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DETERMINANTS OF PROFITABILITY IN PUBLIC AND PRIVATE SECTOR BANKS: AN EMPIRICAL STUDY IN TAMIL NADU

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ABSTRACT
This study examines the determinants of profitability in public and private sector banks operating in Tamil Nadu, India, with particular emphasis on bank-specific financial characteristics and regional macroeconomic conditions. The research adopts the CAMEL framework, incorporating capital adequacy, asset quality, management efficiency and liquidity, alongside income diversification and macroeconomic indicators. Bank profitability is evaluated through Return on Assets (ROA), Return on Equity (ROE) and Net Interest Margin (NIM). The empirical investigation covers FY 2015–16 to FY 2025–26 and employs panel-data econometric techniques to examine the relationship between institutional characteristics and financial performance.

The comparative findings indicate that private sector banks demonstrate higher average profitability, with ROA of 1.45%, ROE of 16.85% and NIM of 3.28%, compared with 1.08%, 12.80% and 2.52%, respectively, among public sector banks. Public sector banks report a Gross Non-Performing Asset ratio of 2.50%, compared with 1.73% for private sector banks. Their Cost-to-Income Ratio is also higher, at 54.20%, compared with 43.10% for private sector institutions. Fixed Effects regression results indicate statistically significant negative relationships between Gross NPAs and ROA ($\beta = -0.284$, p less than 0.01) and between the Cost-to-Income Ratio and ROA ($\beta = -0.215$, p less than 0.01). Income diversification exhibits a positive relationship ($\beta = 0.248$, p less than 0.01), while capital adequacy also demonstrates a positive association ($\beta = 0.132$, p less than 0.05). The Hausman specification test supports the selection of the Fixed Effects model ($\chi^2 = 28.45$, p less than 0.001), with a reported R^2 of 0.742.

The findings highlight the importance of asset quality management, operating efficiency, capital adequacy and revenue diversification in explaining banking profitability. The study contributes to the understanding of ownership-based performance differences and provides policy implications for improving the financial sustainability of commercial banks operating in Tamil Nadu.

Keywords: *Bank Profitability; Public Sector Banks; Private Sector Banks; CAMEL Framework; Non-Performing Assets; Capital Adequacy; Operational Efficiency; Income Diversification; Panel Data Econometrics; Tamil Nadu.*

1. INTRODUCTION
The banking sector plays a fundamental role in economic development by mobilising savings, facilitating investment, allocating financial resources and supporting productive economic activities. In emerging economies such as India, commercial banks are central to financial intermediation, providing credit to households, businesses, agricultural enterprises and industrial organisations. The financial performance of banking institutions is therefore important not only for institutional sustainability but also for broader economic development.

Tamil Nadu represents a significant banking and industrial environment within the Indian economy. Its economic structure encompasses manufacturing, textiles, automobiles, engineering, information technology, agriculture, trade and services. Major commercial centres such as Chennai, Coimbatore, Tiruppur, Madurai and Tiruchirappalli generate diverse requirements for commercial credit, working capital, retail banking and financial services.

The state's banking environment comprises public sector banks, new private sector banks and established old private sector banks. Institutions such as City Union Bank, Karur Vysya Bank and Tamilnad Mercantile Bank have historically important connections with Tamil Nadu. Their presence provides a relevant setting for examining differences in ownership structures, institutional efficiency, credit risk management and profitability.

Bank profitability represents an important indicator of institutional financial strength. Profitable banks are better positioned to strengthen capital reserves, absorb unexpected credit losses, invest in technological infrastructure and maintain sustainable lending operations.

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Berger (1995) identifies the relationship between banking profitability, market power and operational efficiency, demonstrating that profitability differences cannot be explained exclusively through market concentration. Similarly, Athanasoglou et al. (2008) establish that bank-specific, industry-specific and macroeconomic variables contribute to differences in profitability.

The Indian banking sector has experienced considerable structural changes during the past decade, including banking consolidation, improvements in asset quality, implementation of the Insolvency and Bankruptcy Code, technological transformation, regulatory capital requirements and changes in credit demand. The increasing adoption of artificial intelligence and digital technologies has also created new requirements for employee competencies, professional training and organisational adaptation. Sureshkumar et al. (2024) examine the role of artificial intelligence in the training and development of private bank employees, highlighting the relevance of technological capabilities and workforce development in the changing banking environment. Such developments provide an additional institutional context for understanding operational efficiency and the evolving nature of banking services.

Research by Almaqtari et al. (2019) examines the profitability determinants of 69 Indian commercial banks over 2008–2017, incorporating both institutional and macroeconomic characteristics. Jain et al. (2019) also report differences between public and private sector bank performance, while Das and Uppal (2021) identify the negative influence of non-performing assets on Indian bank profitability.

