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ELECTRONIC BANKING CHANNELS AND FINANCIAL PERFORMANCE IN THE NIGERIAN BANKING INDUSTRY

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Abstract

This study investigates the impact of electronic banking channels on the financial performance of the Nigerian banking industry over the period 2000 to 2023. Utilizing Autoregressive Distributed Lag model, the research captures both short-run and long-run dynamics between Automated Teller Machines, Internet Banking, Mobile Banking, Point-of-Sale and financial performance indicators on Return on Assets and Financial Deepening Ratio. The results reveal a mixed pattern of findings: internet and mobile banking demonstrate statistically significant positive impact on profitability while Automated Teller Machines and Point-of-Sale channels exhibit inverse impacts, mainly due to high operational and infrastructural costs. Conversely, the influence of all four channels on financial deepening ratio is statistically insignificant, suggesting that the current deployment of electronic banking technologies does not substantially enhance long-term financial inclusion. These findings underscore the dual nature of electronic banking, profitable when efficiently scaled, but insufficient in driving inclusive finance without complementary structural and policy reforms. The study concludes with targeted policy recommendations, such as a dual-target strategy aligning profitability with inclusion goals; improved cost-sharing and rural deployment of Automated Teller Machines and Point-of-Sale infrastructure; regulatory reforms on transaction fee structures; product innovation in mobile and internet banking platforms; and the establishment of a national framework for tracking digital inclusion outcomes. These measures are essential for optimizing the economic benefits of electronic banking while promoting inclusive and sustainable financial sector growth in Nigeria.

Keywords: *Electronic Banking, Financial Performance, TAM.*

INTRODUCTION

The inception of electronic banking in Nigeria can be traced to 1986, when the banking sector was deregulated. Technological advancement has become a central force in shaping national economies' competitiveness and operational efficiency. In the modern financial ecosystem, digital transformation, particularly in the banking sector in early 2000, is indispensable for expanding financial inclusion, enhancing service delivery, and promoting economic development (Adeniran &Aladejebi, 2023). In developing countries like Nigeria, where financial exclusion and infrastructural deficits persist, adopting electronic banking (e-banking) technologies presents opportunities and challenges for improving institutional performance and economic participation.

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Electronic banking involves the deployment of digital tools such as Internet banking, automated teller machines (ATMs), mobile banking (MB), and point-of-sale (POS) systems to facilitate financial transactions. These platforms enable customers to access services remotely, conduct transactions efficiently, and reduce dependence on physical bank branches (Adeleke & Yusuf, 2023). Internet banking (IB) provides customers with secure, web-based access to account services; ATMs offer continuous access to cash and deposit services; mobile banking simplifies fund transfers through mobile apps and USSD codes; and POS terminals support seamless electronic payments in commercial settings (Adeniran &Aladejebi, 2023). These innovations are particularly crucial in Nigeria, where the Central Bank of Nigeria (CBN) has aggressively promoted policies such as the cashless initiative and the introduction of the e-Naira to foster a more digitally inclusive financial system (CBN, 2022).

However, while digitalization is reshaping the Nigerian banking industry, the outcomes of e-banking adoption on financial performance remain contested. Financial performance, often measured through Return on Assets (ROA) and the Financial Deepening Ratio (FDR), is essential for evaluating operational efficiency and financial system inclusivity. ROA reflects a bank's capacity to convert assets into profits, while FDR indicates the penetration and accessibility of financial services in the broader economy. Despite the global evidence that digital banking improves institutional outcomes, empirical studies in Nigeria present mixed findings. For instance, while Olayemi and Abiola (2023) report significant ROA improvements linked to mobile and internet banking, Adesina et al. (2022) find no consistent evidence that ATM usage enhances financial performance across different bank categories. Sector-specific challenges further complicate the divergence in findings. Nigerian banks continue to grapple with erratic electricity supply, underdeveloped ICT infrastructure, and inconsistent internet connectivity all of which hinder the effectiveness of e-banking platforms (Eze & Nwankwo, 2024). Additionally, regulatory shifts and low digital literacy have contributed to the uneven adoption of e-banking tools across regions. This indicates that technological investments alone do not guarantee improved performance; rather, their impact is influenced by operational capacity, strategic alignment, and external environmental factors (Adeyemi et al., 2024).

Furthermore, existing literature often fails to disaggregate the individual effects of various e-banking tools on specific financial indicators. Most studies treat digital channels as a monolithic construct, overlooking the distinctive contributions of IB, ATM, MB, and POS systems. This limits the precision of empirical insights and undermines strategic policy formulation. Moreover, questions persist regarding whether the benefits of e-banking are realized in the short or long run, especially given the cost implications and sustainability concerns tied to digital infrastructure (Okonkwo & Bamidele, 2023).

However, a comprehensive empirical assessment of how different e-banking platforms affect ROA and FDR in Nigeria remains sparse. To address these gaps, this study adopts the Autoregressive Distributed Lag (ARDL) model, which is particularly suitable for analyzing both short- and long-term relationships among variables of mixed integration orders (I(0) and I(1)). By applying this model, this study offers insight into on the relationship between e-banking channels and financial performance in the Nigeria's banking sector. The article is structure as follows: section two is on literature review; section three is on the methodology; section four is on presentation and discussion of results; and section five is on conclusion and policy recommendations.

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LITERATURE REVIEW

This chapter contains a holistic review of existing literature and conceptual discourse related to the research topic. It also encompasses a theoretical and empirical review of the chosen topic.

