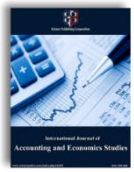
*International Journal of Accounting and Economics Studies*, 12 (6) (2025) 774-784

**International Journal of Accounting and Economics Studies**

*Website: www.sciencepubco.com/index.php/IJAES*
*https://doi.org/10.14419/jkdnj577*
***Research paper***



# Banks with Higher Levels of Fintech Adoption Exhibit Better Financial Performance Than Those with Lower Levels of Adoption

**Mr. Som Shekhar Verma [1] *, Dr. Nenavath Sreenu [2], Dr. Gyaneshwar Singh Kushwaha [2]**

*[1] Research Scholar, Department of Management Studies, Maulana Azad National Institute of Technology Bhopal, MP-462003, Madhya Pradesh, India*
*[2] Associate Professor, Department of Management Studies, Maulana Azad National Institute of Technology Bhopal, MP-462003, Madhya Pradesh, India*
**Corresponding author E-mail: shekharvrm5@gmail.com*

*Received: July 16, 2025, Accepted: August 8, 2025, Published: October 20, 2025*

**Abstract**

This study examines the impact of FinTech adoption on the financial performance of commercial banks in India, with a particular focus on Return on Assets (ROA) as a primary indicator of profitability. Drawing on a comprehensive panel dataset of Indian commercial banks from 2012 to 2022, the research employs advanced econometric techniques—including fixed effects, random effects, and dynamic panel models (Difference and System Generalized Method of Moments)—to address endogeneity and capture both short-term and long-term effects. The findings reveal that while higher levels of FinTech adoption are associated with an initial, statistically significant decline in ROA—reflecting the transitional costs and operational challenges of digital integration—banks with greater scale are better positioned to absorb these short-term impacts and achieve superior financial outcomes over time. Traditional drivers such as loan and deposit growth do not significantly influence ROA in the digital era, highlighting the evolving determinants of banking success. The study validates Schumpeter's Innovation Theory and the Technology Acceptance Model, underscoring the need for strategic planning and gradual implementation of FinTech solutions. Practical implications include recommendations for regulatory support, digital literacy enhancement, and tailored financial incentives to facilitate smoother digital transformation, particularly for smaller banks. This research contributes novel empirical evidence to the limited literature on FinTech and bank profitability in emerging markets and offers actionable insights for banking professionals, policymakers, and financial regulators navigating the digital age.

***Keywords***: *Fintech Adoption; Banking Performance; Return on Assets (ROA); Generalized Method of Moments (GMM); Financial Technology; Digital Banking; India.*

## 1. Introduction

The FinTech force across the financial sector landscape has transformed and left traditional banks scrambling to embrace innovation. The evolution of financial institutions is largely due to the increasingly challenging challenge of higher productivity and efficiency while serving customers' needs (Wang, 2024; Wu, 2023). As part of FinTech providers, advanced technologies, including artificial intelligence and distributed ledger technology, have become essential for integration to help FinTech providers provide improved customer experience and improve operational efficiency (Mukkamala & Vatrapu, 2021; Abeysekera & Kumarawadu, 2022).

However, FinTech also has a far-reaching influence on traditional banking models, as it drives them to hone their analytics and AI brains to stay in competition (Lakshmi, 2024). Financial technologies evolve, institutions must adapt to these changes, and the stronger interest in the banking–customer relationship has generated a need for a greater understanding of bank–customer relationships (Wang, 2024; Lakshmi, 2024). The rise of DLT (Distributed Ledger Technology), especially blockchain technology, stands out for essentially being a decentralized framework that improves the transparency and security of financial transactions, in contrast to the inherent risks of traditional banking systems (Mukkamala & Vatrapu, 2021; Abeysekera & Kumarawadu, 2022).

Second, the competitive pressure imposed by Fintech firms has caused a reappraisal of the traditional business model within the banking sector. A change towards more agile and customer-centric approaches is now seen as essential for meeting modern consumers' expectations (Abeysekera & Kumarawadu, 2022; Wu, 2023). Banks and FinTech companies are expected to collaborate and innovate more as banks undergo major changes while service delivery is improved, which will ensure that consumers get more access and service delivery (Lakshmi and Wang, 2024).

The increasing embracement of Fintech has great potential implications for the banking sector and requires serious research on its effect on financial performance. The research focuses on investigating how FinTech integration affects banks' financial outcomes, with a specific

