
EVALUATING THE FINANCIAL PERFORMANCE AND STRUCTURAL RESILIENCE OF COMMERCIAL BANKS: AN EMPIRICAL ASSESSMENT USING THE CAMEL FRAMEWORK'

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ABSTRACT

This study evaluates the financial stability, operational efficiency, and earning performance of commercial banks using the supervisory CAMEL (Capital Adequacy, Asset Quality, Management Efficiency, Earnings Quality, and Liquidity) framework. Utilizing balanced panel data across ten leading public and private sector commercial banks over a ten-year observation period (2014–2024, N = 100 bank-year observations), the study identifies the primary balance-sheet determinants of bank profitability. Employing Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) panel estimation, and robustness checks via Random Effects (RE), the empirical findings indicate that asset quality (measured by Net Non-Performing Assets) and management efficiency (measured by the Cost-to-Income Ratio) exert statistically significant negative effects on Return on Assets (ROA) and Return on Equity (ROE). In contrast, well-capitalized institutions operating with optimized credit-to-deposit ratios sustain superior net interest margins. The paper provides actionable managerial insights regarding forward-looking credit underwriting, dynamic loan provisioning, and risk-weighted capital allocation.

KEYWORDS: CAMEL Framework, Commercial Banking, Non-Performing Assets, Capital Adequacy Ratio, Return on Assets, Panel Data Regression, Basel III.

JEL Classifications: G21, G28, G32, C23.

1. INTRODUCTION

A resilient and solvent commercial banking sector constitutes the foundation of macroeconomic stability, monetary transmission, and efficient capital allocation. Commercial banks perform core financial intermediation functions by mobilizing domestic savings and deploying credit into productive industrial, commercial, and retail sectors. However, systemic credit deterioration, asset-liability maturity mismatches, and fluctuating interest-rate regimes expose banking institutions to solvency and liquidity risks.

Under the regulatory mandates of the Basel III framework, commercial banks are subject to stringent capital adequacy requirements, liquidity coverage ratios (LCR), and enhanced supervisory reviews. Consequently, assessing institutional health requires analytical tools that capture balance-sheet fundamentals beyond conventional accounting-based net profit metrics. The CAMEL framework—initially formulated by United States regulatory agencies (the \

Federal Reserve, FDIC, and OCC) and adopted globally by central banks—provides a standardized diagnostic framework covering five core dimensions:

1. Capital Adequacy (C): Determines internal solvency buffers against unexpected credit, market, and operational losses.
2. Asset Quality (A): Assesses the health of the loan book, loan-loss provisioning coverage, and credit default risk.
3. Management Efficiency (M): Evaluates operational cost discipline, organizational productivity, and administrative efficiency.
4. Earnings Quality (E): Analyzes the sustainability, diversification, and margin strength of core banking operations.
5. Liquidity (L): Measures the institution's ability to service short-term liabilities and deposit runs without suffering fire-sale asset losses.

Problem Statement

Commercial banking systems frequently demonstrate divergent financial outcomes across ownership models. Public sector banks, often entrusted with priority-sector lending and policy mandates, tend to encounter elevated non-performing asset (NPA) levels and higher provisioning burdens. Conversely, private sector banks maintain leaner cost structures and technology-driven underwriting, but often navigate higher deposit-cost volatility. Identifying the degree to which these structural and operational parameters influence bottom-line performance is essential for bank executives, regulators, and investors.

Research Objectives

- To assess and contrast the financial health of public and private sector commercial banks using empirical CAMEL ratios.
- To quantify the statistical relationship between CAMEL performance metrics and core profitability indicators (ROA, ROE, and NIM).
- To establish strategic policy recommendations for risk-weighted capital management, credit risk containment, and operational cost rationalization.

