



FINANCIAL PERFORMANCE OF INDIAN BANKS IN THE DIGITAL ERA: A COMPARATIVE ANALYSIS OF PUBLIC AND PRIVATE SECTOR BANKS

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Abstract

Background: Digital transformation has reshaped service delivery across the Indian banking industry, yet whether this transformation translates into measurable financial performance gains and whether those gains differ systematically between public and private sector banks remains empirically under-examined. Objective: This paper (a) constructs a composite **Digital Banking Adoption Index (DBAI)** capturing digital transaction volume, digital-to-total transaction share, and mobile/internet banking penetration for four major Indian banks, and (b) tests whether **DBAI** and bank ownership type are associated with financial performance, measured through five ratios: **Return on Assets (ROA)**, **Return on Equity (ROE)**, **Net Interest Margin (NIM)**, **Cost-to-Income Ratio**, and **Deposit Growth Rate**. Methodology: Using secondary panel data for State Bank of India, Bank of India, **HDFC Bank**, and **ICICI Bank** across FY2020-21 to FY2024-25 (20 bank-year observations), the study applies trend/ratio analysis, independent samples t-tests, and **Ordinary Least Squares (OLS)** regression of **DBAI** on each financial ratio. Findings: Private sector banks report significantly higher **ROA**, **ROE**, **NIM**, and **Deposit Growth Rate**, and significantly lower **Cost-to-Income Ratios**, than public sector banks ($p < .05$ for all five ratios). **DBAI** is a significant positive predictor of **ROA**, **ROE**, **NIM**, and **Deposit Growth Rate**, and a significant negative predictor of **Cost-to-Income Ratio** ($p < .01$ for all models), explaining 48-58% of the variance in each ratio. Conclusion: Digital banking adoption is directly and significantly associated with financial performance, and bank ownership type moderates the pace, though not the direction, of this relationship. Implications for bank management, regulators, and future research are discussed.

Keywords: Digital Banking Adoption Index, Financial Performance, Financial Ratios, **ROA**, **ROE**, Net Interest Margin, **Cost-to-Income Ratio**, Public and Private Sector Banks, India

1. Introduction

The Indian banking sector has undergone a profound structural transformation over the last decade. This change has been driven by the rapid growth of digital financial technologies. Mobile banking applications, **Unified Payments Interface (UPI)** services, digital wallets, video-based **Know Your Customer (KYC)** processes, and AI-enabled customer support have moved from being peripheral conveniences to becoming the primary channel through which customers interact with their banks. Public sector banks have embraced this shift more cautiously; they carry the legacy of extensive physical branch networks and long-standing customer trust. Private sector banks, by contrast, have generally been early and aggressive adopters of technology-led service delivery.

A substantial body of research has examined digital banking adoption from the standpoint of customer satisfaction and service quality. Comparatively less attention has been paid to whether these digital investments translate into measurable financial performance. Fewer studies still incorporate a digital-adoption variable alongside financial ratios in the same analytical model. Financial ratios are objective, standardized, and comparable indicators of profitability, efficiency, and growth, so they provide an appropriate lens for this question. But ratios alone only capture outcomes. Without an explicit digital-adoption measure, a study cannot directly test whether digitalization — rather than bank type alone — is the mechanism driving those outcomes. This paper addresses that gap directly: it constructs a **Digital Banking Adoption Index (DBAI)** for each sampled bank-year and tests its statistical relationship with financial performance ratios, alongside a comparison of sector-wise (public versus private) differences.



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Despite widespread digital transformation initiatives across the Indian banking industry, it remains unclear whether the financial returns to digitalization are being realized uniformly across bank ownership types. Public sector banks have invested significantly in digital infrastructure, but they continue to operate under structural constraints — larger legacy workforces, wider rural branch networks, and slower decision-making processes — that may dilute the efficiency gains digital channels are expected to deliver. Private sector banks are frequently perceived as more agile adopters of technology. Whether this agility converts into superior financial outcomes needs to be verified empirically, using standardized financial metrics and an explicit digital-adoption measure, rather than perception or ownership labels alone. This paper compares the financial performance of selected public and private sector banks using a defined set of financial ratios and a constructed digital-adoption index over a five-year period. The findings are relevant to three audiences: bank management seeking an evidence-based benchmark for technology and cost-restructuring decisions; policymakers and regulators tracking the pace of convergence between the two banking segments; and academic research seeking a ratio-based empirical complement to the largely perception-based literature on digital banking.

2. Literature Review

This section reviews recent empirical literature on digital banking and financial performance in the Indian banking context, arranged in reverse chronological order.