focus on the case study of India. Rapid technological and capabilities advancement has exposed many opportunities in financial products and services, which have heightened competition among banks, one of the main motivations for this study.
It shows how such advancements significantly impact consumer retention, transaction accuracy, and financial operation speed (Riaz, 2023; Hussain, 2023). In addition, financial technology is expected to promote the adaptation of banks to create platforms to attract FinTech investments and expand their service scope. This adaptation not only allows banks to reduce operational costs but also helps banks better grasp potential investors that might be interested in certain banking innovations (Riaz, 2023; Hussain, 2023).
This study could yield insights into the banking sector to address the strategy of investor attraction and engagement, especially in the evolution of India's financial industry (Hussain, 2023). FinTech adoption has multifaceted implications for banks, not only addressing issues of operational efficiency, but also giving banks a competitive advantage in the market. Learning these dynamics gives banks the ability to address the challenges that FinTech brings to their business and leverage its gains for their own growth and sustainability (Riaz, 2023; Hussain, 2023).
Financial technology and Fintech have seen the evolution and adoption of the latest information and communication technologies to have a significant influence on an era of rapid innovation and delivery of enhanced banking services. With banks as the aggregators of novel solutions and the ever-widening offering of a variety of applications aimed at improving revenue, improving customer satisfaction, and maintaining cost efficiency while optimizing resource utilization (Alt et al., 2018; Al-Ajlouni, 2018), the application landscape is evolving drastically. New payment channels, such as applying contactless and mobile payment systems and opening banks for open banking solutions, are the introduction of the industry's response to the growing demand for convenience and secure payment methods (Meena, 2023). In addition, the advent of online financial services, courtesy of advisory bots and AI-driven platforms, has made access to investment advisory services easier and cheaper for consumers (Meena, 2023). Not only are these advancements speeding up transactions, but they are also making consumers financially empowered by giving them what they need, when they need it - tailored personal financial solutions. These technologies allow for greater integration, which creates a more efficient banking environment for institutions to remain competitive in this increasingly digital environment (Alajlouli, 2018). Thus, the banking sector is undergoing major transformation under the pressure of technological advancement and consumer expectations (Alt et al., 2018; Al-Ajlouni, 2018).
Financial technology or FinTech has seen the evolution and adoption of the latest information and communication technologies to have a significant influence on an era of rapid innovation and delivery of enhanced service in banking. With banks as the aggregators of novel solutions and ever-widening offering of a variety of applications aimed at improving revenue, improving customer satisfaction, and maintaining cost efficiency while optimizing resource utilization (Alt et al., 2018; Al-Ajlouni, 2018), the application landscape is evolving drastically. New payment channels, such as applying contactless and mobile payment systems, opening banks for open banking solutions, and so on, are the introduction of industry response to the growing demand for convenience and secure payment methods (Meena, 2023). In addition to this, the advent of online financial services, courtesy of advisory bots and AI-driven platforms, has made access to investment advisory services an easier and cheaper affair for consumers (Meena, 2023). Not only are these advancements speeding up transactions, but they are also making consumers financially empowered by giving them what they need, when they need it - tailored personal financial solutions. These technologies allow for greater integration, which then makes a more efficient banking environment for the institutions to remain competitive in this increasingly digital environment (Alajlouli, 2018). So the banking sector is going through a major transformation under the pressure of technology advancement and consumer expectations (Alt et al., 2018; Al-Ajlouni, 2018).

## 2. Literature Review

The relationship between Fintech adoption and banks' financial performance has garnered significant attention in recent years. Numerous studies have shown that banks' financial performance is better when the level of FinTech adoption is higher than when it is lower. This literature review synthesizes this relationship from various sources to elucidate this relationship. The most probable reason for banks adopting FinTech is that it leads to an improvement in the operational efficiency and productivity of banks. Kwon et al. (2023) mention that introducing FinTech solutions to the banking industry helps banks achieve cost reduction and improve their technological flexibility, which is indispensable to the still very rapid evolution of the financial area. In support of this assertion, Baker et al. (2023) find that a positive correlation exists between banks' use of FinTech and key performance indicators, such as total deposits and net profits, and that banks using FinTech can have better financial outcomes. The work of Iman also highlights that the adoption of FinTech is not a trend, but a requirement of banks to remain relevant and competitive in the digital era (Iman, 2018). Collaboration between traditional banks and FinTech companies has demonstrated significant advantages.
Fatmawati and Bebasari's research is significant, as such partnerships enable banks to become involved with new financial products and services they would not be able to offer otherwise, which will lead to improved customer satisfaction and loyalty (Fatmawati & Bebasari, 2023). From the perspective of Islamic banking, banks especially need to adapt to technological innovation to reduce crises and improve their performance (Yudaruddin, 2022). Based on a study by Subanidja et al. (Subanidja et al., 2021), this notion is further substantiated by FinTech in general and with respect to its role in mediating external factors influencing the sustainable performance of banks in developing markets such as Indonesia. Moreover, the regulatory environment surrounding Fintech adoption is crucial for its successful implementation. Rahman (2023) points out that well-developed legislative and supervisory frameworks are necessary to ensure the safe operation of FinTech innovations, which can subsequently promote better banking performance. Ecosystems cannot be built without regulatory support, that is essential to enable FinTech to drive positively in the financial sector. Third, the literature consistently shows that Fintech banks tend to have better financial performance. This positive relationship of FinTech is based on both the operational efficiencies it facilitates through FinTech and the benefits emerging in collaboration with FinTech firms and an enabling regulatory framework. The integration of Fintech is likely to be a key factor influencing the success and sustainability outlook of banking institutions.
In 2024, Kalai revisits her work again in the Thunderbird International Business Review, which confirms that banks embracing digital progressive presence- notably those with institutionalized agile culture and innovation-driven- surge forward in terms of performance. He recommends a phased adoption of FinTech to hit a balance between short- and long-term costs and returns. Taken collectively, this mounting body of evidence supports the notion that banks that have implemented FinTech more effectively do better than those that have not tried as hard in their digital transformation efforts Nesindande et al., 2025). The degree of the positive relationship differs depending on certain factors such as the size of the bank, the regulatory backing, the level of digital literacy of the consumers, and the technology adopted, but the existence of positive correlation is irrespective of a multitude of geographical and regulatory environments. In addition, according to Himabindu (2025), the disruptive aspect of FinTech innovations has a substantial role to play in service deliveries and customer experiences, consequently leading to positive financial performance by banks. An increasing number of financial companies around the world are moving to use FinTech technology because they know it can help them modernize and improve how their banking operations work. In

