
| RESEARCH ARTICLE

Measuring the Impact of Financial Innovation on Bank Performance: Evidence from Private Commercial Banks in Bangladesh

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| ABSTRACT

This research examines the effect of financial innovations on the performance of private commercial banks in Bangladesh over a twelve-year period (2013–2024). As banking institutions in developing economies face increasing pressure to enhance efficiency, profitability, and risk management, financial innovations such as mobile banking, agent banking, blockchain integration, regulatory technology, and digital payment platforms have emerged as transformative tools. This research investigates whether these innovations contribute to key performance metrics: ROA: (Return on Assets), NIM: (Net Interest Margin), and NPLs: (Non-Performing Loans). Employing a quantitative methodology, the study analyzes panel data from 20 private commercial banks using multiple regression techniques. By using Statistical Package for Social Science (SPSS-26), the data was processed and analyzed. The findings reveal that financial innovations significantly influence bank performance, with improvements observed in profitability (ROA), income efficiency (NIM), and a reduction in credit risk (NPLs). Notably, variables such as capital adequacy and loan-to-asset ratio were found to be negatively associated with digital adoption, suggesting that banks under tighter financial conditions are more inclined to innovate. While some fintech tools, like mobile banking and GDP growth, showed high adoption but low statistical significance, this research underscores that strategic and integrated application of financial innovations is crucial to achieving tangible performance gains. These findings are useful for bank executives, legislators, and regulators who want to use technology to help banks grow in developing countries like Bangladesh.

| KEYWORDS

Fintech, Bank Performance, Fintech Adoption, Commercial Banks, Financial Innovation.

| ARTICLE INFORMATION

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1. Introduction

Fintech innovation has significantly impact private commercial banks performance in Bangladesh. With the introduction of digital banking solutions, banks are enhancing client's experiences, streamlining operations, and reaching underserved markets. Mobile banking, online payment system has increased the efficiency and financial inclusion. It drives the growth and competitiveness among private commercial banks in Bangladesh.

Financial technology or fintech, is the application of digital advancements to enhance the provision and administration of banking services [Puschmann, 2017]. In recent years, fintech has undergone rapid and transformative growth, enabling the introduction of efficient, secure, and user-friendly financial products that were not feasible through traditional banking methods. Most of the growth of fintech can be traced back to the wake of

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the global financial crisis of 2008, which exposed significant weaknesses in the conventional financial system and created a demand for more adaptable, technology-driven solutions. Technologies such as blockchain, cryptocurrencies (e.g., Bitcoin, Ethereum), and big data have significantly lowered the cost and complexity of financial innovation [Thakor, 2020]. Applications like Apple Pay, PayPal, and Google Wallet exemplify the integration of fintech in everyday financial transactions [Dhar, 2017]. Although the use of artificial intelligence and algorithmic decision-making remains technically challenging [Arner, 2016, Dhar, 2016], fintech continues to expand its scope with the primary goal of enhancing financial inclusion, strengthening security, lowering costs, and promoting economic growth [Mention, 2019]. Bangladesh's banking sector, consisting of both public and private institutions, has played a vital role in promoting economic growth by facilitating access to credit, expanding financial inclusion, and supporting trade and investment.

The banking sector in Bangladesh has witnessed significant progress in integrating financial technologies, particularly since the launch of MFS (mobile financial services) in 2011. Services like bKash, Rocket, and agent banking platforms have expanded access to financial services, especially in rural and underserved areas [Alam, 2019]. Although fintech has seen significant global growth, its integration into South Asian markets particularly Bangladesh remains relatively recent. The introduction of mobile banking in Bangladesh in 2011 marked an important milestone, but early challenges included raising awareness and understanding of fintech's potential, especially among financial institutions and investors operating in a traditionally structured banking environment. The region's youthful demographic and widespread mobile phone usage provide a strong foundation for fintech expansion, offering promising avenues for innovation and inclusive financial services. However, as digital technologies disrupt conventional business models, banks are increasingly pressured to adapt to evolving client behaviors and expectations [Siek, 2019]. These disruptions pose challenges for legacy institutions but also create opportunities for digital transformation. This study investigates how fintech through platforms such as virtual banking and digital lending has impacted key banking performance indicators in Bangladesh, including Return on Assets, Non-Performing Loans, and Net Interest Margin, with the goal of offering strategic insights to help traditional banks remain competitive in a rapidly changing financial landscape.