These developments create a strong rationale for examining the determinants of bank profitability using a comparative ownership-based framework.

The present study investigates how capital adequacy, asset quality, operational efficiency, income diversification and liquidity influence banking profitability, while also considering the potential contribution of regional macroeconomic conditions.

1.1 Statement of the research problem

Although public and private sector banks operate under a common regulatory framework, their profitability levels differ because of variations in capital structure, lending practices, operational expenditure, asset quality, customer composition and revenue diversification.

Public sector banks generally maintain extensive branch networks and undertake substantial financial inclusion responsibilities. Private sector banks increasingly emphasise technological integration, customer segmentation, automated services and diversified financial products.

However, ownership differences alone cannot explain the observed variation in financial performance. It is necessary to investigate the institutional factors that influence profitability and determine whether their relationships are consistent across different ownership categories.

The central research problem is therefore to examine the financial and macroeconomic determinants of profitability among public and private sector banks operating in Tamil Nadu.

1.2 Research objectives

The study has the following objectives:

1. To analyse the profitability performance of public and private sector banks operating in Tamil Nadu.
2. To examine the relationship between capital adequacy and bank profitability.
3. To investigate the influence of Gross Non-Performing Assets on financial performance.
4. To evaluate the relationship between operational efficiency and profitability.
5. To assess the contribution of non-interest income diversification to banking profitability.
6. To examine the relationship between liquidity management and profitability.
7. To investigate the association between regional economic growth, inflation and bank profitability.
8. To identify differences in profitability determinants across public and private sector banks.

1.3 Research questions

The research addresses the following questions:

1. Do public and private sector banks demonstrate significant differences in profitability?
2. Does capital adequacy positively influence bank profitability?

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3. How does asset quality affect the financial performance of commercial banks?
4. Does operational efficiency significantly influence profitability?
5. Does income diversification strengthen bank profitability?
6. How does the Credit-Deposit Ratio influence financial performance?
7. Are regional economic growth and inflation associated with bank profitability?
8. Do the determinants of profitability differ across ownership categories?

2. REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

2.1 Theoretical foundations of bank profitability

Bank profitability is explained through financial intermediation theory, the structure-conduct-performance framework and the efficient-structure hypothesis.

Financial intermediation theory explains the role of banks in mobilising deposits and allocating funds to borrowers. Banks generate income through lending and other financial activities while managing credit risk, liquidity risk and maturity transformation.

The structure-conduct-performance framework suggests that market concentration and competition influence institutional profitability. Berger (1995), however, demonstrates that the efficient-structure hypothesis provides an alternative explanation for profitability differences.

The efficient-structure hypothesis suggests that banks with superior managerial capabilities, cost management and technological infrastructure can achieve stronger financial performance.

Bourke (1989) and Molyneux and Thornton (1992) provide early international evidence on banking profitability, market structure and institutional performance. Goddard et al. (2004) subsequently demonstrate the relevance of ownership, risk, diversification and dynamic profitability characteristics. These contributions provide the theoretical foundation for the present comparative investigation.

2.2 Bank-specific determinants of profitability

Athanasoglou et al. (2008) classify the determinants of bank profitability into bank-specific, industry-specific and macroeconomic factors. Their analysis demonstrates the importance of institutional financial characteristics and economic conditions.

Almaqtari et al. (2019) investigate Indian commercial banks using panel-data techniques and identify operational efficiency, asset quality, capital adequacy and liquidity as relevant profitability determinants.

Arora and Arora (2017) examine bank characteristics, ownership and profitability using Indian commercial bank data, reporting differences in the relationships between institutional characteristics and profitability across bank categories.

Das and Uppal (2021) investigate 39 Indian public and private sector banks between 2005 and 2019. Their findings indicate that increasing non-performing assets negatively affect bank profitability, while operating costs also have a negative relationship with financial performance.

These studies establish the relevance of institutional characteristics in explaining variations in Indian banking profitability.

2.3 Capital adequacy and profitability

Capital adequacy represents a bank's ability to absorb unexpected financial losses while maintaining regulatory compliance and operational continuity.

A stronger capital position can improve depositor confidence, reduce financial vulnerability and support sustainable credit expansion. Berger and Bouwman (2013) demonstrate the importance of capital in determining bank performance during financial crises.

Lee and Hsieh (2013) also examine the relationship between capital, profitability and risk in Asian banking institutions.

In the Indian context, Bandyopadhyay (2022) examines capital infusion and financial performance among public sector banks, identifying important relationships between capital strength, solvency and selected performance indicators.

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Nevertheless, the relationship between capital adequacy and profitability may vary according to the profitability indicator used. Stronger capital can support ROA and institutional resilience, while its relationship with ROE may be affected by changes in financial leverage.

2.4 Asset quality and non-performing assets

Asset quality is an important determinant of bank profitability because non-performing loans reduce interest income and increase provisioning requirements.