India, FinTech tools have helped bring more people into banking and have made banks operate better. The UPI shows how FinTech changed money transfers forever by allowing people to instantly send and receive cash. Currently, leading banks use blockchain networks for safe financial exchanges, AI computer tools to serve customers, and data methods to assess credit safety. The UPI has helped India include more people in its economy by making quick and easy money transfers through mobile banking available to many different types of users. Rastogi et al. (2021) point out that UPI makes mobile payments simple by connecting mobile phones directly with bank accounts, allowing users to make transactions when and where they want. The system changes help banks work faster and make it easier for regular people, especially village dwellers, to use digital money services and learn more about managing their funds. The beneficial effects of Fintech technology have spread widely across countries.

Financial institutions in rich nations are now using blockchain to protect customer money and show them what is happening with their funds. Banks now rely on AI-based chatbots that provide constant customer service and create customized interactions for each customer. Banks use these modern systems to examine their customers' data carefully, which helps them decide who qualifies for credit and makes better business decisions. These technologies show that banks now need to adopt FinTech not only to stay competitive but also to run their businesses better and make their customers happier. This study is trying to understand how fintech helps banks improve their bottom lines. Smaller banks have battled both technical implementation issues and business regulation barriers when adopting these modern solutions, but larger ones have reaped their benefits. This study explores the link between banks that use FinTech and their financial results.

### 2.1. Problem statement

Banks require strong financial resources to survive and develop as businesses. Banks use Return on Assets, Return on Equity, and Net Interest Margin to measure profitability and efficiency. FinTech transforms bank operations to boost performance. Research shows that we lack complete knowledge about how banks use technology to improve their finances, particularly in emerging markets, where digital adoption rates differ from one bank to another. Studies reveal that FinTech implementation strengthens business results, but organizations must deal with high setup expenses, security threats, and staff resistance.

Hussain's research shows that commercial banks' adoption of FinTech leads to better financial results because competitive forces drive this relationship (Hussain 2023). Ogunode and Akintoye note that emerging economy banks deal with technical obstacles and regulatory restrictions that are barriers to Fintech implementation (Ogunode & Akintoye, 2023). Research must examine more data on how banks perform when their Fintech adoption matches or does not match their competitors' Fintech usage.

According to Riaz's research, banks that incorporate FinTech gain performance advantages, but they still face obstacles in maintaining their competitive position (Riaz, 2023). The extent to which banks use FinTech to enhance performance depends heavily on how widely FinTech has been adopted in each market. Those who want to use Fintech for better business results must clearly understand how these factors affect each other.

### 2.2. Theoretical framework

This study on both the Resource-Based View (RBV) and Technology Acceptance Model (TAM). The RBV explains that businesses build enduring market leads when they develop special capabilities and hold resources. Financial technology tools help banking institutions to work better and build stronger relationships with their clients. Banks can use digital technology to build special abilities that differentiate them from other banking services. TAM shows that successful technology adoption depends on users finding both easy operation and practical benefits. Banks opt for FinTech technology because it helps them make operations run smoothly and cost less, while improving how they serve their customers. We use these theories to show how banks perform better after adopting Fintech solutions.

According to RBV theory, the special skills and tools banks possess when using FinTech create lasting market advantages (Hussain, 2023). Hussain's research shows that banks achieve better financial results with improved operations when they use Fintech effectively. Kaddumi shows that banks need to use FinTech to stay competitive in today's fast-changing market environment. Behavioral studies based on TAM show the process banks use when they adopt new FinTech services.

Zhong-Qing et al.'s research shows that FinTech service users base their adoption choices on how easy the services are to use and how useful they find them (Zhong-Qing et al., 2019). The integration of FinTech services into banking operations leads to better financial results and stronger customer connections, as confirmed by Riaz's 2023 research. We study banking FinTech adoption using the TAM and RBV theories to better understand its effects on financial outcomes.

Based on the theoretical framework and literature review, the following hypotheses is proposed:

H1: Higher levels of FinTech adoption influence the financial performance of banks.

## 3. Data and Model

### 3.1 Sample

This research analyzes how fintech companies shape banking performance in India using data from 2012 to 2022. India's fintech industry has grown significantly in recent years. This study analyzes commercial bank efficiency by combining RBI databases with bank annual reports and ratings of essential FinTech development from the RBI and NPCI. Using a multiple regression model in Gretl Software (Baiocchi & Distaso, 2003), we analyze the relationship between FinTech adoption and commercial banking efficiency.

This study employs panel data to examine how higher levels of FinTech influence the financial performance of banks.

$$\text{FinancialPerformance}_{it} = \beta_0 + \beta_1\,\text{FinTechAdoption}_{it} + \beta_2\,\text{BankSize}_{it} + \beta_3\,\text{LoanGrowth}_{it} + \beta_4\,\text{DepositGrowth}_{it} + \epsilon_{it} \quad (1)$$

### 3.2. Variables

#### 3.2.1. Dependent variable

a) Financial Performance

How well a bank uses its resources to make a profit and attain operational targets defines its financial performance? Bank financial performance indicates whether an institution can survive by generating profits while running its operations effectively. Evaluating bank

performance involves the following essential financial measurements: ROA, ROE, and NIM. These metrics help organizations evaluate how well their banks use resources and profits while running daily operations. Researchers have consistently demonstrated why these financial performance metrics matter. According to Wasiuzzaman and Gunasegavan (2013), the net interest margin proves vital for measuring bank efficiency since it shows how well a bank manages its interest expenses and revenue. AlAli (2019) demonstrates why ROE represents a vital way to evaluate how well banks turn their investments into profits. Din and colleagues investigated different aspects of financial performance but did not explain how ROA helps evaluate a bank system's health and production efficiency (Din et al., 2020). ROA measures how effectively a bank utilizes its total assets to generate net income.