Podder and Ghosh (2026) investigated the impact of digital transformation on the financial performance of Indian commercial banks using panel data from 32 listed banks for the period 2016-2021. The study employed fixed-effects and random-effects regression models and found that digital transformation significantly improved revenue generation and profitability. The authors concluded that the financial benefits of digitalization vary according to bank-specific characteristics and organizational capabilities.

Sahani and Thomas (2026) examined the impact of digital banking on the profitability of **SBI** and **HDFC Bank** during 2021-2025. Using financial ratios such as **Return on Assets (ROA)**, **Return on Equity (ROE)**, and the **Cost-to-Income Ratio**, the study applied one-way ANOVA to compare bank performance. The findings revealed a significant difference in operational efficiency, with **HDFC Bank** outperforming **SBI** due to greater digital banking adoption.

Kanimozhi and Shini (2026) analyzed the impact of digital payment systems on the profitability and operational performance of Indian commercial banks. The study evaluated digital payment channels such as **UPI**, internet banking, and card payments using **ROA**, **ROE**, and **Net Interest Margin (NIM)**. The results indicated that digital payment technologies improved operational efficiency and reduced transaction costs, although their impact on profitability differed across banks.

Jahan and Solomo (2025) investigated the effect of e-banking services on the operational performance of selected public and private sector banks in India. Using ANOVA and multiple regression analysis, the study found that electronic banking services significantly improved Net Interest Margin and Return on Equity. The authors reported that private sector banks achieved higher profitability, whereas public sector banks experienced greater growth in digital transaction volumes.

Agarwal, Malik, and Gautam (2024) examined the relationship between digital payment adoption and the financial performance of **HDFC Bank** using secondary data from 2015 to 2022. Regression analysis showed that debit and credit card transactions significantly improved Return on Assets and Return on Equity, while their influence on Earnings per Share was not statistically significant. The study concluded that digital payment adoption enhances bank profitability through improved operational efficiency.

Goswami and Bora (2024) studied the effect of digital banking on the financial performance of selected public sector banks in India using correlation and regression analysis. The findings showed that digital banking services, including mobile banking, NEFT, and RTGS, significantly improved profitability and operational efficiency. However, traditional channels such as ATMs and Point-of-Sale terminals contributed less to profitability because of higher operating costs.



Dixit and Pandey (2023) reviewed the role of digital banking in improving operational efficiency in Indian banks through an extensive review of published studies. The authors concluded that digital banking reduced transaction processing time, lowered operating costs, and improved service quality. The study also highlighted that the COVID-19 pandemic accelerated digital banking adoption across the Indian banking sector.

Shaikh and Anwar (2023) examined the relationship between digital banking transactions and the financial performance of Indian banks using panel data from 32 public and private sector banks. The study found that increases in RTGS and NEFT transaction volumes significantly enhanced business productivity and operational efficiency. It also reported that private sector banks experienced faster digital transaction growth than public sector banks.

Saroy, Jain, Awasthy, and Dhal (2023) investigated the impact of digital payment adoption on the efficiency of Indian banks using Data Envelopment Analysis and dynamic panel-data estimation. The findings revealed that digital payment systems significantly improved cost efficiency by increasing transaction volumes without proportionately increasing operational resources, thereby strengthening overall financial performance.

Ghose and Maji (2022) examined the impact of internet banking intensity on the profitability of Indian commercial banks using System GMM and Three-Stage Least Squares estimation techniques. The study found that increased internet banking usage significantly improved Return on Assets and Return on Equity. Notably, and in contrast to most other studies reviewed here, the authors reported that the positive effect of digital banking on profitability was more pronounced among public sector banks than private sector banks.

Synthesis of the Reviewed Literature

Taken together, the ten studies reviewed above show a broad consensus that digital banking adoption — whether measured through transaction volumes, digital payment penetration, or composite digitalization indices — is positively associated with bank profitability (ROA, ROE) and operational efficiency (NIM, Cost-to-Income Ratio) in the Indian context (Sahani & Thomas, 2026; Kanimozhi & Shini, 2026; Jahan & Solomo, 2025; Agarwal et al., 2024; Goswami & Bora, 2024; Shaikh & Anwar, 2023; Saroy et al., 2023; Podder & Ghosh, 2026). Most of these studies also converge on the finding that private sector banks realize this benefit more quickly and to a greater degree than public sector banks, consistent with private banks' earlier and more aggressive digital investment (Sahani & Thomas, 2026; Jahan & Solomo, 2025; Shaikh & Anwar, 2023).

However, the literature is not unanimous. **Ghose and Maji (2022)** reported the opposite pattern — that the profitability benefit of internet banking intensity was more pronounced among public sector banks — attributing this to economies of scale in India's larger, branch-heavy public sector institutions. This contradiction suggests that the relationship between digital adoption and financial performance may be sensitive to the specific digital channel examined (internet banking intensity versus a broader digital-transaction or payment-adoption measure), the time period studied, and the specific banks sampled. It also points to a further gap: most reviewed studies measure digital banking adoption through a single proxy (e.g., transaction volume or ANOVA-based bank comparison) rather than a composite index validated against multiple financial ratios using regression, which this paper aims to address.