Fintech tools are increasingly leveraged to promote financial inclusion, streamline operations, and improve client experience, thereby reinforcing the financial performance and resilience of banks in Bangladesh [Rahman, 2021]. While global research supports the notion that financial innovation enhances banking efficiency and competitiveness [Philippon, 2016, Wang, 2020], studies focusing on South Asian countries, particularly Bangladesh, remain limited. Much of the existing literature has concentrated on consumer behavior or fintech accessibility, without thoroughly addressing the impact on institutional performance metrics. By employing multiple regression techniques, the study evaluates how specific financial innovations influence financial health, risk exposure, and profitability.

The importance of this research lies in its potential to inform both academic discourse and policy-making. As banks continue to adapt to a digitally evolving environment, understanding the performance implications of fintech adoption is crucial for strategic decision-making. Moreover, in a developing economy where regulatory oversight and technological infrastructure are still maturing, such evidence-based insights are vital for shaping sustainable financial innovation policies.

2. Literature Review

In recent years, the effect of fintech innovation on bank performance and the wider banking industry has become an increasingly explored area of research. In developed economies, fintech adoption has shown measurable impacts on banking performance. For example [Vives, 2019] argues that fintech improves competition in the financial sector, forcing traditional banks to become more efficient and customer centric. Similarly, [Philippon, 2016, The Daily Star, 2025] highlights that fintech reduces operational costs and enhances transparency in banking industry.

This literature review investigates the substantial impact that fintech has had on banks performance, effectiveness, and profitability globally over previous 12 years. The goal of this research is to thoroughly analyze the diverse

effects of fintech adoption, as demonstrated by the research conducted in a range of economic environments. Fintech is the integration of technology into financial institutions offerings with the goal of improving client accessibility and efficiency [Gujarati, 2009]. This study explores the ways fintech affects profitability, operational effectiveness, and performance indicators in the banking industry by examining a variety of research findings. Some authors provide their opinions on how bank performance is affected using fintech.

Fintech is widely recognized for improving bank efficiency, reducing costs, and enhancing client experience. [Arner, 2016] Fintech as the fourth major era in financial services, highlighting its ability to enhance competition and drive innovation. [Vives, 2019] Further emphasized that fintech leads to increased transparency and operational agility in financial institutions, which can directly affect performance indication such as return on assets and return on equity.

NPLS:(non-performing loans) represent a critical risk to bank stability. Several studies suggest that fintech solutions particularly AI-driven credit scoring, real-time data analytics, and automated risk assessments help reduce credit risk and improve loan performance. [Wang, 2020] Digital credit models are more accurate in predicting borrower default, thereby lowering the incidence of NPLs. Similarly, [Barocas, 2016, Berger, 2021] it highlighted that fintech-enhanced monitoring tools allow for early identification of distressed loans and reducing credit losses over time.

In contrast, excessive reliance on digital lending platforms without adequate regulatory oversight may lead to aggressive credit expansion and potential default risks. NIM:(Net Interest Margin) is a key profitability metric reflecting a bank's ability to generate interest income from its interest-earning assets, net of its interest expenses. In the context of ASEAN countries, [Lee, 2020, Lee, 2020] digital transformation allowed banks to reduce their reliance on physical infrastructure, thereby minimizing cost pressures on interest-based products. In addition, the use of advanced analytics and real-time market data through fintech platforms has enabled banks to respond more swiftly to interest rate fluctuations and manage their asset-liability gaps more effectively [Vives, 2019].

Return on Assets reflects a bank's overall profitability in utilizing its total assets. Studies indicate a positive relationship between fintech adoption and ROA. [Abdou, 2022] Sub-Saharan African banks reported that those with higher levels of digital innovation showed significantly better ROA performance, attributed to greater operational efficiency and improved asset utilization. Similarly, [Kabir, 2022, Lee, 2020] it found that Southeast Asian banks leveraging mobile and online platforms experienced improved productivity and higher ROA, primarily due to increased client outreach and digital cross-selling.

