (p = 0.000) → strongly significant (p < 0.01)

ROA (p = 0.010) → statistically significant (p < 0.05)

NI (p = 0.241) → not statistically significant

YOB (p = 0.634) → not statistically significant

Conclusion:

CAP and ROA are still important factors affecting TLEV.

SIZE is significant, but there is previous multicollinearity.

NI and YOB are not statistically significant. Consider removing them for a better model.

Run the FGLS model after removing variables to control for autocorrelation and heteroscedasticity issues.

Table 12. Correlation regression after removing variables.

Estimated covariances = 1
Estimated autocorrelations = 0
Estimated coefficients = 3
Wald chi2(2) = 85094.310
Log likelihood = 865.249 Prob > chi2 = 0.0000

TLEV	Coefficient	Std. error	Z	P>|z|	[95% conf. interval]	
CAP	-0.801	0.004	-228.460	0.000	-0.808	-0.794
ROA	-0.032	0.015	-2.160	0.031	-0.060	-0.003
_cons	1.792	0.004	480.000	0.000	1.785	1.799

Source: Calculated from Stata software

Table 12 provides an overview of the regression model:

"Correlation: no autocorrelation"

Panels: Homoskedasticity.

Wald chi2(2) = 85094.310, Prob > chi2 = 0.0000.

The model is overall significant, meaning the independent variables have an effect on the dependent variable (TLEV).

CAP (p = 0.000) → Strong statistical significance (p < 0.01).

ROA (p = 0.031) → Statistically significant (p < 0.05).

Regression model:

$$TLEV_i = \beta_o - \beta_1 \times CAP - \beta_2 \times ROA$$

Regression function:

$$TLEV = 1.792021 - 0.8012522 \times CAP - 0.031725 \times ROA$$

5. DISCUSSION AND RECOMMENDATIONS

5.1. Discussion

CAP coefficient = -0.8012522: The impact is negative and very significant on TLEV. That is, when the capital ratio (CAP) increases by 1 unit, TLEV decreases by an average of 0.8012 units, assuming other factors remain constant. This may be because banks with high capital ratios tend to use less financial leverage.

ROA coefficient = -0.031725: Negative effect on TLEV. When ROA increases by 1 unit, TLEV decreases by 0.0317 units on average. This may be because banks with good profitability will rely less on leverage.

Thus, CAP and ROA have an effect on TLEV. The variables NI, YOB, and SIZE have no effect because they were eliminated earlier due to their lack of significance in the previous model.

5.2. Recommendations

The study uses updated data for the period 2014-2024 with a sample of listed commercial banks—a group of banks that play a leading role in the market, thereby improving the representativeness and research results. The study provides empirical evidence in Vietnam on the relationship between solvency, profitability, and capital structure of commercial banks.

The research results show that solvency and profitability have an inverse effect on debt to total assets (TLEV). In other words, TLEV is affected by two variables: CAP and ROA. When CAP solvency increases, commercial banks have stronger cash flow, less dependence on debt, and reduced financial leverage. An increase in ROA indicates that businesses use assets effectively, generate more profit from equity, and utilize retained earnings to finance operations instead of debt. This suggests that banks with strong financial capacity often choose to use lower financial leverage to maintain stability and control risks. Therefore, bank managers should adjust financial policies flexibly, especially in the context of economic fluctuations, to ensure a balance between profitability and financial safety.

First, strengthen funding capacity by improving profitability. Banks need to focus on enhancing sustainable profitability through cost control, diversifying credit products, financial services, and investing in digital transformation to reduce operating costs, thereby increasing ROA. Higher profitability will decrease dependence on debt capital, contributing to a healthier capital structure. Consequently, banks can accelerate the promotion of high-yield financial products such as consumer credit, credit cards, trade finance, etc.

Second, effectively manage liquidity and avoid excessive leverage. With the inverse relationship between solvency and TLEV, banks need to develop a strict liquidity management policy, optimizing the use of short-term assets to maintain high solvency without increasing short-term debt. However, the capital mobilization ratio should not be reduced quickly because financial leverage helps banks expand credit and increase profits, and they should consider using bank bonds to maintain medium- and long-term capital sources instead of relying solely on equity.