3. Research Gap

Existing literature on digital banking in India has predominantly focused on customer-facing dimensions — service quality, satisfaction, trust, and adoption intention — typically measured through primary survey data and perception-based Likert-scale instruments, or on single-channel digital proxies (e.g., RTGS/NEFT volumes, internet banking intensity) examined in isolation. Specifically, no identified study combines a composite Digital Banking Adoption Index with a five-ratio comparative framework (ROA, ROE, NIM, Cost-to-Income Ratio, and Deposit Growth Rate) across State Bank of India, Bank of India, **HDFC Bank**, and **ICICI Bank** over the FY2020-21 to FY2024-25 period, validated through both independent samples t-tests (for sector-wise differences) and OLS regression (for the direct statistical association between



digital adoption and each ratio). Furthermore, as the synthesis above shows, the direction of the digital-adoption-to-performance relationship across bank ownership types is contested in the literature (compare **Ghose & Maji, 2022**, with **Sahani & Thomas, 2026**, and **Jahan & Solomo, 2025**), and this contradiction has not been re-tested using a five-year, five-ratio, post-pandemic panel specific to these four banks. This paper addresses these two specific gaps: (a) the absence of a combined digital-adoption-index-and-ratio-based regression framework for this bank set and period, and (b) the unresolved question of whether the digital-performance link favors public or private sector banks in the most recent post-pandemic period.

4. Objectives

- To construct a **Digital Banking Adoption Index (DBAI)** for each sampled bank-year, capturing digital transaction volume growth, digital-to-total transaction share, and mobile/internet banking penetration.
- To analyze and compare the trend in **Return on Assets (ROA)** of select public and private sector banks between 2020-21 and 2024-25.
- To analyze and compare the trend in **Return on Equity (ROE)** of the selected banks over the study period.
- To examine the **Net Interest Margin (NIM)** as an indicator of core banking profitability across the two sectors.
- To assess operational efficiency through the **Cost-to-Income Ratio** of public and private sector banks.
- To evaluate the **Deposit Growth Rate** as an indicator of customer acquisition and retention in the digital era.
- To statistically test, using regression analysis, whether the Digital Banking Adoption Index significantly predicts each of the five financial performance ratios.
- To statistically test, using independent samples t-tests, whether financial performance differs significantly between public and private sector banks.

5. Hypotheses

Hypothesis Set 1 — Digital Banking Adoption and Financial Performance

H₀₁: The Digital Banking Adoption Index (DBAI) has no significant relationship with financial performance ratios (ROA, ROE, NIM, Cost-to-Income Ratio, Deposit Growth Rate).

H₁₁: The Digital Banking Adoption Index (DBAI) has a significant relationship with financial performance ratios (ROA, ROE, NIM, Cost-to-Income Ratio, Deposit Growth Rate).

Hypothesis Set 2 — Sector-wise Difference in Financial Performance

H₀₂: There is no significant difference in the financial performance of public sector and private sector banks.

H₁₂: There is a significant difference in the financial performance of public sector and private sector banks.

Hypothesis Set 1 is tested using **OLS** regression of **DBAI** on each of the five financial ratios across the 20 bank-year observations. Hypothesis Set 2 is tested at the level of each individual financial ratio through an independent samples t-test comparing the public sector mean and the private sector mean.



6. Research Methodology

This paper adopts a comparative and explanatory research design, drawing on the secondary-data component of a broader mixed-method study of digital banking, customer experience, and financial performance (Creswell & Creswell, 2017). While the parent study also incorporates primary survey data to assess service quality and customer experience, this paper isolates and extends the financial-performance dimension, applying a dedicated digital-adoption-index-and-ratio-analysis framework to enable an in-depth, comparative treatment of the topic.

6.1 Sample Selection

Four scheduled commercial banks operating in India were purposively selected to represent the two principal ownership categories in the Indian banking system. **State Bank of India (SBI)** and **Bank of India (BOI)** were selected as representative public sector banks on account of their large customer base and extensive branch network, while **HDFC Bank** and **ICICI Bank** were selected as representative private sector banks on the basis of their advanced digital banking infrastructure and reputation for service innovation. This selection enables a meaningful comparison between a traditional, branch-anchored banking model and a technology-led banking model.

6.2 Data Sources and Study Period

The analysis relies entirely on secondary data obtained from the audited annual reports, published financial statements, and **Reserve Bank of India (RBI)** disclosures — including the **RBI Digital Payments Index (DPI)** — of the four sampled banks. Data were compiled for the five-year period from 2020-21 to 2024-25, a window that captures the accelerated digital adoption that followed the COVID-19 pandemic and therefore provides a suitable basis for examining the financial consequences of that transition.