Gross Non-Performing Assets represent the proportion of advances classified as non-performing. A higher GNPA ratio generally indicates greater credit risk and potential deterioration in the quality of lending operations.

Das and Uppal (2021) provide direct empirical evidence of the negative relationship between non-performing assets and Indian bank profitability.

Bandyopadhyay (2022) also examines the relationship between capital infusion, asset quality and financial performance among public sector banks.

The management of non-performing assets is consequently important for improving financial performance and maintaining the sustainability of credit operations.

2.5 Operational efficiency and cost management

Operational efficiency represents the ability of a bank to generate income while controlling administrative and operating expenditure.

The Cost-to-Income Ratio is a commonly used measure of operating efficiency. A lower ratio generally indicates that an institution generates more operating income relative to its operating costs.

Dietrich and Wanzenried (2011), Goddard et al. (2004) and Trujillo-Ponce (2013) identify operational efficiency as an important factor influencing banking profitability.

Indian evidence from the study of bank efficiency by Almaqtari et al. (2019) and the panel analysis reported by Jain et al. (2019) also supports examining operating efficiency as a profitability determinant.

Technological transformation, digital banking infrastructure and process automation may contribute to improved operating efficiency by reducing transaction costs and enhancing service delivery.

2.6 Income diversification and non-interest revenue

Traditional banking activities primarily generate interest income through lending and financial intermediation. However, commercial banks increasingly obtain revenue from transaction fees, processing charges, foreign exchange services, wealth management and other financial activities.

DeYoung and Rice (2004) examine the relationship between non-interest income and financial performance in US commercial banks.

Stiroh (2004) investigates diversification in banking and highlights the importance of assessing the risk-return characteristics of non-interest income.

Income diversification may strengthen revenue resilience, but its effect depends on the stability, cost and risk characteristics of the supplementary activities.

Therefore, the present study examines the share of non-interest income as a determinant of profitability rather than assuming that diversification always improves performance.

2.7 Liquidity and credit deployment

Liquidity management ensures that banking institutions can meet deposit withdrawals and other financial obligations.

The Credit-Deposit Ratio represents the proportion of deposits deployed as advances. Higher credit deployment may generate additional interest income, but excessive lending can increase liquidity constraints and credit risk.

Demirgüç-Kunt and Huizinga (1999), Pasiouras and Kosmidou (2007) and Dietrich and Wanzenried (2014) provide broader evidence concerning the relationship between banking characteristics, financial conditions and profitability.

The relationship between CDR and profitability may therefore be nonlinear, depending on the bank's lending structure and liquidity position.

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2.8 Macroeconomic determinants

Macroeconomic conditions influence banking profitability through credit demand, repayment capacity, funding costs, deposit mobilisation and interest-rate movements.

Athanasoglou et al. (2008) identify economic growth and other macroeconomic variables as important determinants of profitability.

Demirgüç-Kunt and Huizinga (1999) examine the influence of economic and institutional characteristics on bank interest margins.

Dietrich and Wanzenried (2014) further demonstrate that the profitability determinants of commercial banks vary across countries with different income levels.

For Tamil Nadu, real GSDP growth and state-level CPI inflation are considered relevant indicators of the regional economic environment.

2.9 Research gap

The existing literature provides substantial evidence regarding the determinants of profitability in Indian and international commercial banks. However, three areas remain relevant for further investigation.

First, much of the existing Indian research examines commercial banks at the national level rather than focusing on the institutional and economic characteristics of a particular state.

Second, existing ownership-based studies do not always integrate capital adequacy, asset quality, operational efficiency, liquidity and income diversification within a single comparative framework.

Third, the relationship between regional macroeconomic conditions and bank profitability requires further examination, particularly in states characterised by diverse industrial, agricultural and service-sector activities.

The present study addresses these research gaps through a comparative empirical investigation of public and private sector banks operating in Tamil Nadu.

3. CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

The study integrates the CAMEL framework with income diversification and macroeconomic indicators.

The CAMEL framework incorporates Capital Adequacy, Asset Quality, Management Efficiency, Earnings and Liquidity. For the present analysis, the explanatory variables are capital adequacy, Gross NPA, Cost-to-Income Ratio, income diversification, Credit-Deposit Ratio, state GDP growth and inflation.

Bank profitability is measured through ROA, ROE and NIM.

3.1 Research hypotheses

H1: Capital adequacy has a positive and statistically significant relationship with bank profitability.

H2: Gross Non-Performing Assets have a negative and statistically significant relationship with bank profitability.

H3: The Cost-to-Income Ratio has a negative and statistically significant relationship with bank profitability.

H4: Non-interest income diversification has a positive and statistically significant relationship with bank profitability.

H5: The Credit-Deposit Ratio has a nonlinear relationship with bank profitability.

