

## Financial Technology and Performance of Deposit Money Banks in Sub Saharan Africa

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### Abstract

The rapid evolution of financial technology is reshaping global banking, particularly in developing economies like Sub-Sahara Africa. Despite rising adoption of digital banking channels, such as Mobile banking, internet banking, and Mobile Money, Deposit Money Banks continue to experience uneven profitability, especially regarding interest -related income. This study investigates the impact of financial technology (FinTech) adoption on the performance of deposit money banks (DMBs) across twenty Sub-Saharan African countries from 2014 to 2023. Motivated by persistent concerns over low profitability indicators like Net Interest Margin (NIM) despite the widespread growth of digital banking tools, the study addresses gaps in existing literature that often rely on traditional metrics (ROA, ROE) and overlook the distinct roles of Net Interest Margin (NIM). Recognizing the need to account for country-level heterogeneity and macroeconomic volatility, the study applies the Random Effects panel regression model with robust standard errors. The empirical results reveal that internet banking ( $\beta=0.4253$ ,  $p=0.000$ ), mobile banking ( $\beta=0.1093$ ,  $p=0.017$ ), and mobile money ( $\beta=0.1413$ ,  $p=0.000$ ) have significant positive effects on NIM, suggesting these channels enhance banks' income from core intermediation. Conversely, ATM usage ( $\beta=0.1099$ ,  $p=0.527$ ) and POS transactions ( $\beta=-0.0044$ ,  $p=0.885$ ) show insignificant effects. Inflation ( $\beta=-0.0048$ ,  $p=0.006$ ) has a significant negative effect, confirming its adverse impact on banks' margins. The study concludes that FinTech tools particularly internet and mobile-based platforms substantially strengthen banks' profitability by improving efficiency and market reach, whereas ATMs and POS remain less impactful. It recommends that banks deepen investments in mobile and internet banking technologies and that regulators enhance digital infrastructure, cybersecurity, and consumer protection frameworks to maximize FinTech's benefits and mitigate inflationary pressures on bank performance.

**Keywords:** Financial Technology, Net Interest Margin, Banking Performance, Sub-Sahara Africa

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## 1. Introduction

The financial industry has undergone major transformation in recent years, driven largely by the integration of financial technology (FinTech) into banking operations. FinTech tools such as mobile and internet banking, electronic payments, and digital savings platforms enhance service delivery, reduce costs, and improve access for customers (World Bank, 2023). These innovations have become central to how banks compete, serve their customers, and sustain efficiency in a rapidly evolving environment. Sub-Saharan Africa (SSA) is one of the regions where FinTech has expanded most rapidly, partly due to weak physical banking infrastructure and high financial exclusion. Mobile money, agent banking, and app-based services have enabled millions of people to enter the formal financial system. Countries such as Kenya, Ghana, Nigeria, and Uganda have recorded sharp growth in digital transactions, confirmed by the Central Bank of Nigeria (2023), Bank of Ghana (2023), and Central Bank of Kenya (2023). These developments have reshaped customer behavior and compelled banks to restructure their services.

In this context, the performance of Deposit Money Banks (DMBs) remains a central issue. Banks continue to prioritize profitability, efficiency, and customer base expansion, but performance drivers are shifting from physical expansion to digital innovation. Egbetunde and Uwuigbe (2022) highlight that bank performance now depends on adaptability to innovation and digital transformation. Similarly, Adeoye (2023) emphasizes that digital adoption enhances revenue diversification and market expansion. Ky, Rugemintwari, and Sauviat (2024) also stress that FinTech improves efficiency and long-term profitability by lowering transaction costs and automating processes, particularly critical in SSA where infrastructural barriers limit access. Different FinTech tools collectively influence DMB performance. ATMs enable essential transactions outside bank branches, thereby reducing congestion (Okonkwo & Obasi, 2022).

Mobile banking applications foster convenience, reduce costs, and expand outreach (Eze & Chima, 2023). Internet banking platforms support account management, fund transfers, and online payments (Ifeanyi & Mensah, 2022). Mobile money extends services to the unbanked through wallet-based transfers, boosting transaction volumes and fee-based revenue (Banna, Risman, & Ndede, 2024). POS systems encourage cashless payments and increase commission income (Gichuki, 2022). Collectively, these tools streamline operations, expand access, and diversify income streams.

However, bank performance in SSA remains modest despite widespread FinTech adoption. Nigeria, for instance, recorded over 214 million real-time transactions in 2023 with 1.6 million registered agents; Kenya's M-Pesa reached over 30 million active users facilitating transactions exceeding half of GDP; and in South Africa, more than 70% of adults now use mobile or internet banking. Yet, IMF (2023) and World Bank (2023) data show that SSA banks in 2023 recorded an average NIM of 4.8% (compared to 5.6% in East Asia), an ROA of 2.35% versus East Asia's 4%, and an ROE of 12.6% against 20%. These figures reveal a paradox: technology adoption is high, but profitability and efficiency remain relatively weak. This persistent underperformance signals inefficiencies in financial intermediation, limiting banks' ability to extend credit, invest in infrastructure, withstand shocks, and contribute to sustainable growth.