- Formula: $ROA = \frac{\text{NET INCOME X 100}}{\text{TOTAL ASSETS}}$

A higher ROA indicates more efficient use of assets in generating profits.

### 3.2.2. Independent variable

a) Fintech Adoption

Banks use modern financial technology tools to boost their daily work while providing better service to customers and working more productively. Banks adopt digital technologies through mobile banking services, plus use AI-powered risk analytics and blockchain security alongside automatic process management. This study examines FinTech adoption as its primary independent element because banks use digital transformation to enhance their services and compete effectively. The measurement of FinTech adoption can be quantified using several key indicators derived from bank operations and technology investments:

Step 1: Data collection: Businesses like India's National Payment Corporation of India and the Reserve Bank of India provide the necessary data needed for this project.

Step 2: Average transaction value per method (e.g., NEFT, RTGS): Given Data Transformation Tool. For each payment method i (where i represents NEFT, RTGS, or Mobile Banking):

$$ATVi = \frac{Tvi}{Ni}$$

Where:

- ATVi: Payment method i shows its average transaction values through this method.
- TVi: The sum of all transactions through payment method I shows in rupees.
- Ni: The payment method i processed how many total transactions

Step 3: Weight assignment using Principal Component Analysis (PCA): Each payment method gets weightings based on its importance. Evaluating each payment method's importance in digital finance, we assign significant weights wi_wi.

$$WATVi = wi \times ATVi$$

Where:

- wi: We assign significance values to payment method i based on PCA results.
- WATVi: Weighted average transaction size goes with payment method 1

Note: PCA is a statistical technique that reduces complex datasets into principal components, capturing most of the data variation. In this study, PCA assigns weights to different payment methods (e.g., NEFT, RTGS, mobile banking) based on their relative contribution to digital transaction activity, ensuring the index reflects the most significant drivers of digital integration (Maćkiewicz & Ratajczak, 1993).

Step 4: Combine all weighted scores to form FI: The final Fintech Adoption Index for this analysis comes from combining all Weighted Average Transaction Values detailed in their respective payment methods. Sum the weighted average transaction values across all payment methods to form the FI:

$$FI = \sum_{i=1}^{3} WATVi$$

Where:

- FI: Fintech Adoption Index

Step 5: Interpretation: The FI indicator helps understand both Fintech performance and market presence across different nations, leading to better financial access policy creation (Banna & Alam, 2021). An economy shows stronger financial service digitization when it earns a higher FI score. It uses scientific principles to measure digital finance by combining data on money to be processed alongside transaction frequency and payment mode diversity. A higher FI score reflects greater digital integration (Banna & Alam, 2021).

### 3.2.3. Control variables

a) Bank Size

Bank Size is the total assets used to measure a bank's operating capability. Banks use it to measure how different financial results come from variations in basic bank size. Banks that handle more money generally serve more customers through advanced technology, which benefits how well they establish digital finance solutions. Less wealthy banks experience resource limitations that prevent them from investing in new banking technologies. A bank's size information typically comes from listing all its Total Assets, including cash, loans, investments, and building value. A bank can determine its size directly from the internal financial records on its balance sheet. Researchers widely show that bank size strongly affects bank performance. Larger banks benefit from bigger operations that produce more efficiency and profitability ratios Menicucci & Paolucci 2016 according to their research study. Kirimi et al (2021) found that financial health impacts profitability differently for big and small banks through their analysis of this relationship. According to Yao and Song (2021), large banks

make better financial technology investments due to their strong capital resources and enhance their market position. Smaller banks face challenges in keeping up with tech updates because of their limited funds, according to Akinola, who shows that internal control quality affects bank size and performance (Akinola, 2022).

Bank Size (Total Assets) = Cash and Cash Equivalents + Loans and Advances + Investments + Other Assets

b) Deposit Growth

The Deposit Growth metric tracks how much more money customers deposit each year, as part of the key research that measures bank financial performance. Banks use deposits to obtain funds to make loans and buy assets while keeping enough money available. Tracking deposit gains shows what makes a bank successful in getting new customers to put money while keeping existing customers happy. Customers' trust and value in digital banking and competitive interest rates affect how well banks grow their deposits. The rise in deposits matters especially in FinTech adoption, because digital financial tools make banking easier for customers and attract more funds to the bank. Better bank processing leads to better customer deposit numbers, which benefits the bank's profit. Deposits, as performance indicators, remain vital in financial industry research. According to Akinola, banks need more deposits to make profitable loans and investments (Phillips and Chen 2011). According to Abilawa (2023), banks that grow their deposits efficiently build stronger financial stability and performance because they provide secure funding sources. Many experts have shown how FinTech tools help banks grow customer deposits. According to Al-Eitan et al. (Andolfatto, 2017), digital banking enhances customer experiences, which leads customers to make more deposits. Financial inclusion efforts through FinTech enhance bank deposit mobilization, according to research by Zhong-qing et al. in 2019 (Zhong-qing et al., 2019). Bank deposits show that financial success depends on customer loyalty and technical progress, with competition for market share. Banks use FinTech solutions to increase their deposits, resulting in better financial success.