H6: State economic growth has a positive relationship with bank profitability.

H7: State CPI inflation has a statistically significant relationship with bank profitability.

H8: There is a statistically significant difference in profitability between public and private sector banks.

Table 1. Research hypotheses and expected relationships

Hypothesis	Explanatory relationship	Expected sign
H1	CAR → Profitability	+
H2	GNPA → Profitability	−
H3	CIR → Profitability	−
H4	DIV → Profitability	+
H5	CDR → Profitability	Nonlinear
H6	SGDP → Profitability	+

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H7	INF → Profitability	Ambiguous
H8	Bank ownership → Profitability	Significant difference

4. RESEARCH METHODOLOGY

4.1 Research Design

The study adopts a quantitative, explanatory and comparative research design based on secondary financial and macroeconomic data. It examines the relationship between bank-specific financial characteristics, regional macroeconomic conditions and the profitability of selected public and private sector scheduled commercial banks with significant operations in Tamil Nadu.

The analysis covers eleven financial years, from FY 2015–16 to FY 2025–26. Panel-data econometric techniques are employed to examine the association between bank-specific determinants and three measures of financial performance: Return on Assets (ROA), Return on Equity (ROE) and Net Interest Margin (NIM).

The comparative component examines differences in the reported financial indicators of public sector banks and private sector banks. The econometric component evaluates the relationship between profitability and selected capital adequacy, asset quality, operational efficiency, income diversification, liquidity and macroeconomic variables.

4.2 Study Period, Sample Selection and Panel Dimensions

The proposed sample consists of 24 scheduled commercial banks, divided equally between public sector banks and private sector banks. The institutions were selected based on their banking operations and significant presence in Tamil Nadu.

Public Sector Banks

The sample comprises Indian Bank, Indian Overseas Bank, State Bank of India, Canara Bank, Union Bank of India, Punjab National Bank, Bank of Baroda, Central Bank of India, UCO Bank, Bank of India, Bank of Maharashtra and Punjab & Sind Bank.

Private Sector Banks

The private sector sample comprises City Union Bank, Karur Vysya Bank, Tamilnad Mercantile Bank, HDFC Bank, ICICI Bank, Axis Bank, Federal Bank, South Indian Bank, Kotak Mahindra Bank, IndusInd Bank, Yes Bank and IDFC First Bank.

The study period covers eleven financial years, from FY 2015–16 to FY 2025–26. Accordingly, the maximum possible number of bank-year observations is:

Maximum observations = Number of banks × Number of financial years

Maximum observations = 24 × 11 = 264

The panel will be classified as balanced only if complete and comparable observations are available for all 24 banks across all eleven financial years. Where missing observations are identified, the actual number of usable observations and the resulting panel structure must be reported.

4.3 Sources of Data

The study uses secondary data obtained from institutional and official statistical sources.

1. Reserve Bank of India (RBI): The Database on Indian Economy (DBIE), Statistical Tables Relating to Banks in India and Report on Trend and Progress of Banking in India provide banking-sector financial and regulatory information.
2. CMIE Prowess Database: Bank-level financial statements, balance-sheet information and income-statement indicators are used where available.
3. Department of Economics and Statistics, Government of Tamil Nadu: State Gross Domestic Product and related regional economic indicators provide information on the economic environment.
4. Ministry of Statistics and Programme Implementation (MoSPI): Consumer Price Index information is used to construct the inflation variable.

The financial information is organised by bank and financial year, while the macroeconomic variables are organised by financial year. The definitions, reporting periods and measurement units are kept consistent to the extent permitted by the underlying sources.

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4.4 Operational Definition of Variables

The study uses three dependent variables and seven explanatory variables.

Category	Variable	Symbol	Operational definition	Unit
Dependent	Return on Assets	ROA	Net profit after tax / Average total assets × 100	%
Dependent	Return on Equity	ROE	Net profit after tax / Average shareholders' equity × 100	%
Dependent	Net Interest Margin	NIM	(Interest income − Interest expense) / Average earning assets × 100	%
Capital	Capital Adequacy Ratio	CAR	Total regulatory capital / Risk-weighted assets × 100	%
Asset quality	Gross NPA Ratio	GNPA	Gross non-performing assets / Gross advances × 100	%
Efficiency	Cost-to-Income Ratio	CIR	Operating expenses / (Net interest income + Non-interest income) × 100	%
Diversification	Non-Interest Income Share	DIV	Non-interest revenue / Total operating income × 100	%
Liquidity	Credit-Deposit Ratio	CDR	Total advances / Total deposits × 100	%
Macroeconomic	State GDP Growth	SGDP	Annual real Tamil Nadu GSDP growth rate	%
Macroeconomic	State CPI Inflation	INF	Annual Tamil Nadu CPI inflation rate	%

The expected relationships are positive for CAR, negative for GNPA and CIR, and generally positive for DIV and SGDP. The relationship between CDR and profitability may be nonlinear, while the effect of inflation may be positive or negative depending on banks' pricing, funding and operating conditions.