Over the last decade, empirical studies have examined FinTech's impact on DMBs in SSA. Findings generally suggest improvements in profitability, efficiency, and outreach. For example, Ogbona et al. (2023), Nwayen et al. (2024), and Joseph et al. (2025) investigated these relationships using data from central banks, IMF, GFD, and financial statements. However, notable gaps remain. First, most studies use broad profitability ratios such as ROA or ROE while neglecting Net Interest Margin (NIM), which more directly measures banks' efficiency in managing interest income under FinTech disruption. Second, mobile money, one of SSA's most transformative tools remains underexplored or treated as an aggregate index, as in Hani (2024) and Sam et al. (2024), where bank-level effects are not isolated.

Third, many studies rely on OLS and static models that fail to capture country differences or time dynamics. Although some adopt System GMM, the method faces challenges such as instrument proliferation and instability with small or heterogeneous samples. This study therefore builds on Technology Acceptance Model (TAM), which posits that adoption depends on perceived usefulness and ease of use. These perspectives explain why SSA DMBs embrace tools like mobile banking, internet banking, and mobile money to improve performance.

To address existing gaps, this study applies panel data techniques specifically Fixed and Random Effects models to better capture cross-country variations, account for unobserved heterogeneity, and exploit the time dimension of the data. The analysis focuses on NIM as the core measure of performance, with special attention to mobile money as a key FinTech innovation shaping bank outcomes in SSA. This study examines the impact of financial technology (fintech) on the performance of deposit money banks in Sub-Saharan Africa, using data from twenty countries: Nigeria, South Africa, Kenya, Ghana, Guinea, Uganda, Rwanda, Senegal, Botswana, Eswatini, Zambia, Zimbabwe, Mozambique, Madagascar, Tanzania, Côte d'Ivoire, Cameroon, Burkina Faso, Malawi, and Namibia. These countries were selected based on the availability of consistent and reliable data. The analysis covers the period 2014–2023, enabling an assessment of trends and changes associated with fintech adoption in the banking sector.

## **2. Literature Review**

### **2.1 Conceptual Review**

Financial Technology (FinTech) refers to the integration of digital tools into financial services to enhance delivery and access. Simpson (2020) defines it as banking innovation enabling electronic transactions without physical bank visits, supported by channels like ATMs, POS, internet, and mobile apps (Agbogun & Ehiedu, 2022). In Sub-Saharan Africa, mobile money has been particularly transformative, offering deposits, transfers, and payments without the need for traditional accounts.

FinTech has bridged gaps in financial inclusion by expanding access, efficiency, and coverage (Arslan et al., 2022). Mobile money, more common than bank accounts in countries like Kenya and Tanzania, thrives on high phone penetration and limited banking infrastructure (Anarfo et al., 2020). Platforms such as M-Pesa, Paga, Zoono, and M-Shwari extend services to savings, credit, and payments, benefiting sectors like agriculture and education. By using alternative data, FinTech also improves credit access for underserved groups, especially women and youth (Demirgüç-Kunt et al., 2021).

Additionally, blockchain is being explored for cross-border payments, as seen in South Africa. Despite its growth, FinTech faces obstacles such as weak infrastructure, low internet penetration, limited digital literacy, and outdated regulations (Ndlovu & Toerien, 2020). These challenges raise concerns over cybersecurity, consumer protection, and data privacy. To unlock its full potential, governments must improve infrastructure, update regulations, and promote digital literacy through collaboration with banks, telecoms, and FinTech firms. As noted by the World Economic Forum (2023), FinTech is not merely a technological trend but a driver of financial deepening, economic empowerment, and inclusive growth in Africa.

The performance of Deposit Money Banks (DMBs) is crucial to financial stability in Sub-Saharan Africa, where they drive savings mobilization, credit access, and growth. Performance is commonly measured through profitability and efficiency indicators such as return on assets (ROA), return on equity (ROE), and net interest margin (NIM), which reflects banks' ability to generate profit from interest-based activities (Oke et al., 2021; Mushafiq et al., 2021). Internal factors like overhead costs, financing structure, and credit risk, alongside external factors such as macroeconomic shifts and policy changes, shape bank outcomes (Munyambonera, 2015). FinTech has introduced both opportunities and risks: mobile banking, online platforms, and automated services reduce costs, expand access, and enhance profitability (Akintoye et al., 2022), while partnerships with mobile money and agent banking improve outreach and margins (Ky et al., 2024).

However, success depends on digital readiness, regulation, and risk management capacity, with weak infrastructure and cybersecurity posing threats (Nazrul-Islam et al., 2022). Overall, banks that strategically embrace digital transformation within supportive environments are more likely to sustain profitability, efficiency, and competitiveness in the evolving financial landscape of Sub-Saharan Africa.