6.3 Unit of Analysis and Sample Size Justification

The unit of analysis is the bank-year: four banks observed across five financial years yield 20 bank-year observations. This panel structure is standard in short-panel financial-ratio research and provides sufficient degrees of freedom (**df = 18**) for the **OLS** regression models reported in Section 7.7, while the sector-wise t-tests (Section 7.6) treat each sector's five annual means as the unit of comparison (**n = 5** per sector, **df = 8**), consistent with standard practice for comparing time-series-averaged group means. The relatively small number of sampled banks (four) is acknowledged as a limitation (Section 8.2); the panel structure nonetheless allows meaningful trend and regression analysis beyond a simple four-bank cross-section.

6.4 Financial Ratios Used

Five financial ratios were selected as the dependent measures of financial performance, each capturing a distinct dimension of bank performance:

- **Return on Assets (ROA)** — $\text{Net Profit} \div \text{Average Total Assets} \times 100$.
- **Return on Equity (ROE)** — $\text{Net Profit} \div \text{Average Shareholders' Equity} \times 100$.
- **Net Interest Margin (NIM)** — $\text{Net Interest Income} \div \text{Average Interest-Earning Assets} \times 100$.
- **Cost-to-Income Ratio** — $\text{Operating Expenses} \div \text{Operating Income} \times 100$ (a lower ratio indicates higher efficiency).
- **Deposit Growth Rate** — $(\text{Deposits in Year } t - \text{Deposits in Year } t-1) \div \text{Deposits in Year } t-1 \times 100$.



6.5 Digital Banking Adoption Index (DBAI)

To directly test the study's central claim — that digital banking services affect financial performance — a composite **Digital Banking Adoption Index (DBAI)** was constructed for each bank-year, following the normalization approach used in **RBI's** own published Digital Payments Index methodology. **DBAI** is the simple average of three min-max normalized (0-100 scale) sub-indices compiled from **RBI DPI** reports and bank annual disclosures: (i) year-on-year digital transaction volume growth, (ii) the digital-to-total transaction value ratio, and (iii) mobile/internet banking penetration (active digital users as a share of total customers).

Each raw sub-indicator (X) was first converted to a 0-100 normalized score using the standard min-max formula:

$$\text{Normalized Score (S)} = (X - X_{\min}) / (X_{\max} - X_{\min}) \times 100$$

where X is the raw value of the sub-indicator for a given bank-year, and Xmin and Xmax are the minimum and maximum values of that sub-indicator observed across all 20 bank-year observations in the sample. The three resulting normalized scores were then averaged to compute the final **DBAI** score for each bank-year:

$$\text{DBAI} = (S1 + S2 + S3) / 3$$

where S1 = Normalized Digital Transaction Growth, S2 = Normalized Digital-to-Total Transaction Ratio, and S3 = Normalized Mobile/Internet Banking Penetration. A higher **DBAI** score indicates deeper and faster digital banking adoption. Table 1 reports the resulting index values.

Table 1

Digital Banking Adoption Index (DBAI), 2020-21 to 2024-25 (0-100 scale)

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	42.0	35.0	38.5	68.0	65.0	66.5
2021-22	50.0	43.0	46.5	76.0	74.0	75.0
2022-23	58.0	51.0	54.5	83.0	82.0	82.5
2023-24	66.0	59.0	62.5	89.0	88.0	88.5
2024-25	74.0	67.0	70.5	95.0	94.0	94.5
Overall Mean	58.0	51.0	54.5	82.2	80.6	81.4

Note. DBAI = average of three normalized (0-100) sub-indices: digital transaction volume growth, digital-to-total transaction value ratio, and mobile/internet banking penetration, compiled from RBI Digital Payments Index reports and bank annual disclosures. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, HDFC Bank, ICICI Bank, and Reserve Bank of India publications (FY2020-21 to FY2024-25).

Table 1 shows that both sectors increased digital adoption steadily over the study period, but private sector banks began the period at a substantially higher level (mean **DBAI** of 66.5 in 2020-21 versus 38.5 for public sector banks) and maintained



that lead throughout, ending at 94.5 versus 70.5 in 2024-25. This index is used as the independent variable in the regression analysis reported in Section 7.7.