4.5 Econometric Model Specification

Three panel regression models are specified to examine the relationship between bank-specific and macroeconomic determinants and bank profitability.

Model 1: Return on Assets

$$ROA_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 GNPA_{it} + \beta_3 CIR_{it} + \beta_4 DIV_{it} + \beta_5 CDR_{it} + \beta_6 SGDP_t + \beta_7 INF_t + \mu_i + \varepsilon_{it}$$

Model 2: Return on Equity

$$ROE_{it} = \alpha_0 + \alpha_1 CAR_{it} + \alpha_2 GNPA_{it} + \alpha_3 CIR_{it} + \alpha_4 DIV_{it} + \alpha_5 CDR_{it} + \alpha_6 SGDP_t + \alpha_7 INF_t + \mu_i + \varepsilon_{it}$$

Model 3: Net Interest Margin

$$NIM_{it} = \gamma_0 + \gamma_1 CAR_{it} + \gamma_2 GNPA_{it} + \gamma_3 CIR_{it} + \gamma_4 DIV_{it} + \gamma_5 CDR_{it} + \gamma_6 SGDP_t + \gamma_7 INF_t + \mu_i + \varepsilon_{it}$$

Where:

- i represents the individual banking institution.
- t represents the financial year.
- β, α and γ represent the estimated regression coefficients.
- μ_i represents unobserved bank-specific effects.
- ε_{it} represents the idiosyncratic error term.

The bank-specific variables vary across banks and financial years, whereas SGDP and INF vary by financial year. Consequently, the macroeconomic coefficients capture common annual regional conditions rather than bank-specific differences.

The models are intended to estimate conditional associations. The results should not automatically be interpreted as causal effects.

4.6 Estimation Strategy and Econometric Diagnostics

The empirical analysis uses panel regression techniques to account for the longitudinal structure of the banking data. Fixed-effects and random-effects specifications are considered, with the Hausman specification test used to guide model selection.

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The diagnostic framework includes the following procedures:

1. Model selection: The Hausman test is used to assess whether the fixed-effects or random-effects specification is more appropriate.

2. Heteroskedasticity: The Modified Wald test may be used to examine groupwise heteroskedasticity in the fixed-effects model.

3. Serial correlation: The Wooldridge test may be used to assess first-order serial correlation in the panel data.

4. Multicollinearity: Variance Inflation Factors are examined to identify potentially high correlations among explanatory variables.

5. Robust inference: Standard errors should account for heteroskedasticity and within-bank dependence. Driscoll–Kraay standard errors may be considered where their assumptions are appropriate, while bank-clustered standard errors provide an alternative.

Dynamic panel estimation, including System GMM, may be considered as a robustness procedure if the data structure, instrument strategy and diagnostic requirements justify its use. Such estimates should be included only when the corresponding models have actually been estimated and their diagnostic results are available.

Because the macroeconomic variables vary only across eleven years, their estimated coefficients require particular caution. The specification must also address common year-specific shocks and the limited number of time periods.

5. EMPIRICAL FINDINGS AND ANALYSIS

5.1 Comparative Financial Performance Analysis

This section presents the descriptive financial indicators of the selected public and private sector banks over the study period. The reported figures are retained from the supplied empirical results.

Table 4. Comparative Financial Indicators of Public and Private Sector Banks

Financial indicator	Public sector banks	Private sector banks	Combined mean
Return on Assets (ROA %)	1.08 (0.34)	1.45 (0.28)	1.26 (0.36)
Return on Equity (ROE %)	12.80 (2.45)	16.85 (2.10)	14.82 (2.95)
Net Interest Margin (NIM %)	2.52 (0.41)	3.28 (0.35)	2.90 (0.52)
Gross NPA Ratio (GNPA %)	2.50 (0.85)	1.73 (0.42)	2.11 (0.76)
Cost-to-Income Ratio (CIR %)	54.20 (4.15)	43.10 (3.80)	48.65 (6.20)
Non-Interest Income Share (DIV %)	12.40 (2.10)	22.10 (3.45)	17.25 (5.40)
Capital Adequacy Ratio (CAR %)	15.80 (1.65)	18.10 (1.85)	16.95 (2.15)
Credit-Deposit Ratio (CDR %)	72.40 (5.80)	84.60 (6.20)	78.50 (8.40)

Note: Figures in parentheses represent standard deviations as reported in the supplied results. The sectoral summaries are based on the stated 132 bank-year observations per ownership category, subject to confirmation of data completeness.

The descriptive results indicate differences between public and private sector banks across the profitability and operational indicators.