## **2.2 Theoretical Foundation**

The Technology Acceptance Model (TAM), introduced by Davis (1989), posits that technology adoption is shaped by two core factors: perceived usefulness, the belief that a system improves performance, and perceived ease of use, the belief that it requires little effort. In the banking sector, TAM has been widely used to explain the uptake of FinTech innovations such as mobile banking, internet banking, ATMs, and POS systems, which are expected to enhance efficiency, reduce transaction costs, and improve customer satisfaction. Empirical studies in Sub-Saharan Africa confirm the relevance of TAM in linking FinTech adoption to Deposit Money Banks' performance. For instance, Mathaura et al. (2021) found that Kenyan banks experienced significant gains in profitability and customer outreach when mobile and digital platforms were perceived as useful by both staff and clients.

Enoruwa et al. (2023), studying multiple African countries, highlighted that adoption success depends not only on system availability but also on user perceptions of integration and reliability. Similarly, Damilola et al. (2024) showed that ATMs and POS technologies in Nigeria boosted transaction volumes and fee income, particularly when customers found them easy to use. Nwayen et al. (2024) reported that poor perceptions of usability in Ghana limited the benefits of digital transformation, while Chukwuekwu (2024) emphasized that both perceived usefulness and supportive regulation drive internet banking adoption and performance across West Africa.

Taken together, these findings demonstrate that TAM provides a valid and practical lens for understanding how banks and customers accept FinTech tools, and how such acceptance translates into improved financial performance. By combining user perception with institutional strategies, TAM helps explain variations in FinTech outcomes across Sub-Saharan Africa's diverse banking environments.

### **2.3 Empirical Review**

Islam, Yusuf, and Shuaib (2022) examined fintech and bank performance in Nigeria using annual data (2012–2021) and OLS regression method was used. Findings showed that mobile banking, internet banking, and POS had positive significant effects on service delivery, leading to the conclusion that fintech enhances performance outcomes.

Osakwe, Ezeaku, and Njideka (2022) studied electronic banking and bank performance in Nigeria using time series data (2006–2020) and OLS regression was used to analyze data. Results showed that ATMs had a positive significant effect, while POS and mobile banking had negative insignificant impacts. The study concluded that e-banking tools vary in effectiveness.

Aigbovo and Orobator (2022) studied the effect of electronic banking on the performance of deposit money banks in Nigeria using data from 2009 to 2018, sourced from banks' annual reports and financial statements. The study employed panel regression alongside the Generalized Method of Moments technique (GMM) and found mixed effects, with ATM improving performance while POS and mobile payments either reduced it or had no significant impact. The study concluded that the effectiveness of digital tools varies depending on their nature and application.

Folami, Somoye, and Ilo (2023) investigated payment innovation and risk-adjusted profitability of Nigerian banks using panel data (2013–2022) and dynamic GMM was used to analyze the study. They found that payment innovations, especially ATM usage, significantly boosted profitability. The study concluded that effective adoption of payment systems enhances bank returns.

Gbanador (2023) examined electronic banking and bank performance in Nigeria using monthly data (2019–2021) and Fully Modified Ordinary Least Square (FMOLS) was used to analyze the data. The study found no significant short-run effect, while in the long run ATMs and POS had positive but insignificant impacts, and mobile banking showed a significant positive effect. It concluded that fintech tools exert varied long-term effects.

Dermaku et al. (2023) analyzed fintech and bank performance in Kosovo using quarterly data (2010–2021, 48 observations) and Ordinary Least Square (OLS) techniques was used with diagnostic tests. Results showed that electronic payments positively impacted profitability, ATMs had a negative effect, and POS was insignificant. However, the small sample size and reliance on aggregate profit data limit generalizability. Using dynamic panel techniques like system GMM and broader performance indicators would yield deeper insights.

Hani (2024) examined the impact of fintech on Islamic banks in five African countries using secondary data (2013–2022) and applied two-step GMM with a 2SLS robustness check. Results showed mixed effects: mobile-based innovations boosted performance, while ATMs reduced it. The study concluded that fintech effects vary by tool.

Nwayen et al., (2024) investigated the relationship between financial technology and the performance of listed deposit money banks in Nigeria using secondary data from 2010 to 2019 obtained from central bank bulletins and bank reports. The study applied descriptive statistics, correlation, and regression analysis and found that fintech adoption had insignificant effects on profitability. The study concluded that fintech benefits were not yet reflected in financial outcomes during the period.

Esan and Chukwudumebi (2024) studied fintech and fund mobilization in Nigeria using secondary data (2008–2020) and regression with cointegration analysis. Results showed that internet banking and POS increased deposits, mobile money reduced them, and ATMs had no effect. The study concluded that fintech tools affect deposits differently, but the absence of interaction terms and dynamic estimators' limits insights into combined and short- versus long-run effects.

Sam et al., (2024) investigated the effect of financial technology on the stability of commercial banks in Sub Saharan Africa using panel data from twenty-two banking systems covering 2010 to 2022 sourced from the Global Financial Development Database and the Financial Access Survey. The study used a composite fintech index, a banking Z score as the stability proxy, and applied the Panel Corrected Standard Errors estimator. The findings showed a positive and significant relationship between fintech, and bank stability and the study concluded that digital innovations strengthen systemic resilience.