Third, to maintain a sustainable TLEV, banks should actively grow their credit portfolios, especially focusing on high-yield products such as consumer loans, credit cards, and trade finance.

Fourth, manage capital sources effectively by: (1) diversifying capital sources: in addition to customer deposits, banks should explore interbank markets and long-term bond issuance to ensure flexibility in capital structure; (2) controlling capital costs: a higher proportion of non-term deposits lowers funding costs, which can be leveraged for credit expansion without rapidly increasing equity capital.

Fifth, strengthen risk control and financial transparency. To enhance the confidence of investors and regulators, thereby providing more options for capital structure, banks need to be more transparent in disclosing financial information, especially regarding credit risk, liquidity, and asset quality.

6. CONCLUSION

This study investigated the internal factors affecting the capital structure of listed joint-stock commercial banks on the Vietnamese stock market during the period 2014-2024. Based on data collected from 15 listed joint-stock commercial banks, an empirical model was developed to demonstrate the correlation between internal factors and the banks' capital structure. The regression model accurately reflects the recent operations of listed joint-stock commercial banks in Vietnam, indicating that implementing the suggested solutions is necessary. Banks should maintain an optimal capital structure, avoid abrupt reductions in financial leverage, leverage low-cost capital sources to expand credit, and ensure financial stability through effective liquidity management.

Funding: This research is supported by the Academy of Finance, Vietnam.
Institutional Review Board Statement: Not applicable.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author
Competing Interests: The authors declare that they have no competing interests
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

Berger, A. N., & Di Patti, E. B. (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Journal of Banking & Finance*, *30*(4), 1065-1102. http://doi.org/10.1016/j.jbankfin.2005.05.015

Berger, A. N., & Udell, G. F. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, *22*(6-8), 613-673. https://ssrn.com/abstract=137991

Chen, X., Zhang, Y., & Wang, L. (2022). Capital structure and performance of commercial banks: Evidence from emerging markets. *Journal of Emerging Market Finance*, *21*(2), 123–145.

David, M. (2021). Capital structure and profitability: Panel data evidence of private banks. *Cogent Economic and Finance*, *9*(1). https://doi.org/10.1080/23322039.2021.1953736

Degryse, H., Elahi, M. A., & Penas, M. F. (2013). Determinants of banking system fragility: A regional perspective. *The Social Science Research Network*, *47*(3). http://doi.org/10.2139/ssrn.2027897

Diamond, D. W., & Rajan, R. G. (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. *Journal of Political Economy*, *109*(2), 287-327. https://doi.org/10.1086/319552

Eltweri, A., Sawan, N., Al-Hajaya, K., & Badri, Z. (2024). The influence of liquidity risk on financial performance: A study of the UK's largest commercial banks. *Journal of Risk and Financial Management*, *17*(12), 580. https://doi.org/10.3390/jrfm17120580

Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, *38*(1), 1-37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

Gropp, R., & Heider, F. (2010). The determinants of bank capital structure. *Review of Finance*, *14*(4), 587-622. https://doi.org/10.1093/rof/rfp030

Khan, S. (2022). The impact of capital structure on bank performance in emerging markets: Empirical evidence from GCC countries. *Financial Internet Quarterly*, *18*(1), 56-65. https://doi.org/10.2478/fiqf-2022-0005

Konovalova, N. (2019). Management of liquidity and profitability in commercial banks. *Reliability and Statistics in Transportation and Communication*, *68*(3), 725 – 736. https://doi.org/10.1007/978-3-030-12450-2_70

Koroleva, E., Jigeer, S., Miao, A., & Skhvediani, A. (2021). Determinants affecting profitability of state-owned commercial banks: Case study of China. *Risks*, *9*(8), 150. https://doi.org/10.3390/risks9080150

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, *48*(3), 261-297. https://www.jstor.org/stable/1809766

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The Journal of Finance*, *50*(5), 1421-1460. http://dx.doi.org/10.1111/j.1540-6261.1995.tb05184.x