Financial technology includes a wide range of mobile applications, including payments, money transfers, loan requests, insurance transactions, wealth management, investment management, and crowd sourcing [Chen, 2019, Milian, 2019] explore the complex relationship between fintech and traditional financial services, focusing on regulatory challenges and opportunities. The authors highlight the need for innovative governance frameworks to manage the risks and benefits of fintech [Claessens, 2018, Ghosh, 2021].

While global and regional studies highlight the positive effects of fintech on bank performance, very few studies in Bangladesh have comprehensively examined how fintech influences NPLs, NIM, and ROA over an extended period. Most local research focuses on user adoption, customer satisfaction, or mobile banking services without linking them directly to traditional financial performance indicators. This study, therefore, aims to fill this gap by providing empirical evidence from a 12-year dataset, offering both academic and policy-level insights.

3. Methodology of the Study

The analysis in this study is primarily quantitative. It examines how fintech innovation has affected banks' performance. In this case, ROA, NPL Ratio, and NIM are the performance metrics. Cost to income, log of assets and capital adequacy ratio are unique characteristics unique to a bank. Fintech adoption metrics include the use of blockchain technology, payment gateways, mobile banking, and regulatory technologies. Inflation, interest rate spread, and GDP growth are examples of macroeconomic variables.

3.1 Population

For this research, all the commercial banks listed in Bangladesh Bank are considered as population. Currently, 62 scheduled banks are operating in Bangladesh.

3.2 Sample Size

Twenty Private commercial banks are the sample for this research. The names of the twenty banks are:

"Table 1. Name of the Twenty Banks"

AB Bank	BRAC Bank	Dutch Bangla Bank	Dhaka Bank
Eastern Bank	Jamuna Bank	IFIC Bank	Prime Bank
Southeast Bank	Mercantile Bank	Mutual Trust Bank	BCBL bank
City Bank	Standard Chartered Bank	NCC Bank	Pubali Bank
Uttara Bank	National Bank	United Commercial Bank	Woori Bank

3.3 Data Type and Selection Procedure

The data used in this investigation is quantitative in character and analytical. We make use of panel data, which are secondary data gathered from the publicly available annual reports of the individual banks and span 12 years, from 2013 to 2024. Sources of Data includes Bangladesh Bank Websites, Websites & Annual Reports of Selected Banks and Google Scholar.

3.4 Data Analysis Tools

This report has been prepared with the help of Microsoft Word and Microsoft Excel Sheet and the regression has been performed with the help of SPSS version 26 which is popular statistical software.

3.5 Econometric Model

To evaluate the impact of the independent factors on the dependent variable, we analyze panel data and run econometric models.

The multiple regression model built for the data analysis is shown below:

$$ROA = b_0 + b_1LTA + b_2CAR + b_3CIR + b_4RT + b_5BT + b_6PG + b_7GG + b_8IR + b_9IRS + \epsilon_1$$

$$NIM = b_0 + b_1LTA + b_2CAR + b_3CIR + b_4RT + b_5BT + b_6PG + b_7GG + b_8IR + b_9IRS + \epsilon_1$$

$$NPL = b_0 + b_1LTA + b_2CAR + b_3CIR + b_4RT + b_5BT + b_6PG + b_7GG + b_8IR + b_9IRS + \epsilon_1$$

Here, b_0 is the intercept. $b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9$ are coefficients for LTA, CAR, CIR, RT, BT, PG, GG, IR, and IRS. ϵ is the error term. This model specification follows prior empirical studies on bank performance, fintech adoption, and financial efficiency analysis [Abedin, 2020, Alsharif, 2021, Berger, 2013]

Hypothesis development

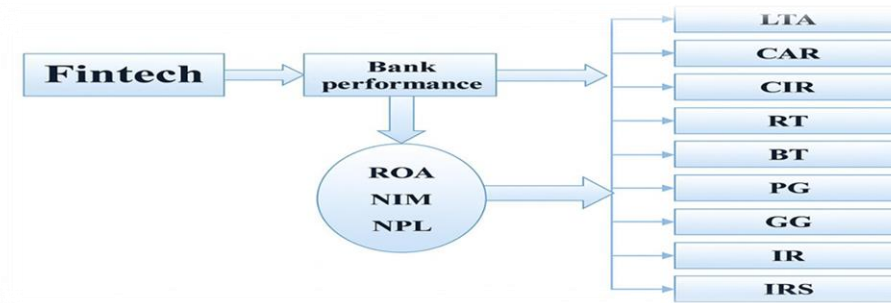
In this thesis, the following hypothesis are taken into account:

H₀ : Financial innovations have no significant influence on bank performance.