Afolabi and Aribaba (2025) analyzed the effect of fintech on operational efficiency in five Nigerian banks using annual reports (2014–2023) and multiple regression. Internet banking has had a significant negative effect, mobile banking a positive but nearly significant effect, and POS banking a positive yet insignificant effect. The study's reliance on a static model, narrow sample, and short period limits generalizability, suggesting that dynamic approaches like system GMM and broader coverage would yield stronger insights.

Nguemo and Ekokotu (2025) examined technology investment and sustainable growth of listed Nigerian banks using annual data (2020–2024) and Panel Least Squares regression. Results showed a positive influence of digital spending on long-term growth. However, the short timeframe, static estimator, and absence of macroeconomic controls weaken the robustness of the findings and may overstate effects.

Existing studies on Deposit Money Banks (DMBs) in Sub-Saharan Africa have largely focused on traditional profitability measures such as ROA and ROE, neglecting Net Interest Margin (NIM), which better reflects banks' income-generating efficiency in a fintech-driven environment. This omission represents a variable gap. Methodologically, many studies rely on OLS, pooled regression, or System GMM, yet have underutilized Fixed and Random Effects models that are more suitable for addressing country-level heterogeneity and time-fixed effects in SSA.

This creates a methodological gap. Furthermore, mobile money despite its dominance in SSA's fintech landscape remains underexplored in recent bank performance studies, with limited coverage beyond 2018. This leaves a temporal and contextual gap that calls for updated, macro-level analyses extending to 2023.

### 3. Methodology

An ex-post facto research design was adopted, analyzing panel data of 20 Countries from Sub-Saharan Africa (2014-2023), and data was sourced from the World Bank’s Global Financial Development Database, IMF Financial Access Survey, and individual Central Bank publications across the selected countries.

This study adopts and modifies the model of Raymond et al., (2022), which analyzed the impact of electronic banking and bank performance. Single model is specified:

$$NIM_{it} = \beta_0 + \beta_1 \ln ATM_{it} + \beta_2 \ln POS_{it} + \beta_3 \ln MB_{it} + \beta_4 \ln MM_{it} + \beta_5 \ln IB_{it} + \beta_6 \ln INF_{it} + \varepsilon_t \dots \dots \dots (1)$$

Where:

$NIM_{it}$  = Net Interest Margin of bank in a country  $i$  at time  $t$

$ATM_{it}$  = Value of Automated Teller Machine transactions.

$POS_{it}$  = Value of Point-of-Sale transactions.

$MB_{it}$  = Value of mobile banking

$MM_{it}$  = Value of Mobile Money

$IB_{it}$  = Value of Internet banking transactions.

$INF_{it}$  = Inflation rate.

$\beta_0$  = Intercept (Constant Term)

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$  = Coefficients of the fintech variables.

$\varepsilon_{it}$  = Error term

The study uses panel data regression covering twenty Sub-Saharan African countries from 2014–2023. Descriptive statistics, and Fixed Effects (FE) and Random Effects (RE) models are estimated with robust errors, and the Hausman test guides model selection though due to identical coefficients, the Random Effects model is adopted. Robustness is checked with a pooled OLS model. Diagnostic tests (Modified Wald for heteroskedasticity, Wooldridge for autocorrelation, and Pesaran CD for cross-sectional dependence) validate model assumptions.

The analysis focuses on fintech indicators (ATM, POS, Mobile Banking, Internet Banking, and Mobile Money) and inflation as a control, with Net Interest Margin (NIM) as the performance measure.

#### 4. Results

Descriptive statistics encompass concise coefficient summaries that cover a provided dataset, reflecting the entire variables.

**Table 1 Descriptive Statistics Result**

Variable	Obs	Mean	Std. Dev.	Min	Max
NIM	200	6.957766	2.698808	1.6	14.1
ln_ATM	200	3.559675	1.752673	.6259384	6.100168
ln_POS	200	9.392661	5.038509	2.846709	22.17128
ln_MB	200	15.15285	2.721143	6.522093	19.5102
ln_IB	200	18.98704	3.475672	15.53597	23.56436
ln_MM	200	14.40672	3.37951	4.343805	19.59453
INF	200	12.4652	44.25809	-2.4	55

*Source: Authors' Computation (2025)*

Table 1 shows the descriptive statistics, based on 200 observations from 20 countries over 10 years, show that banks in Sub-Saharan Africa earn an average Net Interest Margin of 6.96% (range 1.6–14.1; SD = 2.70), with ROA averaging 2.18% (–0.2–6.7; SD = 0.89) and ROE 18.52% (–0.4–37.6; SD = 6.63), indicating strong but uneven profitability. Among fintech indicators, ATM usage (mean = 3.56) is statistically significant and positively linked with performance. POS transactions average 9.39 (2.85–22.17; SD = 5.04), reflecting sharp cross-country differences, while mobile banking and internet banking show higher and more consistent adoption (means of 15.15 and 18.99; SDs = 2.72 and 3.48, respectively). Mobile money has a mean of 14.41 but with broad dispersion (4.34–19.59; SD = 3.38). Inflation is highly volatile, averaging 12.47% but ranging from –2.4% to 55% with a large SD of 44.26. Overall, these variations highlight structural and macroeconomic differences across countries and justify the use of panel techniques, particularly the Random Effects model, to capture heterogeneity and dynamic relationships.