Deposit Growth (%) = Deposits at End of Year - Deposits at Start of Year X 100

Deposits at Start of Year

- Deposits at End of Year: Total deposits at the close of the financial year.
- Deposits at Start of Year: Total deposits at the beginning of the financial year.

c) Loan Growth

Financial technology solutions that use AI help lenders accelerate their loan processes and expand their lending ranges. New technologies process loans faster and evaluate risks better while increasing what banks can do with loans to grow their portfolios. Research has demonstrated the value of loan growth when measuring bank performance. According to Abbas and Ali (2021), loan expansion strongly affects both the level of credit danger and bank performance, especially in Islamic banks. Through his research, Agustin shows how interest rates impact existing loans, but his data do not show how FinTech use really improves loan growth (Agustin 2023). Research findings indicate that citations need to go. Since Matsuyama et al.'s research does not address ways to effectively run a loan portfolio through credit scoring technology, it should be excluded from reference (Matsuyama et al. 2023). Soedarmono and Sitorus (2016) demonstrate how banks that experience irregular loan expansion threaten financial stability across the system. Berger and Black's research shows that big banks use technology systems to obtain better loan expansion results (Berger & Black, 2011). Loan growth reveals key information about a bank's performance, whereas FinTech adoption helps banks lend better and faster to meet customer credit needs.

Loan Growth (%) = Loans at End of Year - Loans at Start of Year X 100

Loans at Start of Year

- Loans at End of Year: The total outstanding loans at the close of the financial year.
- Loans at Start of Year: The total outstanding loans at the beginning of the financial year.

# 4. Empirical Analysis

## 4.1. Correlation test and stability test

The initial phase entailed correlation analysis for each variable. The results of this study are summarized in Fig. 1. This demonstrates that the correlation coefficient values were larger than 0.5 among ROA, Fintech, Total Asset, Deposit, and loan growth. The VIF test showed that the VIF value for each explanatory variable was less than 10; hence, there was no problem with high multicollinearity in the current investigation. Each variable is tested for stationarity.

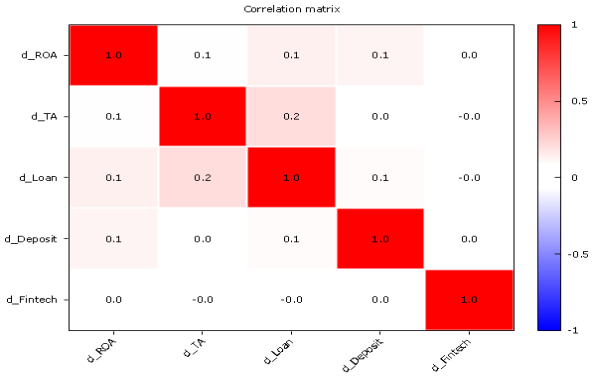



**Fig. 1:** Correlation Test and Stability Test.

Source: Output of Gretl Software.

Note: Fig. 1 presents the correlation matrix and stationarity results.

Correlation values >0.5 indicate strong associations; VIF values <10 confirm no multicollinearity; this supports robust estimation.
In Table 1, Banks display wide-ranging financial performance levels during FinTech integration assessments through their Return on Assets (ROA), total asset numbers, and the growth rates of loans and deposits.

**Table 1:** Variable Design and Descriptive Statistics

| Type | Variable | Symbol | Variable design | Mean | Median | Standard deviation | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Dependent variable | Return on Assets | ROA | Financial Performance | -0.0180 | 0.000 | 0.881 | -6.81 | 5.10 |
| Independent variable | Fintech | Fintech | Fintech Adoption | -36.4 | -23.2 | 1490 | -17600 | 17600 |
| | Bank Size | Bank Size | Total Asset | 46900 | 1440 | 96200 | -123000 | 749000 |
| Control Variable | Deposit % | | Deposit Growth | -0.708 | 0.135 | 64.6 | -738. | 692. |
| | Loan % | | Loan Growth | -0.790 | 0.293 | 26.5 | -219. | 181. |

Note: Output of Gretl Software.