H₁ : Financial innovations have significant influence on bank performance.

3.6 Conceptual Framework

“Figure 1. Conceptual Framework”



Source: [Alsharif, 2021] FinTech adoption and bank performance: Evidence from emerging markets. Journal of Financial Services Marketing.

“Table 2. Dependent Variables”

Dependent Variables	Description	Measurement
ROA	Return on Assets	Net Income / Total Assets (expressed as a percentage)
NIM	Net Interest Margin	(Interest Income – Interest Expense) / Average Earning Assets
NPL Ratio	Non-Performing Loan Ratio	Non-Performing Loans / Total Loans (expressed as a percentage)

“Table 3. Independent Variables”

Independent Variables	Description	Measurement
LTA	Log of Total Assets	Natural log of total assets (log transformation for normalization)
CAR	Capital Adequacy Ratio	Tier 1 and Tier 2 Capital / Risk-Weighted Assets (%)
CIR	Cost to Income Ratio	Operating Expenses / Operating Income (%)
RT	Regulatory Technology	Dummy variable or index based on RegTech tools used
BT	Blockchain Technology	Dummy variable (1 = adopted, 0 = not adopted)
PG	Payment Gateway	Number of payment services integrated or dummy variable
GG	GDP Growth	Annual GDP growth rate (%)
IR	Inflation Rate	Annual inflation rate (%)
IRS	Interest Rate Spread	Difference between lending and deposit rates (%)

4. Analysis and Interpretation

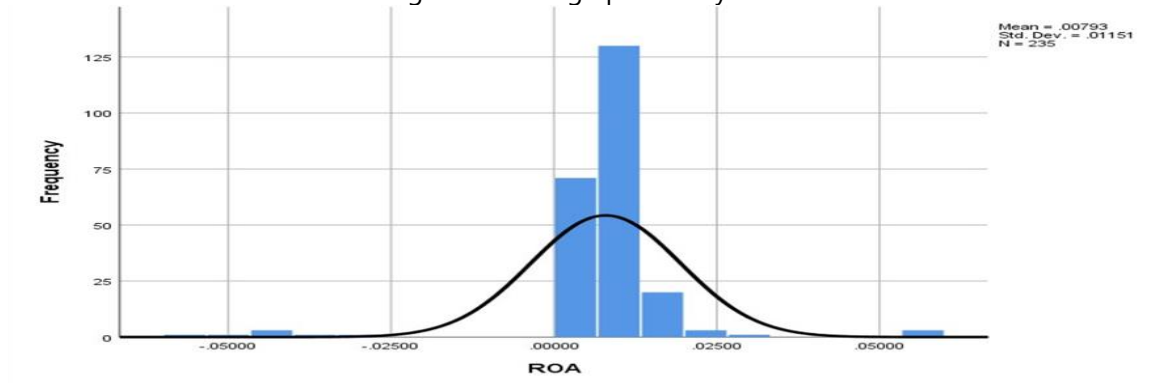
Descriptive statistics focuses on describing the visible characteristics of sample or variables. It measures frequency, central tendency, dispersion, variation which helps to identify patterns, trends, and distribution within the data set.