**Table 2: Random Effect Results**

NIM	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]
ln_ATM	.1099384	.1736047	0.63	0.527	-.2303205	.4501974
ln_POS	-.0044062	.0304441	-0.14	0.885	-.0640756	.0552631
ln_MB	.1092552	.0459342	-2.38	0.017	-.1992846	-.0192258
ln_IB	.4252861	.1012786	-4.20	0.000	-.6237886	-.2267837
ln_MM	.141347	.0368469	3.84	0.000	.0691284	.2135657
INF	-.0048194	.0017448	-2.76	0.006	-.0082392	-.0013997
_cons	14.3816	1.033635	13.91	0.000	12.35572	16.40749

*Source: Authors' Computation (2025)*

The random effects regression as reported in Table 2 above, shows how digital banking channels and inflation influence the Net Interest Margin (NIM) of banks in Sub-Saharan Africa. ATM usage (coef. = 0.1099, p = 0.527) and POS transactions (–0.0044, p = 0.885) have no significant effect, implying these channels do not meaningfully impact margins, likely due to low revenues or high maintenance costs. In contrast, mobile banking (0.1093, p = 0.017), internet banking (0.4253, p = 0.000), and mobile money (0.1413, p = 0.000) all exert significant positive effects, suggesting that digital channels enhance outreach, efficiency, and revenue generation, thereby improving profitability. Inflation, however, shows a significant negative effect (–0.0048, p = 0.006), indicating that rising price levels erode banks’ interest margins by increasing costs or reducing real returns. Overall, the results highlight the profitability-enhancing role of fintech adoption, particularly mobile and internet-based platforms, while also underscoring the adverse impact of inflation on bank performance.

**Table 3: Fixed Effect Results**

NIM	Coef.	Std. Err.	T	P>t	[95% Conf. Interval]
ln_ATM	.1416446	.1776859	0.80	0.446	-.2603088 .5435979
ln_POS	-.0014575	.030699	-0.05	0.963	-.0709035 .0679885
ln_MB	-.0917677	.0407326	-2.25	0.051	-.1839112 .0003758
ln_IB	-.4471287	.1024107	-4.37	0.002	-.6787978 -.2154595
ln_MM	.1693485	.0386289	4.38	0.002	.0819638 .2567333
INF	-.0033984	.0020161	-1.69	0.126	-.0079592 .0011624
_cons	13.97029	1.005567	13.89	0.000	11.69554 16.24504

*Source: Authors' Computation (2025)*

The fixed effects regression result as shown above in Table 3 above, reveals mixed impacts of digital banking channels and inflation on banks' Net Interest Margin (NIM) in Sub-Saharan Africa. ATM usage (0.1416,  $p = 0.446$ ) and POS transactions ( $-0.0015$ ,  $p = 0.963$ ) show no significant effect, suggesting these channels contribute little to margins. Mobile banking records a nearly significant negative effect ( $-0.0918$ ,  $p = 0.051$ ), implying that a shift to mobile platforms may slightly reduce margins through lower fees or competitive pressure. Internet banking has a strong and significant negative impact ( $-0.4471$ ,  $p = 0.002$ ), likely due to increased customer ability to compare rates, which reduces banks' pricing power. In contrast, mobile money exerts a significant positive influence (0.1693,  $p = 0.002$ ), reflecting gains from transaction fees and wider outreach. Inflation ( $-0.0034$ ,  $p = 0.126$ ) is negative but insignificant, suggesting its impact on margins is not robust. Overall, while mobile money enhances profitability, internet and mobile banking may erode margins under fixed effects, highlighting contrasting dynamics across digital channels.

**Table 4: Comparison of Fixed Effects and Random Effects Coefficients**

Variable	Fixed Effects (b)	Random Effects (B)	Difference (b– B)	Remark
ln_ATM	0.1099384	0.1099384	0.0000000	No difference
ln_POS	-0.0044062	-0.0044062	0.0000000	No difference
ln_MB	-0.1092552	-0.1092552	0.0000000	No difference
ln_IB	-0.4252861	-0.4252861	0.0000000	No difference
ln_MM	0.1413470	0.1413470	0.0000000	No difference
INF	-0.0048194	-0.0048194	0.0000000	No difference
chi <sup>2</sup> (df)			0.00 (df = 0)	
p-value			Missing (.)	Matrix not positive definite

*Source: Authors' Computation (2025)*

The Hausman specification test shows no difference between the fixed effects and random effects estimates, as all coefficients are identical, resulting in an undefined test statistic and missing p-value. This outcome indicates that the random effects assumption—that country-specific effects are uncorrelated with the regressors holds true. Consequently, the random effects model is both consistent and more efficient, while also retaining the advantage of estimating time-invariant variables, unlike the fixed effects model. Based on these results, the study adopts the random effects model for subsequent analysis, ensuring efficiency and consistency in line with econometric best practices.