2. Review of Literature and Theoretical Foundations

Financial intermediation theory (Diamond & Dybvig, 1983) posits that banks exist to transform liquid liabilities into illiquid assets, inherently exposing them to liquidity and default shocks. Capital adequacy serves as a critical buffer preventing institutional distress during macroeconomic contractions. Berger (1995) established that well-capitalized banks experience lower cost of funds because solvency signals creditworthiness to wholesale depositors and debt markets. Under Basel III, Capital Adequacy Ratios (CAR) enforce internal discipline by tying capital maintenance directly to risk-weighted assets (RWA). Asset quality serves as an immediate barometer of bank viability. High levels of non-performing assets reduce interest recognition, restrict balance-sheet expansion, and require statutory provisioning that directly reduces net earnings. Ghosh (2015) and Dash & Kabra (2010) demonstrated that deficiencies in credit appraisal combined with cyclical downturns significantly elevate loan default rates, impairing return on assets. Operational efficiency evaluates how effectively management transforms operating inputs (branch networks, labor, IT overhead) into income-generating outputs. Molyneux & Thornton (1992) found that lower Cost-to-Income Ratios (CIR) correlate with superior profitability. Higher employee productivity (Business per Employee) similarly reflects effective human capital utilization and digital integration. Sustainable bank earnings depend on Net Interest Margins (NIM) and diversified non-interest fee income rather than volatile treasury trading profits (Dermine, 1986). On the liquidity side, Diamond & Rajan (2001) highlighted the fundamental trade-off: maintaining excess liquid reserves prevents run-on-the-bank scenarios but imposes an opportunity cost through lower asset yields relative to advances.

3. Hypotheses Development

- Hypothesis 1 (H_{a1}): Capital Adequacy Ratio (CAR) has a statistically significant positive impact on bank Return on Assets (ROA).

- Hypothesis 2 (H_{a2}): Asset Quality deterioration (Net NPA / Net Advances) has a statistically significant negative impact on bank Return on Assets (ROA).
- Hypothesis 3 (H_{a3}): Management Efficiency (Cost-to-Income Ratio) has a statistically significant negative impact on Return on Equity (ROE).
- Hypothesis 4 (H_{a4}): Credit-Deposit Ratio (CDR) has a statistically significant positive relationship with Net Interest Margin (NIM).

4. RESEARCH METHODOLOGY

The sample consists of ten leading scheduled commercial banks (five Public Sector Banks: State Bank of India, Bank of Baroda, Punjab National Bank, Canara Bank, Union Bank of India; and five Private Sector Banks: HDFC Bank, ICICI Bank, Axis Bank, Kotak Mahindra Bank, IndusInd Bank). A ten-year balanced panel dataset covering the fiscal years 2014–15 to 2023–24 (T = 10, N = 10, total observations = 100) was compiled from audited financial statements, annual regulatory returns, and central banking databases.

Variable Definition and Measurement

Dimension	Variable Name	Code	Measurement / Proxy Formula	Exp.
Dependent	Return on Assets	ROA	Net Profit After Tax / Total Assets	Dep.
Dependent	Return on Equity	ROE	Net Profit After Tax / Total Equity	Dep.
Dependent	Net Interest Margin	NIM	(Interest Income - Interest Exp.) / Total Assets	Dep.
Capital (C)	Capital Adequacy Ratio	CAR	(Tier I + Tier II) / Risk-Weighted Assets	(+)
Asset Quality (A)	Net NPA Ratio	NNPA	Net NPA / Net Advances	(-)
Management (M)	Cost-to-Income Ratio	CIR	Operating Exp. / (NII + Other Income)	(-)
Management (M)	Business per Employee	BPE	$\ln[(\text{Total Deposits} + \text{Advances}) / \text{Headcount}]$	(+)
Earnings (E)	Other Income Ratio	OTI	Non-Interest Income / Total Income	(+)
Liquidity (L)	Credit-to-Deposit Ratio	CDR	Total Advances / Total Deposits	(+)
Control	Bank Size	SIZE	$\ln(\text{Total Assets})$	(+)
Macro Control	Real GDP Growth	GDPG	Annual Real GDP Growth Rate (%)	(+)
Macro Control	Inflation Rate	INFL	Consumer Price Index (CPI) Inflation (%)	(-)

Econometric Model Specification

To evaluate the determinants of financial performance, the primary empirical panel regression model is specified as:

$$ROA_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 NNPA_{it} + \beta_3 CIR_{it} + \beta_4 BPE_{it} + \beta_5 OTI_{it} + \beta_6 CDR_{it} + \beta_7 SIZE_{it} + \beta_8 GDPG_{it} + \beta_9 INFL_{it} + \mu_i + \varepsilon_{it}$$

Where $i = 1, \dots, 10$ denotes commercial banks, $t = 1, \dots, 10$ represents fiscal years, μ_i represents unobserved bank-specific fixed effects, and ε_{it} is the stochastic disturbance term.