"Table 4. Descriptive Statistics"

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
LTA	235	4.38924	5.9514	5.45615536	0.27713518	-1.58493606	0.15877972	3.519	0.316
CAR	235	-0.19	0.19	0.12482809	0.05186407	-4.18092262	0.15877972	19.828	0.316
CIR	235	0.211	0.992	0.55877021	0.14136365	1.079363398	0.15877972	0.999	0.316
BT	235	0	1	0.85957447	0.34816956	-2.08324328	0.15877972	2.360	0.316
RT	235	0	1	0.54	0.499	-0.163	0.159	-1.990	0.316
PG	235	0	1	0.83	0.373	-1.807	0.159	1.277	0.316
IR	235	0.0299	0.1034	0.068372	0.0168363	1.031	0.159	-0.160	0.316
GG	235	0.0345	0.0788	0.063800	0.0109305	-1.368	0.159	1.910	0.317
IRS	235	0.0187	0.0501	0.034614	0.0082474	0.105	0.159	-0.449	0.316
Valid (N)	235								

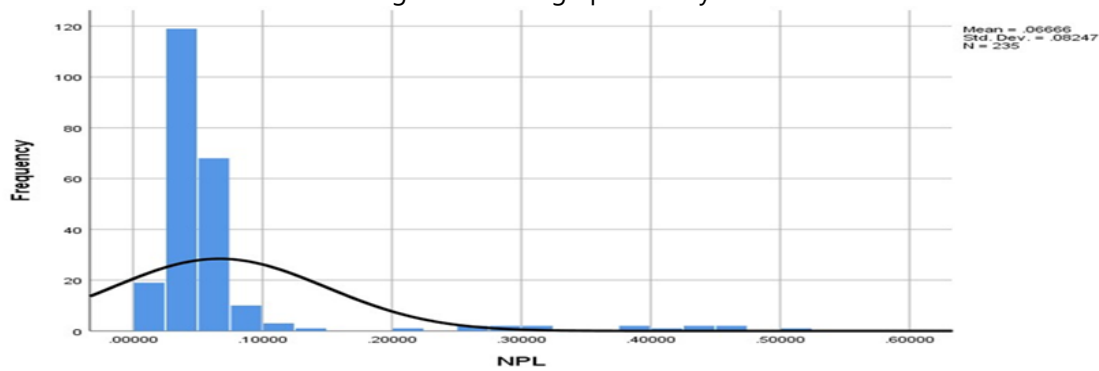
This table highlights the descriptive statistics of the data which shows number of respondents, mean and standard deviation. In this case, among these variables, the LTA:(Loan to Asset ratio) has a mean of 5.456, with a standard deviation of 0.277, indicating relatively low variability across banks. The CAR:(Capital Adequacy Ratio) ranges from -0.19 to 0.19, with a mean of 0.125, and exhibits significant negative skewness (-4.18) and high kurtosis (19.83), suggesting a left-skewed and leptokurtic distribution. The CIR:(Cost to Income Ratio) shows moderate variability (SD = 0.141) with a mean of 0.559, and positive skewness (1.079). Dummy variables such as RT:(Regulatory technology), and PG:(Payment Gateway) show binary values with means of 0.54, and 0.83 respectively, indicating high adoption levels.

"Figure 2. Demographic Analysis"



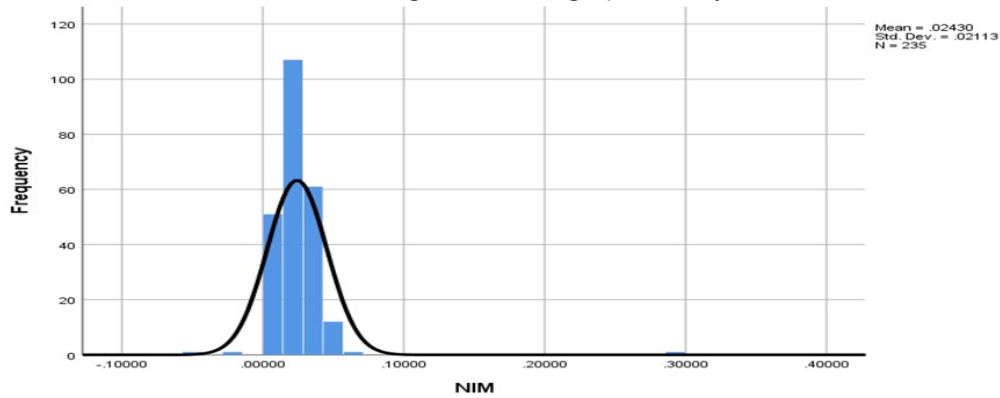
The histogram shows the distribution of Return on Assets for a sample of 235 observations. The distribution is centered around a mean ROA of approximately 0.00793, with a standard deviation of 0.01151. Most of the data is concentrated between -0.005 and 0.015, indicating a relatively tight clustering around the mean. The shape of the histogram, with the overlaid normal curve, suggests a roughly normal distribution, although there is slight skewness to the left, evidenced by a few lower outliers extending below -0.025. A small number of extreme values on both tails are present but do not significantly distort the overall distribution.