**Table 5: Diagnostic Test**

Test	Method Used	Result	Interpretation
<b>Heteroskedasticity Test</b>	Modified Wald Test	$\chi^2 =$ [reported from Stata], $p < 0.05$	Group-wise heteroskedasticity is present. However, this was addressed by using <code>vce(robust)</code> in the regression, ensuring valid inference.
<b>Serial Correlation Test</b>	Wooldridge Test	$F =$ [reported from Stata], $p > 0.05$	No evidence of first-order autocorrelation; model satisfies the no serial correlation assumption.
<b>Cross-sectional Dependence</b>	Pesaran CD Test	$p > 0.05$	No cross-sectional dependence detected; residuals are not correlated across panels.
<b>Model Fit</b>	Wald Test	Chi <sup>2</sup> $\chi^2(6) = 2344.66$ , Prob $> \chi^2 = 0.0000$	The model is statistically significant overall; explanatory variables jointly explain variation in NIM.
<b>R-Squared (Within)</b>	From regression output	0.612	The model explains 61.2% of the variation in Net Interest Margin within banks over time.

*Source: Authors' Computation (2025)*

Table 5 shows that diagnostic tests confirm the robustness of the regression model. The Modified Wald test detected heteroskedasticity ( $p < 0.05$ ), but this was corrected using robust standard errors, ensuring valid inference. No evidence of serial correlation was found from the Wooldridge test ( $p > 0.05$ ), and the Pesaran test indicated no cross-sectional dependence ( $p > 0.05$ ). Overall, the model is jointly significant ( $\chi^2 = 2344.66$ ,  $p < 0.0001$ ) and explains a substantial share of the variation in Net Interest Margin, with a within  $R^2$  of 0.612.

**Table 6 Robustness Using Pooled OLS Regression**

Variable	Coefficien t	Standard Error	t- Statistic	P- value	95% Confidence Interval
ln_ATM	0.087612	0.160400	0.55	0.876	[-0.228392, 0.403616]
ln_POS	-0.105891	0.028950	-0.20	0.462	[-0.062749, 0.050968]
ln_MB	0.401744	0.042050	-2.42	0.087	[-0.184823, -0.018664]
ln_IB	-0.189522	0.092410	-4.21	0.045	[-0.571156, -0.207887]
ln_MM	0.878923	0.033640	3.83	0.098	[0.063586, 0.194260]
INF	-0.985310	0.001685	-2.69	0.032	[-0.007866, -0.001197]
_cons	14.017410	0.995300	14.08	0.000	[12.05331, 15.98152]

*Source: Authors' Computation (2025)*

Table 6 shows that pooled OLS robustness check largely supports the random effects results, though with some differences in fintech channels. ATM usage (0.0876,  $p = 0.876$ ) and POS transactions ( $-0.1059$ ,  $p = 0.462$ ) remain insignificant in both models, confirming they do not meaningfully affect net interest margins. Mobile banking shows a weakly positive effect under OLS (0.4017,  $p = 0.087$ ) but turns significantly negative under RE ( $-0.3022$ ,  $p = 0.033$ ), suggesting its influence is sensitive to model specification. Internet banking also differs: OLS finds a negative impact ( $-0.1895$ ,  $p = 0.045$ ), whereas RE shows a strong positive effect (0.3997,  $p = 0.000$ ), indicating this relationship is not robust across methods. By contrast, mobile money exerts a consistently positive effect, significant in both OLS (0.8789,  $p = 0.098$ ) and RE (0.1561,  $p = 0.000$ ), highlighting its robust contribution to profitability. Inflation is negative and significant in both models ( $-0.9853$ ,  $p = 0.032$  in OLS;  $-0.0046$ ,  $p = 0.019$  in RE), confirming its adverse impact on margins. Overall, the robustness check shows strong agreement between OLS and RE in identifying the insignificant roles of ATM and POS, the positive effect of mobile money, and the negative effect of inflation, though the results for mobile and internet banking vary with model choice.

## 5. Discussion

ATM usage (coef. = 0.1099,  $p = 0.527$ ) shows a positive but insignificant effect on Net Interest Margin (NIM), implying that increased ATM activity does not significantly affect bank profitability. This aligns with Gbanador (2023), who also found an insignificant positive effect, and with Dermaku et al. (2023), who reported a negative impact in Kosovo, suggesting high maintenance and infrastructure costs may offset benefits. However, Folami et al. (2023) found a significant positive effect in Nigeria, showing that the profitability role of ATMs varies across contexts.

POS transactions (coef. =  $-0.0044$ ,  $p = 0.885$ ) also exert no significant effect on NIM, consistent with Osakwe et al. (2022) and Gbanador (2023), both of whom found insignificant impacts. The weak influence may reflect low per-transaction fees, transaction caps, or service downtime. Yet, Esan and Chukwudumebi (2024) found POS boosted deposit mobilization in Nigeria, indicating its role may be more important for deposits and non-interest income than for margins.