Financial data shows a loss-making average ROA of -0.0180 while bankers find themselves in severe struggles according to the extensive range between -6.81 to 5.10 (Nguyen et al., 2021; Mansour, 2024). The variations in the profitability gaps between banks seem to be related to their dissimilar levels of FinTech implementation. Research shows FinTech benefits financial outcomes through operational enhancements and improved customer interactions, along with other studies such as Baker et al (2023) and Riaz (2023), and Lv et al (2022). FinTech profit relations present complex findings that suggest initial damage to traditional banking revenue with potential permanent upside effects, as banking entities adopt these technologies (Lv et al., 2022; Magdy, 2023). The FinTech adoption levels of institutions show wide-ranging discrepancies, as their values extend from -17,600 to 17,600. Bank competitiveness, together with client adaptation, requires digital technology adoption because of unpredictable market conditions (Sarfraz et al., 2022; Wahga, 2023).
FinTech implementation enables operational improvements as well as improved client satisfaction because both are critical factors for sustaining market position in digitally oriented environments (Khuan, 2024; Chen et al., 2021). Total asset differences exhibit wide variability between branches, with an average of 46,900 and a standard deviation of 96,200, thus affecting their capability to obtain FinTech solutions (Mansour, 2024; Harmadi et al., 2022). Loan and deposit growth indicators demonstrate different banking performance patterns because their mean values are -0.790 and -0.708, respectively. The analysis of banking performance requires a complete evaluation of variables that affect deposit and credit base development because some financial institutions grow while others decline (Keliuotytė-Staniulėnienė & Smolskytė, 2019; Pasha, 2023).
The analysis establishes that Fintech technology plays a fundamental role in enhancing loan and deposit expansion because digital platforms both simplify operations and broaden financial service accessibility (Baker et al., 2023; Lv et al., 2022). The data shows that better financial performance occurs among banks that use FinTech techniques at higher rates, although numerous external and internal variables influence this relationship (Riaz 2023; Lv et al. 2022; Magdy 2023).
The regression results are presented in Table 2. Researchers conducted a regression analysis focusing on how FinTech adoption impacts bank financial outcomes by evaluating its effects on Return on Assets (ROA). FinTech adoption produces a small yet statistically significant negative impact on ROA according to the FE, D_GMM, and S_GMM econometric models. A significant negative relationship exists between FinTech adoption and the dependent variable in both Fixed Effects (-8.89621e-05, p = 0.0223), Difference GMM (-8.40941e-05, p < 0.001), and System GMM (-9.64803e-05, p < 0.001) (Hussain, 2023; Bouheni et al., 2023). The expenses of technology adoption, implementation obstacles, and disrupted traditional revenue channels lead banks to experience reduced profits during their initial integration of Fintech innovations into their operations.

**Table 2:** To Examine the Influence of Financial Technology (Fintech) on the Operational Efficiency of Commercial Banks Within the Whole Sample

| Variable | P_OLS | FE | RE | D_GMM | S_GMM |
|---|---|---|---|---|---|
| Const | 0.102914*<br>(0.0889) | 0.131658**<br>(0.0391) | 0.102914*<br>(0.0874) | 0.0435674**<br>(0.0233) | 0.118067**<br>(0.0133) |
| Fintech | −4.56092e-05<br>(0.1796) | −8.89621e-05**<br>(0.0223) | −4.56092e-05<br>(0.1781) | −8.40941e-05***<br>(2.18e-08) | −9.64803e-05***<br>(1.85e-07) |
| TA | 0.163434***<br>(0.0023) | 0.164510***<br>(0.0024) | 0.163434***<br>(0.0020) | 0.150280***<br>(0.0030) | 0.0776886**<br>(0.0307) |
| Loan | −0.00194375<br>(0.3173) | −0.00200032<br>(0.3521) | −0.00194375<br>(0.3161) | 0.000695906<br>(0.6976) | −0.000421203<br>(0.8228) |
| Deposit | 8.74347e-05<br>(0.9162) | 0.000698676<br>(0.4362) | 8.74347e-05<br>(0.9161) | −0.000176535<br>(0.4573) | −7.97090e-05<br>(0.7540) |
| LgROA | 0.232822***<br>(0.0002) | 0.273348***<br>(2.47e-05) | 0.232822***<br>(0.0002) | 0.326786 **<br>(0.0228) | 0.254495*<br>(0.0949) |
| F | 4.492788<br>(0.000663) | 1.663578<br>(0.019674) | | | |
| $R^2$ | 0.099634 | 0.238793 | | | |
| Hausman | | | 23.402<br>(0.000282766) | | |
| AR (1) | | | | -2.22254<br>(0.0262) | -2.30207<br>(0.0213) |
| AR (2) | | | | 0.113969<br>(0.9093) | 0.494311<br>(0.6211) |
| Sargan | | | | 153.287<br>(0.3445) | 354.538<br>(0.0000) |

Note: Author's Calculation.

These experimental observations show parallelism with Schumpeter's Innovation Theory because technological developments result in creative destruction through short-term business disruptions, which later create enduring financial advantages, according to Baker et al. (2023).
Banks that adopt Fintech technologies encounter increased expenses alongside new cybersecurity challenges, together with consumer behavioral shifts. The merger process starts with initial financial setbacks resulting from these organizational factors (Dwivedi et al., 2021). FinTech adoption leads to operational efficiency, and customer retention and profitability increase when banking institutions successfully merge digital financial services into their systems and restructure their costs, according to Riaz (2023) and Dwivedi et al. (2021). The study

finds that the total assets (TA) measure of bank size demonstrates a positive correlation with ROA across both the S_GMM (0.0777 $p < 0.05$) and FE models (0.1645 $p < 0.01$). This discovery demonstrates economies of scale theory because it reveals that larger banks successfully deploy resources, manage risks, and absorb Fintech investment expenses (Wheelock & Laux, 2011; Wheelock & Wilson, 2012). Research reveals that loan and deposit expansion have no substantial influence on ROA; thus, conventional banking activities alone may not ensure profitability in digital banking environments (Hussain, 2023; Riaz, 2023). The research reveals that LgROA has an enduring impact on financial success through GMM estimation that resolves the Nickell bias (D_GMM: 0.3267, $p = 0.0228$; S_GMM: 0.2545, $p = 0.0949$). Profitability levels from past years have generated considerable effects on future financial performance; therefore, banks must adopt continuous digital transformation approaches instead of focusing on quick cost-reduction measures (Bouheni et al., 2023; Kalai, 2024).