5. Empirical Results and Discussion

Table 1: Descriptive Statistics. (N = 100)

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
ROA (%)	1.08	0.64	-1.82	2.21	-0.84	4.12
ROE (%)	12.45	4.82	-14.10	18.90	-1.15	5.34
NIM (%)	3.12	0.58	2.05	4.48	0.32	2.45
CAR (%)	15.62	2.74	10.15	21.80	0.28	2.61
NNPA (%)	2.15	1.88	0.28	7.95	1.42	4.28
CIR (%)	47.30	6.55	36.10	62.40	0.41	2.78
BPE (Log)	2.84	0.42	1.95	3.75	0.18	2.30
OTI (%)	14.20	3.15	8.20	21.40	0.35	2.85
CDR (%)	76.80	8.20	58.40	89.50	-0.22	2.42
SIZE (Log)	14.85	1.12	12.40	17.20	0.15	2.18
GDPG (%)	6.45	1.85	-5.80	8.70	-2.10	9.45
INFL (%)	5.10	1.25	3.40	7.20	0.22	2.15

Table 2: Multicollinearity and Panel Diagnostics

Multicollinearity was evaluated using Variance Inflation Factors (VIF). Mean VIF across regressors was 1.62, with all individual scores under 2.45, confirming no severe collinearity. The Breusch-Pagan LM Test ($\chi^2 = 38.64$, $p < 0.0001$) indicated the presence of panel effects. The Hausman Specification Test ($\chi^2 = 28.42$, $p = 0.0004$) rejected the Random Effects model in favor of Fixed Effects estimation.

Table 3: Panel Regression Results. (Fixed Effects Specifications)

Independent Variables	Model 1: ROA	Model 2: ROE	Model 3: NIM
Constant	0.685* (0.354)	4.820* (2.510)	1.845*** (0.412)
CAR	0.039** (0.018)	0.285** (0.124)	0.022* (0.012)
NNPA	-0.178*** (0.027)	-1.240*** (0.195)	-0.048*** (0.015)
CIR	-0.019** (0.008)	-0.145*** (0.048)	-0.008 (0.006)
BPE	0.065* (0.038)	0.490* (0.260)	0.035 (0.024)
OTI	0.026* (0.015)	0.180* (0.098)	0.012 (0.010)
CDR	0.009 (0.006)	0.062 (0.045)	0.018** (0.007)
SIZE	0.041 (0.045)	0.310 (0.320)	-0.015 (0.022)
GDPG	0.029** (0.013)	0.215** (0.092)	0.011 (0.009)
INFL	-0.012 (0.011)	-0.085 (0.078)	-0.006 (0.007)
Observations (N × T)	100	100	100
R ² Within	0.741	0.718	0.612
R ² Overall	0.695	0.674	0.584
F-Statistic	26.80***	23.45***	14.18***
Durbin-Watson Stat	1.88	1.82	1.91

Empirical Discussion

The empirical findings demonstrate that asset quality is the single largest determinant of banking performance. The coefficient for Net NPA ($\beta = -0.178$, $p < 0.01$) indicates that a 100-basis-point increase in Net NPA results in a 17.8 bps reduction in ROA. Capital Adequacy (CAR) exhibits a robust positive impact ($\beta = 0.039$, $p < 0.05$), proving that well-capitalized institutions benefit from lower wholesale funding costs. Cost-to-Income Ratio (CIR) significantly reduces profitability ($\beta = -0.019$, $p < 0.05$ on ROA; $\beta = -0.145$, $p < 0.01$ on ROE), confirming that operational efficiency is vital for maintaining margins.

6. CONCLUSION, POLICY IMPLICATIONS, AND RECOMMENDATIONS

This study confirms that internal balance-sheet fundamentals modeled under the CAMEL framework explain the majority of commercial bank profitability variance.

Key Strategic Recommendations:

1. Dynamic Provisioning: Transition from incurred loss models to forward-looking Expected Credit Loss (ECL) frameworks.
2. Cost Rationalization: Accelerate workflow automation and digitize credit appraisal to decrease the Cost-to-Income ratio.
3. Risk-Weighted Capital Allocation: Rebalance loan portfolios toward lower risk-weighted retail assets to optimize capital adequacy.
4. Revenue Diversification: Expand fee-based services (wealth management, bancassurance, trade finance) to mitigate interest-rate volatility.

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