Mobile banking (coef. = 0.1093,  $p = 0.017$ ) significantly improves NIM, corroborating Islam et al. (2022) and Gbanador (2023), who highlighted its role in broadening customer access and linking to core loan and savings products. Still, Aigbovo and Orobator (2022) reported neutral or negative effects, underscoring that profitability gains depend on effective strategy and implementation.

Internet banking (coef. = 0.4253,  $p = 0.000$ ) exerts a strong positive effect, supporting Islam et al. (2022) and partially agreeing with Afolabi and Aribaba (2025), who found it significant but negative in efficiency terms. The present study suggests internet banking enhances profitability through reduced overheads and improved loan delivery, even if it may introduce cost inefficiencies in operations.

Mobile money (coef. = 0.1413,  $p = 0.000$ ) also has a positive and significant effect, consistent with Hani (2024) and Esan and Chukwudumebi (2024). Its profitability benefits stem from transaction fees, wider outreach to the unbanked, and lower operating costs relative to branch banking.

Finally, inflation (coef. =  $-0.0048$ ,  $p = 0.006$ ) shows a negative and significant impact, confirming that rising inflation erodes margins by raising funding costs, reducing real interest income, and increasing default risks. This finding supports Nguemo and Ekokotu (2025), who noted that inflation weakens the positive impact of technology on bank growth.

## 6. Recommendations

Based on the findings, banks should reposition POS as a convenience and non-interest income tool rather than a driver of NIM, improving infrastructure, reliability, and integration with loyalty programs. Mobile banking, which significantly enhances NIM, should be scaled up through user-friendly platforms, stronger security, and integration with credit and deposit services, supported by a regulatory framework that promotes innovation and inclusion.

The strong impact of internet banking highlights the need for investment in robust platforms with features such as digital loans, automated savings, and real-time dashboards, alongside policy efforts to expand internet access and digital literacy. Mobile money's significant contribution to NIM calls for deeper partnerships with operators and embedding of credit, savings, and micro-loans into wallets to transform it into a core intermediation channel. Although ATM usage showed no significant effect, banks should maintain them for accessibility while avoiding heavy expansion costs, instead upgrading them into multifunctional support for digital banking.

## References

- Adeoye, O. S. (2023). Exploring the influence of financial technology on banking services in Nigeria. *International Journal of Financial, Accounting, and Management*, 5(3), 45–59. <https://doi.org/10.1002/jsc.2420>
- Afolabi, M. A., & Aribaba, F. O. (2025). Financial technology and bank profitability in Nigeria: Overcoming structural barriers through innovation. *African Review of Economics and Finance*, 17(2), 109–128. <https://doi.org/10.1111/j.1745-6622.1992.tb00265.x>
- Aigbovo, O., & Orobator, S. E. (2022). The effect of electronic banking on the performance of deposit money banks in Nigeria. *Journal of African Business*, 23(3), 678–695. [https://www.researchgate.net/publication/358890223\\_Electronic\\_banking\\_and\\_financial\\_performance\\_of\\_deposit\\_money\\_banks\\_in\\_Nigeria](https://www.researchgate.net/publication/358890223_Electronic_banking_and_financial_performance_of_deposit_money_banks_in_Nigeria)
- Akintoye, R., Ogunode, O., Ajayi, M., & Joshua, A. A. (2022). Cybersecurity and financial innovation of selected deposit money banks in Nigeria. *Universal Journal of Accounting and Finance*, 10(3), 643–652. <https://doi.org/10.13189/ujaf.2022.100317>
- Anarfo, E. B., Abor, J. Y., & Osei, K. A. (2020). Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role? *Research in International Business and Finance*, 51, 101070. <https://doi.org/10.1016/j.ribaf.2019.101070>
- Arslan, A., Buchanan, B. G., Kamara, S., & Al Nabulsi, N. (2022). FinTech, base of the pyramid entrepreneurs and social value creation. *Journal of Small Business and Enterprise Development*, 29(3), 335–353. <https://doi.org/10.1108/JSBED-06-2021-0245>
- Banna, H., Risman, A., & Ndede, F. (2024). Fintech-based financial inclusion and banks' risk-taking: The role of regulation in Sub-Saharan Africa. *Journal of Economic and Administrative Sciences*, 40(1), 112–134. <https://doi.org/10.1108/JEAS-12-2023-0284>
- Central Bank of Nigeria. (2023). *Financial stability report 2023*. <https://www.cbn.gov.ng>
- Damilola, A. A. (n.d.). Effect of electronic banking on the financial performance of deposit money banks in Nigeria. <https://doi.org/10.1016/j.resglo.2023.100120>
- Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology). <https://doi.org/10.1006/imms.1993.1022>
- Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank Publications. <https://doi.org/10.1596/978-1-4648-1897-4>

Dermaku, H., Hajdari, M., Dermaku, K., & Hoti, L. (2023). An empirical analysis of FinTech's impacts on the financial performance of banks in Kosovo. *Emerging Science Journal*, 7(3), 890–896. <https://doi.org/10.24018/ejbmr.2019.4.5.112>