The findings from this research require banks to purposefully direct their digital transformation efforts, regardless of whether FinTech adoption immediately raises detectable bank performance metrics. Financial success is guaranteed over the long term using this method because it prevents temporary financial difficulties caused by technological advancements. This study validates the essential need to maintain equilibrium between effectiveness costs, regulatory acceptance, and customer-oriented creativity for FinTech-enabled success in banking operations (Bouheni et al., 2023; Dwivedi et al., 2021; Riaz, 2023).

# 5. Conclusion

The analysis investigates the complicated relationship between financial technology adoption and bank profitability, determined through Return on Assets (ROA) performance metrics. The collected data show that this relationship contains multiple dimensions, which shows that banks must adopt FinTech technologies, yet they do not result in immediate profitability enhancements. The research findings show that adopting more

Fintech systems produce a minimal yet statistically significant decline in ROA during the initial period. Multiple factors, such as high implementation expenses related to new technology, operational structural changes, and disturbances to conventional banking systems, explain this phenomenon. Venturing into FinTech solution implementation may cause a substantial financial burden for organizations. Financial organizations must handle substantial expenses necessary for establishing modern technological systems, worker education, and regulatory compliance requirements. The expenses needed to achieve digital transformation lead to temporary profit losses during the bank's implementation of complex digital transformation procedures.

## 5.1. (A) contraction in performance (short-term) because of fintech

Preliminary stages of FinTech involvement in the banks can be readily identified and characterized by:

- Large initial investment (investments in infrastructure, licenses, and cybersecurity investments)
- Operational restructuring (improvements of new systems, processes, and realignment)
- Training the employees, acclimatizing them to the new culture. Temporal lowering in profitability because of slow rates of return on technology investment.

Both Kalai (2024) and Magdy (2023) provide attention to these phenomena. According to the comparative analysis presented by Kalai, in early digital transformation, Return on Assets (ROA) may turn negative as a result of the amortization costs of investment in new technology and technology retraining costs. In a similar observation, Magdy (2023) asserts that risk provisioning and decreasing returns to investments in cybersecurity and data privacy can be a factor in the higher exposure to risks in their initial adoption stages. Riaz (2023) refers to this explicitly as a period drag in which restructuring causes a delay in monetary advances. Such lag tends to be more intense among mid-sized and small banks that are less inclined to digital preparedness and absorptive capacity regarding innovation.

## 5.1. (B) Shifting to long-term monetary benefits

Nevertheless, a common theme in recent literature (2023 - 2025) is that the long-term financial performance of the firm increases because of the strategic use of FinTech. This is how banks get into benefits:

1) Economies of Scale: Scale allows big banks to run off the cost and derive more value out of their own digital infrastructure (Kalai, 2024). They have a greater number of customers, which enables the effective integration of AI, blockchain, and mobile platform (Khuan, 2024).
2) Operational Efficiency: The authors of Bouheni et al. (2023) arm one with economic estimates of higher cost-to-income indicators and smoother service production because of digitalization. Automated risk analysis, chatbots, and robo-advisors based on AI minimize overhead expenses.
3) Customer Purchase and Relationship: According to Kaddumi (2023) and Baker et al. (2023), the digital channels are expanding customer contact even among young and technologically advanced segments. Improved customer experience results in increased loyalty and lifetime value.
4) Diversification in Revenues: FinTech offers cross-selling of digital insurance, wealth management, and e-wallets, which allows the bank to increase the frontiers of its non-interest income sources (Hussain, 2023).
5) Data-Driven Decision Making: The adoption of FinTech in biometrics enhances credit scoring and risk assessment and prevents frauds, which guarantee better asset quality and fewer non-performing assets (Rahman, 2023). Major financial institutions harness their abundant funds to fund innovative technologies, optimize business operations, and expand customer service platforms to produce superior financial outcomes. These findings support economies of scale theory because larger organizations can lower their costs per unit while enhancing their resource management to establish superior market leadership. Within modern digital financial environments, research shows that traditional banking metrics such as loan and deposit growth do not create substantial variations in ROA measurements.

The financial industry evolved during this transition because bank success relies more heavily on digital financial solutions and operational excellence with technological innovations than on conventional metrics alone. Banking sector development requires companies to adapt their business structure to digital trends and client expectations to maintain profitability. Historical financial performance continues to indicate future profitability that exceeds current periods. Financial institutions must develop extended strategic planning strategies to integrate Fintech technology.

Financial stability emerges from technological progress only when sustainable development and strict oversight monitor digital transformation projects. The advantages of FinTech innovation within banking require excellent implementation and proficient cost control while

linking digital solutions to client-based financial services. Across the board, success for banks requires implementing digital development alongside profitable models, regulatory adherence, and operational stability systems. A detailed approach enables banks to cope with digital complexity and maintain their economic well-being.

## 5.2. Policy Implementation

### 5.2.1. Policy support, and why it is important in fintech adoption

As research has continually found, clearness in regulations, strategic incentives, and government-sponsored innovation programs can be considered decisive in the speed of FinTech integration into the banking system (Rahman, 2023; Kalai, 2024). In the absence of such frameworks, banks, particularly smaller banks, are not able to overcome:

- Large start-up capital costs
- issues in compliance and cybersecurity

Digital literacy in customer gaps

Using the experiences of other countries around the world, at least several models of policies can be emulated in India to promote sustainable and inclusive adoption of FinTech in the Indian banking industry.