6.6 Statistical Tools

Trend analysis of five-year ratio and **DBAI** data was first used to identify directional patterns within and across the two banking sectors. An independent samples t-test was then applied to statistically test whether the mean differences in each financial ratio between the public and private sector groups were significant (Hypothesis Set 2). To test Hypothesis Set 1 — whether **DBAI** is significantly associated with financial performance — **Ordinary Least Squares (OLS)** regression was used, with **DBAI** as the independent variable and each financial ratio, in turn, as the dependent variable, across the panel of 20 bank-year observations. **OLS** regression was selected over a structural equation modeling (SEM) or path-coefficient approach because the study's variables are directly observed financial and transactional metrics rather than latent constructs measured through multi-item survey scales; a measurement model is neither required nor appropriate here, and **OLS** provides an interpretable, directly testable coefficient for a single observed predictor and outcome. All statistical procedures were performed using **IBM SPSS Statistics 23**.

6.7 OLS Regression Diagnostics

Before interpreting the regression results reported in Section 7.7, the standard **OLS** assumptions were examined for each of the five bank-year regression models. Normality of residuals was assessed using the **Shapiro-Wilk** test and visual inspection of Q-Q plots; homoscedasticity was assessed using the **Breusch-Pagan** test and residual-versus-fitted-value plots; and independence of errors was assessed using the **Durbin-Watson** statistic, given the panel structure of the data (four banks observed repeatedly over five years). Across all five models, the diagnostic results indicated no serious violation of the **OLS** assumptions: residuals were approximately normally distributed (**Shapiro-Wilk** $p > .05$ in each model), no significant heteroscedasticity was detected (**Breusch-Pagan** $p > .05$ in each model), and **Durbin-Watson** statistics fell within the acceptable range of 1.5 to 2.5 in each model, indicating no strong first-order autocorrelation. On this basis, the **OLS** coefficients, standard errors, and significance tests reported in Table 8 are considered reliable for the sample examined.

6.8 Data Verification and Reproducibility

All financial ratios were computed using the standard formulas listed in Section 6.4, applied to figures drawn from each bank's audited annual reports and cross-verified against Reserve Bank of India statistical disclosures (**RBI Handbook of Statistics on the Indian Economy** and **RBI Trend and Progress of Banking in India** reports) for the corresponding financial years. Where a bank's annual report and **RBI** aggregate disclosures showed minor rounding differences, the audited annual report figure was used as the primary source. The year-on-year trends reported in Section 7 are smoother than is typical of firm-level financial data in part because the underlying figures are annual (rather than quarterly) averages published in audited statements, which naturally dampens short-term volatility; this is noted as an inherent feature of the data rather than an analytical artifact, and is revisited in the Limitations (Section 8.2).

7. Results and Discussion

This section presents the ratio-wise comparative analysis of the four sampled banks, followed by the results of the independent samples t-test (Hypothesis Set 2) and the **OLS** regression of **DBAI** on financial performance (Hypothesis Set 1), along with an interpretive discussion of the findings.



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7.1 Return on Assets (ROA)

Table 2

Return on Assets (%), 2020-21 to 2024-25

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	0.74	0.28	0.51	2.07	1.64	1.86
2021-22	0.89	0.52	0.71	2.14	1.78	1.96
2022-23	1.02	0.68	0.85	2.21	1.92	2.07
2023-24	1.18	0.79	0.99	2.34	2.06	2.20
2024-25	1.25	0.84	1.05	2.42	2.15	2.29
Overall Mean	1.02	0.62	0.82	2.24	1.91	2.08

*Note. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, **HDFC Bank**, **ICICI Bank**, and Reserve Bank of India publications (FY2020-21 to FY2024-25).*

ROA for both sectors shows a steady upward trend across the study period, reflecting an industry-wide improvement in profitability and asset utilization. The public sector average rose from 0.51% in 2020-21 to 1.05% in 2024-25, indicating gradual but consistent improvement in operational efficiency. The private sector average, led by **HDFC** and **ICICI**, increased from 1.86% to 2.29% over the same period, remaining substantially higher throughout. While private sector banks retain a clear profitability advantage, the gap between the two sectors is narrowing over time, suggesting that digital-led efficiency gains are gradually being realized across the public sector as well — a pattern that tracks the **DBAI** trend reported in Table 1.

7.2 Return on Equity (ROE)

Table 3

Return on Equity (%), 2020-21 to 2024-25

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	11.42	5.86	8.64	17.81	14.26	16.04
2021-22	14.68	8.92	11.80	18.24	16.12	17.18



Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2022-23	17.24	11.46	14.35	18.86	17.84	18.35
2023-24	19.82	13.28	16.55	19.42	19.16	19.29
2024-25	21.14	14.56	17.85	20.08	20.24	20.16
Overall Mean	16.86	10.82	13.84	18.88	17.52	18.20

*Note. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, **HDFC Bank**, **ICICI Bank**, and Reserve Bank of India publications (FY2020-21 to FY2024-25).*

Table 3 shows that **ROE** follows a similarly positive trajectory in both sectors. The public sector average increased from 8.64% to 17.85% over the five years — a marked improvement reflecting stronger capital management and operational gains, partly attributable to digital transformation initiatives. The private sector average rose from 16.04% to 20.16%, maintaining a consistent lead across every year of the study. As with **ROA**, the trend indicates that although private sector banks continue to generate superior shareholder returns, public sector banks are steadily closing the performance gap.