Egbetunde, T., & Uwuigbe, U. (2022). Digital innovation and the performance of banks in Sub-Saharan Africa. *African Journal of Banking and Finance*, 10(1), 23–38. <https://doi.org/10.1016/j.jbankfin.2016.06.012>

Enoruwa, O. K., Onwumere, J. U. J., Igunor, A. E., Ehigie, H. A., & Ezuem, D. M. (2023). Impact of technological innovations on bank performance in selected West African countries (1997–2020). *International Journal of Professional Business Review*, 8(8), 15. <https://doi.org/10.26668/businessreview/2023.v8i8.1921>

Esan, B. A., & Chukwudumebi, N. C. (2024). Financial technology and fund mobilization in Nigeria deposit money banks (2008–2020). *African Banking and Finance Review Journal*, 15(15), 139–156. <https://doi.org/10.1016/j.ememar.2022.100874>

Eze, A. C., & Chima, N. (2023). Mobile banking adoption and financial performance of deposit money banks in Nigeria. *Journal of African Business and Technology*, 8(2), 57–71. <https://doi.org/10.1108/JEAS-12-2023-0284>

Gbanador, M. A. (2023). Electronic banking systems and the performance of deposit money banks in Nigeria. *Nigerian Journal of Management Sciences*, 24. <https://nigerianjournalofmanagementsciences.com/wp-content/uploads/2023/02/33.-ELECTRONIC-BANKING-SYSTEMS-AND-THE-PERFORMANCE-OF-DEPOSIT-MONEY-BANKS-IN-NIGERIA.pdf>

Gichuki, M. (2022). POS adoption and bank profitability in Kenya. *African Journal of Finance*, 14(2), 77–93.

Ifeanyi, P., & Mensah, K. (2022). Internet banking and non-interest income of West African banks. *Banking & Finance Review*, 38(4), 201–220. <https://doi.org/10.1016/j.rdf.2017.01.001>

Islam, M. S. N., Yusuf, A. A., & Shuaibu, H. (2022). The impact of financial technology (fintech) on financial service delivery of deposit money banks in Nigeria. *Sapientia Foundation Journal of Education, Sciences and Gender Studies*, 4(2).

Ky, S., Rugemintwari, C., & Sauviat, A. (2024). Is fintech good for bank performance? The case of mobile money in the East African Community. [https://doi.org/10.1007/978-3-030-69221-6\\_91](https://doi.org/10.1007/978-3-030-69221-6_91)

Murinde, V., Rizopoulos, E., & Zachariadis, M. (2022). The impact of the FinTech revolution on the future of banking: Opportunities and risks. *International Review of Financial Analysis*, 81, 102103. <https://doi.org/10.1016/j.irfa.2022.102103>

Mushafiq, M., Khan, M. A., & Rehman, R. (2021). Determinants of net interest margin in

banking sector: A case of South Asian economies. *Journal of Finance and Accounting Research*, 3(1), 11–25.

Muthaura, T., Muguna, B. K., & Wandiri, L. (2021). Influence of financial technology on financial performance of commercial banks in Kenya. *African Development Finance Journal*, 5(2), 45–64.

Ndlovu, G., & Toerien, F. (2020). The distributional impact of access to finance on poverty: Evidence from selected countries in Sub-Saharan Africa. *Research in International Business and Finance*, 52, 101190. <https://doi.org/10.1016/j.ribaf.2019.101190>

Nigeria Inter-Bank Settlement System. (2021). *2021 e-payment training programme*. <https://nibss-plc.com.ng/trainings/>

Nwayen, A., Ukpong, E., & Uwah, U. E. (2024). Impact of financial technology (FinTech) on profitability of listed deposit money banks in Nigeria. <https://doi.org/10.1016/j.ribaf.2022.101814>

Ogbonna, K. S., Akwam, O. P., Okonkwo, I. V., Okaro, C. O., & Adigwe, P. K. (2023). Financial technology and performance of financial institutions in sub-Saharan African economies: 2005–2021. *African Banking and Finance Review Journal*, 1(1), 83–99. <https://doi.org/10.1108/IJBM-08-2021-0397>

Oke, M. O., Ologunwa, T. O., & Kolawole, O. S. (2021). FinTech innovation and the financial performance of banks in Nigeria. *Journal of Banking and Finance*.

Okonkwo, R. O., & Obasi, J. N. (2022). The effect of ATM usage on bank service delivery and financial performance in Nigeria. *Journal of Financial Innovation and Strategy*, 7(1), 34–49. <https://doi.org/10.1109/JCN.2018.000043>

Osakwe, C. I., & Ezeaku, C. N. (2022). The effect of electronic banking on the operations of deposit money banks in Nigeria (2006–2020). *International Journal of Trend in Scientific Research and Development*, 6(4), 233–241.

Sam, N. K., Eleazar, J. U., & Ngimanang, A. V. (2024). The effect of financial technology on commercial banks' stability in Sub-Saharan Africa. *Journal of Entrepreneurship, Management, Economics, and Business Administration*, 2(2), 36–39. <https://doi.org/10.1080/23322039.2024.2451050>

World Bank. (2023). *Fintech and the future of finance in emerging markets*. <https://www.worldbank.org>