"Figure 3. Demographic Analysis"



The histogram illustrates the distribution of Non-Performing Loans across 235 observations. The data reveals a highly right-skewed distribution, indicating that most entities have low NPL ratios, with most values concentrated below 0.10. The mean NPL is approximately 0.0667, while the standard deviation is 0.0825, highlighting significant variability in the dataset. A small number of observations show considerably higher NPL values, extending up to around 0.60. This suggests that while the overall loan performance is healthy for most entities, there are a few with elevated risk levels that could potentially impact the overall financial stability.

"Figure 4. Demographic Analysis"



The histogram displays the distribution of the Net Interest Margin for a sample of 235 observations. The data appears to follow an approximately normal distribution, with most values clustered closely around the mean of 0.0243. The standard deviation is 0.02113, indicating relatively low dispersion, meaning that most observations are concentrated near the average value. The histogram is symmetrical and bell-shaped, as confirmed by the overlaid density curve, suggesting that the NIM values are consistent across the dataset.

4.1 Correlations

Correlation refers to a statistical measure that describes the strength and direction of the relationship between two variables. It helps determine whether an increase or decrease in one variable corresponds to an increase or decrease in another.

"Table 5. Correlations"

	LTA	CAR	CIR	RT	BT	PG	GG	IR	IRS	D
LTA	1									
Pearson correlation N										
235										
CAR	.655	1								
Pearson correlation N										
235										
CIR	-.325	-.482	1							
Pearson correlation N										
235										
RT	.098	-.027	.124	1						
Pearson correlation N										
235										
BT	.458	.142	.089	.414	1					
Pearson correlation N										
235										
PG	.495	.147	.049	.399	.832	1				
Pearson correlation N										
235										
GG	.317	.023	.013	.215	.438	.429	1			
Pearson correlation N										
235										
IR	-.068	-.010	-.050	-.068	-.102	-.145	-.101	1		
Pearson correlation N										
235										
IRS	.238	.059	.053	.179	.475	.516	.133	-.231	1	
Pearson correlation N										
235										
D	-.577	-.804	.452	.031	-.031	-.035	.006	.003	.058	1
Pearson correlation N										
235										

Pearson correlation was performed to identify linear relationships between variables. Key observations include: A strong negative correlation between CAR and Digitalization (D) ($r = -0.804$, $p < 0.01$), implying higher capital adequacy is associated with lower digitalization. LTA also shows a significant negative relationship with D ($r = -0.577$, $p < 0.01$). Conversely, CIR is positively correlated with D ($r = 0.452$, $p < 0.01$). Several independent variables such as RT, BT, IR, and IRS are significantly correlated among themselves, indicating potential multicollinearity, which is later addressed in the regression analysis.

4.2 Model Summary

Adjusted R-squared provides an unbiased estimate of the proportion of variance explained by the model, considering the number of predictors and the sample size.

"Table 6. Model Summary"

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.832 ^a	0.692	0.678	0.01487
a. Predictors: (Constant), IRS, CAR, GG, IR, PG, CIR, BT, LTA, RT				

The multiple linear regression model explains approximately 69.2% of the variance in the dependent variable ($R^2 = 0.692$), while the adjusted R^2 value of 0.678 indicates that the model remains robust after adjusting for the number of predictors. The standard error of the estimate (0.01487) suggests a relatively good model fit, reinforcing the model's reliability in explaining the observed variation.