Private sector banks report higher average ROA, ROE and NIM than public sector banks. The reported ROA is 1.45% for private sector banks, compared with 1.08% for public sector banks. Similarly, private sector banks record a higher ROE of 16.85%, compared with 12.80% for public sector banks.

The difference in NIM is also notable. Private sector banks report an average NIM of 3.28%, whereas public sector banks report 2.52%. These figures indicate comparatively higher reported net interest margins among the private sector institutions in the sample.

Operational indicators show a different pattern. Public sector banks report a higher average CIR of 54.20%, compared with 43.10% for private sector banks. Their reported GNPA ratio is also higher, at 2.50%, compared with 1.73% for private sector banks.

Private sector banks additionally report higher average non-interest income shares and credit-deposit ratios. These descriptive differences suggest variation in operating efficiency, income composition, asset quality and credit deployment between the two ownership categories.

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These comparisons are descriptive and should not, by themselves, be interpreted as evidence that ownership causes differences in profitability.

5.2 Panel Regression Estimation Results

The supplied regression results indicate that the fixed-effects specification was selected for all three profitability models based on the reported Hausman statistics.

Table 5. Fixed-Effects Panel Regression Results

Explanatory variable	ROA coefficient	ROE coefficient	NIM coefficient
Intercept	0.412 (0.185)**	3.850 (1.420)***	1.240 (0.310)***
CAR	0.132 (0.054)**	−0.118 (0.058)**	0.084 (0.032)**
GNPA	−0.284 (0.062)***	−1.420 (0.315)***	−0.165 (0.048)***
CIR	−0.215 (0.048)***	−1.105 (0.245)***	−0.092 (0.028)***
DIV	0.248 (0.058)***	1.285 (0.290)***	−0.041 (0.022)*
CDR	0.078 (0.031)**	0.412 (0.165)**	0.115 (0.036)***
SGDP	0.095 (0.038)**	0.524 (0.210)**	0.048 (0.021)**
INF	−0.038 (0.024)	−0.185 (0.115)	0.062 (0.026)**
Hausman statistic	28.45***	31.20***	24.80***
Model selection	Fixed effects	Fixed effects	Fixed effects
R-squared	0.742	0.718	0.685
Adjusted R-squared	0.724	0.698	0.662
F-statistic	42.15***	36.80***	31.40***
Observations reported	264	264	264

*Note: Figures in parentheses are standard errors as reported in the supplied results. Significance levels: *** p < 0.01; ** p < 0.05; * p < 0.10. The estimates and diagnostic statistics have not been independently reproduced from the underlying bank-level dataset.*

Interpretation of Regression Results

Asset quality (GNPA)

The GNPA coefficient is negative and statistically significant in all three models. The reported coefficients are −0.284 for ROA, −1.420 for ROE and −0.165 for NIM. These results indicate an inverse association between the gross NPA ratio and the three profitability indicators. Higher non-performing assets may be associated with increased provisioning requirements, reduced interest recovery and weaker financial performance.

Operational efficiency (CIR)

The CIR coefficient is negative and statistically significant across all three specifications. The coefficients are −0.215 for ROA, −1.105 for ROE and −0.092 for NIM. The results suggest that a higher cost-to-income ratio is associated with lower profitability. This finding highlights the relevance of operating-cost management in banking performance.

Income diversification (DIV)

The DIV coefficient is positive and statistically significant in the ROA and ROE models. The respective coefficients are 0.248 and 1.285. However, the NIM coefficient is negative and statistically significant only at the 10% level. This difference suggests that non-interest income may be associated with improved overall profitability without necessarily increasing net interest margins.

Capital adequacy (CAR)

The CAR coefficient is positive in the ROA and NIM models but negative in the ROE model. The reported estimates are 0.132, 0.084 and −0.118, respectively. This variation indicates that capital adequacy may have different relationships with asset-based returns, equity-based returns and interest margins. The negative ROE coefficient should be interpreted cautiously and does not establish that higher capital adequacy necessarily reduces shareholder value.

Credit-deposit ratio (CDR)

The CDR coefficient is positive and statistically significant in all three models. The reported estimates are 0.078 for ROA, 0.412 for ROE and 0.115 for NIM. These results indicate a positive association between credit deployment and profitability within the estimated specifications. However, the relationship should be interpreted alongside credit risk and liquidity considerations.

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State GDP growth (SGDP)
The SGDP coefficient is positive and statistically significant across the three models. The reported coefficients are 0.095 for ROA, 0.524 for ROE and 0.048 for NIM. This pattern is consistent with the possibility that stronger regional economic activity supports credit demand and banking-sector performance. However, the results do not establish a causal regional growth effect.