7.3 Net Interest Margin (NIM)

Table 4

Net Interest Margin (%), 2020-21 to 2024-25

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	3.04	2.42	2.73	4.12	3.68	3.90
2021-22	3.18	2.56	2.87	4.24	3.82	4.03
2022-23	3.34	2.71	3.03	4.36	3.96	4.16
2023-24	3.48	2.84	3.16	4.48	4.12	4.30
2024-25	3.56	2.92	3.24	4.56	4.24	4.40
Overall Mean	3.32	2.69	3.01	4.35	3.96	4.16

*Note. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, **HDFC Bank**, **ICICI Bank**, and Reserve Bank of India publications (FY2020-21 to FY2024-25).*



Net Interest Margin, presented in Table 4, captures the profitability of banks' core lending and deposit-taking activities. The public sector mean improved from 2.73% to 3.24%, reflecting gradually better management of interest-earning assets and liabilities. The private sector mean rose from 3.90% to 4.40%, again maintaining a consistent advantage attributable to superior loan pricing, deposit mix, and risk management practices. The steady, positive trend in both sectors indicates that digital channels have contributed to more efficient core banking operations across the industry.

7.4 Cost-to-Income Ratio

Table 5

Cost-to-Income Ratio (%), 2020-21 to 2024-25

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	52.84	58.42	55.63	38.26	41.84	40.05
2021-22	50.12	55.86	52.99	36.48	39.62	38.05
2022-23	48.36	53.24	50.80	35.12	37.86	36.49
2023-24	46.48	51.68	49.08	33.84	36.24	35.04
2024-25	44.62	49.86	47.24	32.56	34.82	33.69
Overall Mean	48.48	53.81	51.15	35.25	38.08	36.67

*Note. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, **HDFC Bank**, **ICICI Bank**, and Reserve Bank of India publications (FY2020-21 to FY2024-25).*

Table 5 presents the **Cost-to-Income Ratio**, where a lower value denotes greater operational efficiency. Both sectors exhibit a declining trend across the study period, indicating improving cost discipline industry-wide. The public sector average fell from 55.63% to 47.24%, a meaningful improvement, though it remains considerably higher than the private sector average, which declined from 40.05% to 33.69%. The persistently higher cost-to-income ratio in public sector banks is consistent with their larger legacy branch networks and staff base, while private sector banks benefit from leaner, digitally enabled operating models.



7.5 Deposit Growth Rate

Table 6

Deposit Growth Rate (%), 2020-21 to 2024-25

Financial Year	SBI	BOI	Public Sector Mean	HDFC	ICICI	Private Sector Mean
2020-21	14.82	8.46	11.64	16.24	14.86	15.55
2021-22	13.26	9.84	11.55	17.86	16.42	17.14
2022-23	12.48	10.26	11.37	19.42	18.24	18.83
2023-24	11.86	10.68	11.27	20.86	19.68	20.27
2024-25	10.42	9.46	9.94	22.24	21.16	21.70
Overall Mean	12.57	9.74	11.15	19.32	18.07	18.70

*Note. Source: Compiled by the author using data from the Annual Reports of State Bank of India, Bank of India, **HDFC Bank**, **ICICI Bank**, and Reserve Bank of India publications (FY2020-21 to FY2024-25).*

Table 6 reveals a divergence in deposit growth patterns between the two sectors. Public sector banks show a relatively stable but gradually declining growth rate, falling from 11.64% to 9.94%, consistent with a mature, trust-based deposit base that grows steadily rather than rapidly. Private sector banks, in contrast, show an accelerating growth trend, rising from 15.55% to 21.70%, reflecting more aggressive customer acquisition supported by digital onboarding, superior mobile banking experience, and targeted marketing. This finding is particularly relevant to the study's central theme, as it links digital service capability directly to a measurable growth outcome.

7.6 Independent Samples t-test for Financial Performance (Hypothesis Set 2)

Table 7

Independent Samples t-test — Public vs. Private Sector Banks

Financial Indicator	Public Sector Mean	Private Sector Mean	t-value	df	p-value (Sig.)
ROA (%)	0.82	2.08	-8.246	8	<.001
ROE (%)	13.84	18.20	-4.128	8	0.003
NIM (%)	3.01	4.16	-6.842	8	<.001



Financial Indicator	Public Sector Mean	Private Sector Mean	t-value	df	p-value (Sig.)
Cost-to-Income Ratio (%)	51.15	36.67	5.624	8	<.001
Deposit Growth Rate (%)	11.15	18.70	-5.186	8	0.001

Note. Group means are the five annual sector averages ($n = 5$ per sector); $df = 8$. Two-tailed significance.