### 5.2.2. Global examples and their applicability to India

1) United Kingdom -Regulatory Sandbox – FCA Description: The UK Financial Conduct Authority (FCA) developed the regulatory sandbox, permitting innovative product testing by FinTech firms and banks under a controlled environment without the full weight of the compliance requirements.

India's applicability of the sandbox idea: an analog sandbox is already provided by the Reserve Bank of India (RBI), but it is more limited in nature. It would be worth expanding it to cover co-innovation between banks and FinTechs, and temporarily relaxing compliance on pilot projects, to give innovation a boost whilst maintaining consumer protection.

2) Singapore- MAS Fintech Innovation Grant Scheme Description: The Monetary Authority of Singapore (MAS) offers direct grants to banks and FinTech companies that create AI, blockchain, and other payment innovations. Grants absorb a huge amount of costs used in R&D and implementation.

Applicability to India: India might form a FinTech Transformation Fund to be administered in collaboration with RBI, NABARD, and SIDBI in order to subsidize the cost of technology upgrade of small and medium-sized banks. With rural banks, it may be to enable them to use digital lending platforms and mobile money systems.

3) Australia - Open Banking CDR, consumer handy data proper Description: The CDR legislation in Australia requires the banks to share consumer data securely with third-party parties when consent is sought to increase competition and innovation in the provision of services.

Applicability to India, the governing body in India known as India Account Aggregator (AA) is, as it stands, already facilitating secure data sharing, although consolidating greater legislative support along with interoperability among all financial institutions would provide greater flexibility of mobility and access to custom digital services for each customer.

4) Kenya -Mobile Money Connectivity (M-Pesa Model) Description: Kenya has a regulatory framework that allowed telecoms firms to partner with banks to launch mobile money capabilities, transforming the level of financial inclusion drastically.

Applicability to India: UPI has already been a success; however, institutionalizing bank-telecom collaboration to provide the services of rural mobile banking (offline USSD, low-connectivity apps) has the potential of increasing inclusion in the low occurrence of connectivity areas.

5) Digital Operational Resilience Act (DORA) in the European Union. Definition: DORA provides stringent standards on cybersecurity operations and resiliency to all financial bodies, allowing technological consistency and security of the customer.

Application to India: A similar standard under the regulatory wing of RBI would be useful in curbing the cyber risks as the digitalization continues to penetrate, more so with the adoption of AI and blockchain.

These incentives assist financial institutions in handling transition costs towards digital services so that they can build infrastructure, along with training to develop higher operating abilities. Financial assistance from regulators will empower every banking institution to access FinTech technologies, thus improving service quality and financial performance. Effective risk management protocols and proper compliance safeguards must be strengthened because they help address multiple issues caused by FinTech acceptance, including cyber risks, data privacy problems, and digital fraud possibilities. The dangers related to digital platform dependence by banks increase at the same rate as banks shift towards digital operations. Owing to these developments, regulatory bodies need to develop complete cybersecurity standards together with data protection guidelines and methods to tackle digital fraud. Through their regulatory approach, regulators can help banks prevent risks that threaten the advantages of adopting Fintech technologies, so financial performance remains positive. Public-private partnerships (PPPs), together with innovation centers, function as strategic tools to boost collaborative efforts between regulators, financial institutions, and FinTech companies. Collaborative projects between stakeholders enable better information sharing, resource sharing, and industry standards development to align with the goals of technical progress and financial inclusion.

The partnership between stakeholders facilitates the development of communication pipelines for coordinating solutions against regulatory challenges while promoting innovation, which results in better access to FinTech benefits for diverse population segments. Consumer protection regulations must maintain a central position when the government develops legislation for FinTech adoption. Digital financial services require a trusted environment because they face challenges regarding acceptance by individuals new to Fintech systems or reluctant to use them. The protection of consumer rights, along with better digital transaction transparency, should be well established through proper laws, which also provide customer compensation after instances of fraud or service interruptions. Through regulatory actions that promote digital banking, security regulators help improve market acceptance of FinTech services, leading to increased financial stability among both banking institutions and their customers. Banks need an incentive system that provides them with the opportunity to design and implement financial education programs to help customers adapt to digital financial solutions.

The banking industry's move toward technology-driven paradigms requires clients to obtain competencies to effectively perform tasks on these platforms. Through financial education, customers can learn to make knowledgeable decisions while gaining digital service experience as well as understanding both the benefits and risks of FinTech technology. Educational programs strengthen both customer service quality and banks' long-term financial success during their transition to digital-focused operations. Complete FinTech integration in banking requires united support from banking institutions working with regulators and policymakers to fulfill this objective. A sustainable digital

transformation can be achieved by stakeholders through collaborative actions, including strategic regulatory measures and financial incentives alongside strengthened compliance. The proposed strategic approach combines financial outcomes with short-term pressure relief to establish a better banking environment for all stakeholders.

## Acknowledgement

The authors thank the International Journal of Accounting and Economics Studies reviewers, the Reserve Bank of India, and the National Payments Corporation of India for their valuable input and data support.

## Disclosure Statement

No potential conflict of interest was reported by the author(s).

## Ethical Approval and Consent to Participate

No human participants were involved in this research study.

## Consent to Publish

The manuscript does not contain data from any person and is not applicable.

## Authors' Contributions

## Funding

No Funding.

## Availability of Data and Materials

The data used in this paper were collected from the Reserve Bank of India database (RBI) (www.rbi.org.in) and the National Payment Corporation of India (NPCI) (www.npci.org.in).

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