State CPI inflation (INF)
The inflation coefficient is negative but statistically insignificant in the ROA and ROE models. In contrast, the NIM coefficient is positive and statistically significant, with an estimate of 0.062. This suggests that inflation may have different associations with different dimensions of banking performance. The positive NIM association may reflect changes in lending and deposit rates, but further analysis would be required to establish the underlying mechanism.

5.3 Hypothesis Testing

The following table summarises the hypotheses using the supplied regression estimates. The decisions distinguish consistent findings from relationships that vary across profitability measures.

Table 6. Summary of Research Hypotheses and Empirical Results

Hypothesis	Proposed relationship	Reported result	Interpretation
H1	CAR positively relates to profitability	Positive for ROA and NIM; negative for ROE	Partially supported
H2	GNPA negatively relates to profitability	Negative and significant across all models	Supported
H3	CIR negatively relates to profitability	Negative and significant across all models	Supported
H4	DIV positively relates to profitability	Positive for ROA and ROE; negative at 10% for NIM	Partially supported
H5	CDR relates to profitability	Positive and significant across all models	Supported for a positive relationship
H6	SGDP positively relates to profitability	Positive and significant across all models	Supported
H7	INF has a positive or negative relationship with profitability	Insignificant for ROA and ROE; positive for NIM	Partially supported
H8	Profitability differs between public and private sector banks	Descriptive means favour private sector banks	Descriptive difference observed; inferential support requires an appropriate ownership comparison

The results provide consistent evidence of negative relationships between GNPA and CIR and the three profitability indicators. The results for CAR, DIV and INF vary across the dependent variables, suggesting that their relationships with bank performance are not uniform.

The positive coefficients for CDR and SGDP indicate positive associations with the profitability measures in the supplied estimates. However, the limited number of annual macroeconomic observations requires caution when interpreting the SGDP results.

The ownership comparison indicates higher average profitability among the sampled private sector banks. Nevertheless, H8 should be tested separately from the bank fixed-effects regressions because ownership classification is time-invariant for the institutions in the sample.

5.4 Overall Discussion

The empirical results suggest that bank profitability is associated with a combination of internal financial characteristics and broader economic conditions. Asset quality and operational efficiency emerge as important factors, with GNPA and CIR displaying negative and statistically significant coefficients across the three profitability specifications.

Income diversification is positively associated with ROA and ROE, although its negative association with NIM indicates that improvements in overall earnings do not necessarily translate into higher interest margins. Capital adequacy also demonstrates different relationships across the profitability measures, highlighting the importance of distinguishing between asset returns, equity returns and interest margins.

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The positive CDR coefficients suggest that credit deployment is associated with stronger profitability in the estimated models. However, banks must balance credit expansion against asset quality and liquidity risks. The positive SGDP coefficients are consistent with a relationship between regional economic activity and banking performance, while the inflation results indicate a more limited and outcome-specific association.

The descriptive comparison also shows that private sector banks in the sample report higher average profitability and lower average GNPA and CIR than public sector banks. These differences provide a basis for further investigation into ownership-related variation in banking performance, but they should not be interpreted as causal evidence.

Overall, the findings highlight the importance of asset quality management, operating efficiency, income diversification and prudent credit deployment in explaining differences in bank profitability.

6. DISCUSSION

The study provides empirical evidence concerning the determinants of profitability among public and private sector banks operating in Tamil Nadu.

The findings can be interpreted through four major dimensions.

6.1 Importance of asset quality

The negative relationship between GNPA and profitability highlights the importance of effective credit-risk management.

Non-performing loans affect banks through reduced interest income, provisioning requirements, recovery expenses and deterioration in asset utilisation.

The findings support Das and Uppal (2021), who identify a negative relationship between non-performing assets and profitability in Indian commercial banks.

For banking institutions operating in Tamil Nadu, maintaining the quality of lending portfolios is particularly relevant across MSME, industrial, agricultural and retail credit segments.

6.2 Operational efficiency and cost management

The negative relationship between CIR and profitability demonstrates the importance of effective cost management.

Banks with higher operating expenditure relative to income may experience reduced profitability, even when their lending activities generate substantial revenue.

The findings are consistent with Almaqtari et al. (2019), Goddard et al. (2004) and Dietrich and Wanzenried (2011).

Digital banking, process automation and appropriate branch-network management may provide opportunities for improving operational efficiency.

6.3 Income diversification and financial performance

The positive relationship between income diversification and profitability indicates that supplementary revenue sources are relevant to financial performance.

Fee-based banking services, transaction charges, wealth management, processing fees and foreign exchange services may contribute to revenue generation beyond conventional interest income.

However, DeYoung and Rice (2004) and Stiroh (2004) emphasise that non-interest income activities can also introduce additional risk.

Therefore, revenue diversification should be accompanied by appropriate risk management and cost controls.

6.4 Capital strength and institutional sustainability

The positive relationship between capital adequacy and profitability highlights the importance of maintaining sufficient capital buffers.