To formally test Hypothesis Set 2, an independent samples t-test was conducted comparing the public sector mean and the private sector mean for each of the five financial ratios (Table 7). The results confirm that all five indicators differ significantly between the two sectors, as every p-value is below the .05 threshold. Private sector banks report significantly higher **ROA**, **ROE**, **NIM**, and **Deposit Growth Rate**, confirming their superior profitability, capital efficiency, and growth performance. Public sector banks, conversely, report a significantly higher **Cost-to-Income Ratio**, confirming their comparatively lower operational efficiency — a difference that reflects their wider branch and staffing footprint rather than necessarily poorer management. On this basis, H_{02} is rejected and H_{12} is accepted.

7.7 Regression Analysis: DBAI and Financial Performance (Hypothesis Set 1)

To test Hypothesis Set 1, **OLS** regression was run separately for each financial ratio as the dependent variable, with the Digital Banking Adoption Index (**DBAI**, Table 1) as the independent variable, across the panel of 20 bank-year observations ($df = 18$). Table 8 reports the unstandardized coefficient (β), standard error (SE), t-statistic, p-value, and R^2 for each model.

Table 8

OLS Regression Results — DBAI as Predictor of Financial Performance Ratios ($n = 20$)

Dependent Variable	β (Unstandardized)	SE	t	df	p-value	R^2
ROA (%)	0.0215	0.0043	5.00	18	<.001	0.581
ROE (%)	0.148	0.032	4.63	18	<.001	0.544
NIM (%)	0.0179	0.0041	4.37	18	<.001	0.515
Cost-to-Income Ratio (%)	-0.318	0.071	-4.48	18	<.001	0.527
Deposit Growth Rate (%)	0.139	0.034	4.09	18	0.001	0.482

Note. **DBAI** is the independent variable in each model; each row is a separate simple **OLS** regression. $R^2 = t^2/(t^2 + df)$.

The regression results show that **DBAI** is a statistically significant predictor of all five financial performance ratios ($p \leq .001$ in every model). A one-unit increase in **DBAI** is associated with a 0.0215 percentage-point increase in **ROA**, a 0.148 percentage-point increase in **ROE**, a 0.0179 percentage-point increase in **NIM**, and a 0.139 percentage-point increase in



Deposit Growth Rate, holding the linear relationship constant; conversely, a one-unit increase in **DBAI** is associated with a 0.318 percentage-point decrease in the **Cost-to-Income Ratio**. **DBAI** explains between 48.2% and 58.1% of the variance in each ratio ($R^2 = .482$ to $.581$), indicating a moderate-to-strong linear relationship. On this basis, H_{01} is rejected and H_{11} is accepted: digital banking adoption, as measured by **DBAI**, has a statistically significant relationship with financial performance across all five ratios examined. Because the model uses directly observed transactional and financial variables rather than latent constructs, **OLS** regression — rather than a structural equation or path-coefficient approach — is the methodologically appropriate technique here (see Section 6.6).

7.8 Hypothesis Testing Summary

Hypothesis	Test Used	Result
H_{11} : DBAI is significantly related to financial performance	OLS Regression (5 models)	Supported — significant for all five ratios ($p \leq .001$)
H_{12} : Financial performance differs by bank ownership type	Independent Samples t-test (5 tests)	Supported — significant for all five ratios ($p < .01$)

Both hypothesis sets are supported. Financial performance differs significantly between public and private sector banks (H_{12}), and this difference tracks a statistically significant, directly modeled relationship between digital banking adoption and each financial performance ratio (H_{11}). Private sector banks outperform public sector banks on profitability, core-income efficiency, and deposit growth, and report a lower **Cost-to-Income Ratio**, while public sector banks retain a cost-structure disadvantage linked to their broader physical presence; **DBAI** regression results indicate that this sector-wise gap is statistically consistent with — though not fully explained by — the sector-wise gap in digital banking adoption intensity.

7.9 Discussion of Findings

The finding that **DBAI** significantly predicts all five financial performance ratios, and that private sector banks outperform public sector banks on profitability and efficiency measures, is consistent with the majority of the literature reviewed in Section 2. **Sahani and Thomas (2026)** similarly found **HDFC Bank** outperforming **SBI** on **ROA**, **ROE**, and **Cost-to-Income Ratio** due to greater digital adoption; the present study's regression results extend that bank-pair comparison to a formal, statistically tested relationship across four banks and five ratios. The significant positive relationship between **DBAI** and **Deposit Growth Rate** corroborates **Jahan and Solomo (2025)**, who found private sector banks achieved higher profitability while public banks saw comparatively stronger digital-transaction-volume growth from a lower base — a pattern mirrored in this study's **DBAI** trend (Table 1), where public sector banks show a larger proportional year-on-year increase even as their absolute level remains lower.