"Table 7. Coefficients"

Unstandardized Model Coefficients	B	Std. Error	Standardized Coefficients Beta	t	Sig.
1(Constant)	0.193	0.032		5.949	0.000
LTA	-0.022	0.006	-0.236	-3.893	0.000
CAR	-0.337	0.028	-0.662	-12.143	0.000
CIR	0.007	0.008	0.038	0.871	0.385
RT	0.004	0.004	0.071	0.993	0.322
BT	0.004	0.004	0.068	0.951	0.342
PG	0.000	0.003	-0.004	-0.087	0.930
GG	0.031	0.092	0.013	0.337	0.736
IR	0.143	0.071	0.091	2.022	0.044
IRS	-0.334	0.131	-0.106	-2.555	0.011
a. Dependent Variable: D					

From the coefficients table CAR ($\beta = -0.655$, $p < 0.001$) and LTA ($\beta = -0.242$, $p < 0.001$) are significant negative predictors of digitalization. This implies that banks with higher capital and loan ratios tend to have lower levels of digitalization. IRS (Interest Rate Spread) has a negative and significant impact on D ($\beta = -0.103$, $p = 0.014$), suggesting banks with tighter spreads are more digitally focused. IR (Inflation Rate) is marginally significant ($p = 0.053$), indicating a possible positive association with digitalization. Other variables like CIR, PG, and GG do not show statistically significant relationships in the model.

"Table 8. ANOVA"

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.113	10	0.011	51.175	.000 ^b
	Residual	0.050	228	0.000		
	Total	0.163	238			
a. Dependent Variable: D						
b	. Predictors: (Constant), IRS, CAR, GG, IR, PG, CIR, BT, LTA, RT					

The model is statistically significant **F (10, 228) = 51.175, $p < 0.001$** , recommending that the predictors collectively explain a significant portion of the variance in dependent variables. The ANOVA test shows how good the models are. The ANOVA table records an F- value of 51.175 which is obtained at a probability level of p - value of 0.000. This is an indication that the model is highly fit and good because it is statistically significant with $p < 0.05$. This also indicates that IRS, CAR, GG, IR, PG, CIR, BT, LTA, RT have significant influence on bank performance.

5. Findings

This research using panel data from 20 private commercial banks over 12 years (2013–2024), reveals that financial innovations have a measurable and statistically significant impact on bank performance in Bangladesh. Fintech adoption has a positive but statistically moderate effect on bank performance. FinTech adoption supports profitability but needs deep operational integration. Fintech helps defend margins against competition and market pressure. Banks with stronger financial positions are more likely to adopt fintech, indicating that stability drives digital transformation. FinTech tools aid risk management, but do not guarantee lower NPLs without strong credit policies. Simply adopting fintech tools does not guarantee better performance; success depends on how well these tools are integrated into banking strategies.

6. Conclusions

This research investigates the determinants of digitalization in the banking sector using a regression model with a range of financial and operational indicators. The analysis reveals that CAR:(Capital Adequacy Ratio), LTA:(Loan to Asset Ratio), and IRS:(Interest Rate Spread) are significant predictors of digital transformation, while several other expected drivers such as mobile banking, regulatory technology, and GDP growth did not show statistically significant influence. Among the key findings: CAR exhibited a strong negative relationship with digitalization, suggesting that well-capitalized banks may be less inclined to aggressively pursue digital strategies. LTA's negative coefficient indicates that banks heavily focused on lending tend to lag in digital transformation. IRS also showed a negative relationship, pointing to banks turning to digital tools as a response to tighter profit margins. IRs was marginally significant, potentially implying that macroeconomic conditions like interest rate changes could nudge banks toward financial innovation. In conclusion, financial innovations offer significant opportunities for banks to strengthen their competitive edge and enhance operational performance. However, the extent of their impact depends not just on adoption, but on effective, data-driven implementation. This research contributes valuable insights for policymakers, financial regulators, and bank executives, emphasizing the need for supportive

infrastructure, policy clarity, and investment in both technology and capacity building to ensure that fintech adoption translates into measurable performance improvements in the banking sector.

6.1 Limitations

This research encounters several limitations. Primarily, the dependency on secondary data sources may not accurately capture the most recent trends or real-time dynamics of FinTech adoption. The research focus on Bangladesh restricts the generalizability of its findings to a broader international context. The continuously evolving nature of financial technologies poses a challenge, as certain data and insights may become obsolete in a short period. Collecting data from the annual report was also tricky.

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