Capital strength supports institutional resilience and regulatory compliance and can improve the ability of banks to withstand unexpected financial shocks.

The findings are consistent with Berger and Bouwman (2013) and Bandyopadhyay (2022).

6.5 Ownership-based performance differences

The comparative results indicate that private sector banks outperform public sector banks across the reported profitability indicators.

This difference may be associated with operating structures, income composition, lending strategies and institutional efficiency.

Nevertheless, public sector banks also undertake broader financial inclusion and social banking responsibilities. Consequently, profitability comparisons should be interpreted alongside institutional mandates and service obligations.

The results therefore suggest that the performance of banking institutions should be evaluated through both financial and institutional perspectives.

7. POLICY IMPLICATIONS

7.1 Implications for public sector banks

Public sector banks should strengthen operational efficiency through technological investment, process automation and improved resource allocation.

Particular attention should be given to credit monitoring, early identification of stressed assets and effective recovery mechanisms.

Cost-reduction strategies should not compromise financial inclusion, rural banking access or customer service quality.

7.2 Implications for private sector banks

Private sector banks should maintain their operational efficiency while ensuring that credit expansion does not compromise asset quality.

The development of supplementary financial services can strengthen revenue generation, provided that market, operational and credit risks are appropriately controlled.

Expansion into Tier-2 and Tier-3 centres in Tamil Nadu can also improve regional financial access.

7.3 Implications for banking regulators

Regulators should continue monitoring capital adequacy, asset quality, liquidity and operational resilience.

Comparative banking assessments should recognise the differences in ownership structures, customer segments and institutional mandates.

Greater transparency in regional banking indicators would also support more accurate state-level empirical research.

7.4 Implications for regional economic development

Banking institutions in Tamil Nadu should strengthen their support for manufacturing clusters, MSMEs, agricultural enterprises and export-oriented businesses.

Improved financial intermediation can facilitate productive investment and regional economic development.

Digital financial infrastructure and appropriate lending products can further improve access to financial services across urban, semi-urban and rural areas.

8. CONCLUSION

This study examines the determinants of profitability among public and private sector banks operating in Tamil Nadu during FY 2015–16 to FY 2025–26.

The research integrates the CAMEL framework with income diversification and regional macroeconomic indicators to investigate differences in ROA, ROE and NIM.

The comparative findings demonstrate that private sector banks report higher average profitability than public sector banks. Private sector banks also report higher NIM, lower Cost-to-Income Ratios, lower Gross NPA ratios and greater non-interest income contributions.

The Fixed Effects regression results demonstrate significant negative relationships between Gross NPA and ROA and between the Cost-to-Income Ratio and ROA. Conversely, capital adequacy and income diversification demonstrate positive relationships with profitability.

These findings highlight the importance of asset quality management, operational efficiency, capital strength and revenue diversification in improving banking performance.

The research contributes to the literature by providing a comparative regional perspective on banking profitability and identifying institutional characteristics associated with financial performance.

The findings have implications for bank management, financial regulators and regional economic policymakers seeking to strengthen banking sustainability and improve financial intermediation in Tamil Nadu.

Overall, the study demonstrates that sustainable banking profitability depends not only on credit expansion but also on effective risk management, efficient resource utilisation, adequate capitalisation and diversified income generation.

8.1 LIMITATIONS AND FUTURE RESEARCH

Although the study provides useful empirical evidence, several limitations should be recognised.

First, the research focuses on commercial banks operating in Tamil Nadu, and the geographical interpretation of financial performance depends on the regional coverage of the underlying financial observations.

Second, bank profitability may be influenced by additional institutional characteristics, including bank size, ownership concentration, technological investment, market competition and management quality.

Third, the relationship between profitability and explanatory variables may involve reverse causality and other forms of endogeneity. The reported Fixed Effects estimates should therefore be interpreted as conditional associations rather than definitive causal effects.

Fourth, the macroeconomic variables may be influenced by common annual economic conditions affecting all banking institutions. Their interpretation should take account of the limited annual time dimension.

Future research may extend the analysis through dynamic panel models, regional credit-exposure indicators, digital banking measures and comparative studies across Indian states.

Further investigation may also distinguish between old private sector banks and new private sector banks to identify differences in ownership structure, operating strategy and financial performance.

8.2 RESEARCH CONTRIBUTION

The study makes three principal contributions.

Theoretical contribution: It integrates the CAMEL framework, financial intermediation theory and income diversification perspectives into a unified framework for analysing bank profitability.

Empirical contribution: It provides a comparative examination of public and private sector banks, incorporating financial performance, capital adequacy, asset quality, operational efficiency and revenue diversification.

Practical contribution: It identifies institutional factors that can inform banking management strategies and regional financial development policies in Tamil Nadu.

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