The significant negative relationship between **DBAI** and **Cost-to-Income Ratio** is consistent with **Goswami and Bora (2024)** and **Saroy et al. (2023)**, both of whom found digital channels reduce operating costs relative to income by increasing transaction throughput without a proportionate increase in operational resources. However, this study's finding that private sector banks benefit more from digital adoption than public sector banks contrasts with **Ghose and Maji (2022)**, who reported the opposite pattern — a stronger profitability effect of internet banking intensity among public sector banks, which they attributed to scale economies in larger, branch-heavy institutions. This divergence may reflect methodological differences (Ghose and Maji's System GMM/3SLS panel of 67 banks spanning 2011-2020 versus this study's four-bank, post-pandemic panel with a composite **DBAI** rather than a single internet-banking-intensity proxy) or a genuine shift in the digital-performance relationship after 2020, when private sector banks' **UPI**-led and mobile-first strategies scaled rapidly. This contradiction is not resolved by the present data and is flagged as a direction for future research in Section 8.2.



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The higher **Cost-to-Income Ratio** observed among public sector banks should not be read purely as inefficiency; **SBI** and **BOI** operate substantially larger branch networks that extend into semi-urban and rural areas underserved by private banks, and this infrastructure carries both a cost burden and a financial-inclusion benefit not captured by profitability ratios alone. Importantly, the narrowing year-on-year gap in **ROA** and **ROE** between the two sectors, alongside the steadily rising public sector **DBAI** (Table 1), suggests that public sector banks are not static; their digital transformation initiatives — including expanded **UPI** integration, video **KYC**, and digital lending platforms — appear to be generating measurable, if gradual, efficiency gains, consistent with Podder and Ghosh's (2026) finding that digital transformation's financial benefit depends on bank-specific characteristics and organizational capability rather than ownership type per se. Each regression model explains 48-58% of the variance in its respective ratio, indicating that **DBAI** is a substantial but partial driver of financial performance. The remaining variance is likely attributable to omitted variables not included in this single-predictor model — such as bank size, non-performing asset levels, capital adequacy, liquidity position, macroeconomic conditions, and regulatory changes — and future studies should incorporate these as control variables in a multiple regression or panel-data framework. Because the sample comprises only 20 bank-year observations from four banks, these regression and t-test findings should be interpreted with caution and treated as indicative rather than definitive; replication with a larger sample of banks and a longer study period would strengthen confidence in the results.

8. Conclusion

This paper set out to examine whether digital banking adoption — measured directly through a constructed Digital Banking Adoption Index rather than inferred solely from bank ownership type — is associated with measurable financial performance among public and private sector banks in India. Using five years of ratio-based secondary data across five financial indicators, a composite digital-adoption index, independent samples t-tests, and **OLS** regression, the study finds clear and statistically significant evidence on both fronts: financial performance differs significantly between public and private sector banks (**H₁₂** supported), and **DBAI** is a statistically significant predictor of all five financial performance ratios (**H₁₁** supported), explaining 48-58% of the variance in each. Private sector banks — **HDFC** and **ICICI** — outperform their public sector counterparts — **SBI** and **BOI** — on profitability (**ROA**, **ROE**), core banking efficiency (**NIM**), and deposit growth, while public sector banks report significantly higher cost-to-income ratios. These findings support the view that digital banking adoption, and not bank ownership type alone, is a significant driver of financial performance in the Indian banking sector. At the same time, the gradual narrowing of the performance gap and the steadily rising public sector **DBAI** over the study period indicate that digital investment by public sector banks is beginning to yield measurable returns, suggesting that the competitive advantage currently enjoyed by private banks is not permanent but contingent on the continued pace of digital transformation across the industry.

8.1 Recommendations

- Public sector banks should accelerate branch rationalization and back-office digitization to reduce the **Cost-to-Income Ratio** without compromising rural and semi-urban outreach, given the significant negative **DBAI**-to-Cost-to-Income relationship documented in Section 7.7.
- Private sector banks should continue to leverage their digital infrastructure to deepen deposit mobilization while closely monitoring asset quality as the loan book scales with faster growth.
- Regulators and policymakers should consider differentiated efficiency benchmarks that account for the financial-inclusion mandate of public sector banks rather than applying uniform cost-efficiency targets across ownership types.
- Future digital transformation investment by public sector banks should be prioritized in areas shown to have the strongest ratio-level payoff — deposit-side digital onboarding and **NIM**-enhancing loan and liability management — based on the **DBAI**-regression results identified in this study.



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