Financial Performance

Financial performance of a company refers to the means by which a company measures its ability to meet its obligations and goals as and when due. Amaefule, Okoye, Kalu and Nwosu (2018) observed that it can serve as a measurable variable to assess the effectiveness of a banking institution in running its daily operations. This will determine whether organizations are able to survive in the market or not. Because this determines an institution's existence as well as liquidation, hence utmost attention is expended. The means of measuring financial performance includes the following determinants: Historical data**:** Historical data is used as a means of measuring financial performance in the view of comparison. That is, being able to identify the areas in which the companies flourished or were behind because of numerous factors which may include low customer base, poor service delivery, untimely service delivery, low number of staff/personnel, and lack of adequate resources to function effectively as an institution. Being able to compare historical information helps the institutions to set realistic and achievable benchmarks for both the present and the future. Comparison can also be done with other banks and financial institutions. The study adopts two proxy for financial indicators; Return on Asset (ROA) and the Financial Deepening Ratio (FDR).

ROA indicates how the institution is generating revenue from its assets. The ROA is often adopted because it shows its investors that their capital was not wasted but that it was put to good use that now yield returns, which surpass the capital invested. Hence, a high ROA shows that a business is more profitable and efficient. It is derived by dividing net profit after tax with total assets. This ratio is used as a pointer of management efficiency; it indicates how capable the management of the banks has been in converting the bank's assets into profits.Net Interest Margin: The net interest margin shows the successfulness of investment against debt obligations. It focuses on the difference between the inflows (net interest income) generated and the outflows (amount paid to lenders) relative to assets. The net interest margin is usually measured by dividing a bank's investment income minus its interest expenses by dividing it by its average earning assets. This calculation provides a percentage of how efficiently the bank uses its investments.

FDR is a metric used to evaluate an economy's financial development level. It is calculated as the ratio of total bank savings to the Gross Domestic Product (GDP). This ratio provides insight into the extent to which financial institutions, particularly banks, are integrated into the economic system through the mobilization of savings and provision of financial services. A higher FDR indicates that a greater proportion of the country's economic output is held within the formal banking sector, suggesting improved financial intermediation, broader financial inclusion, and a more effective banking system. FDR reflects how deeply financial services have penetrated the economy and is widely used by researchers and policymakers to assess the efficiency and inclusiveness of the financial system. In the Nigerian context, the FDR helps to measure the influence of electronic banking innovations, such as mobile banking, internet banking, POS, and ATMs, on deposit mobilization and financial access. As such, a rising FDR may imply that adopting digital banking channels successfully brings more people and businesses into the formal financial system, thereby supporting economic growth and development.

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Electronic Banking Systems in Nigeria

Electronic banking (e-banking) means using technology by banks to facilitate encrypted financial transactions without human interaction. Okoro (2020) defines e-banking as the use of computers and telecommunications to execute banking operations, while Kim and Mull (2006) describe it as conducting financial intermediation over the Internet. These definitions agree that e-banking allows customers to do banking activities through digital platforms. In Nigeria, this has reduced the traditional banking challenges of long queues, overworked staff and limited access to account information.E-banking has improved efficiency in the Nigerian banking sector by automating services and reducing operational bottlenecks. According to Amaduche, Adesanya and Adediji (2020), automation saves time and resources and boosts service delivery. AI applications have reduced storage costs and improved system flexibility, customers can manage their finances conveniently, and banks can deliver cost-effective services (Zayyanu, Umar & Taiwo, 2022). Data encryption has also enhanced user confidence in digital banking (Zayyanu et al., 2022).

Employees also benefit from reduced workload which promotes job satisfaction and productivity. As Amaduche et al. (2020) noted, happy employees contribute positively to institutional goals. Customers can now have multiple banking options like mobile apps, ATMs, and POS terminals, and there is no need to visit the bank frequently (Adetugi, 2017). They can access their balance, make payments, and generate statements or receipts remotely.E-banking also offers services like airtime/data purchase, bill payment (electricity, cable TV, transport), loan acquisition and investment management. This convenience supports Nigeria's cashless policy. Banks can now serve customers in remote or overseas locations and expand their reach (Oniore & Okoli, 2019). Ultimately, the e-banking system (mobile banking, internet banking, ATMs, and POS terminals) has transformed the banking landscape in Nigeria and encouraged digital inclusion.

MB enables users to conduct seamless financial transactions using phones or tablets and specific banking codes (Asidok & Michael, 2018; Zayyanu et al., 2022). It is popular due to its simplicity, affordability, and instant fund transfer capabilities. MB often supports account management, stock trading, balance inquiries, and more without airtime or data (Kennedy & Jacky, 2013; Adewoye, 2013). The system relies only on a linked PIN and recipient information to complete secure and efficient transactions. IB is an e-banking channel accessed via bank websites or apps using internet-enabled devices, eliminating the need for physical bank visits. Users set up an online profile with passwords and PINs to access services such as bill payment, fund transfers, and receipt generation. It enhances convenience, improves transaction documentation, and supports verification processes for secure operations. This channel revolutionizes customer experience by providing comprehensive banking from anywhere, bridging the limitations of traditional banking.

ATMs are self-service electronic banking devices offering cash withdrawals, transfers, and balance inquiries with a debit card and secure PIN authentication. They operate 24/7 and are installed in diverse locations, promoting round-the-clock access and reducing bank hall congestion (Gambo, 2020). Their convenience and security have made them one of Nigeria's most adopted e-banking tools (Nwakoby et al., 2020; Ighoreje & Okoroyibo, 2020). ATMs reduce the risks of carrying large cash amounts and boost customer satisfaction with instant financial services. POS terminals are widely adopted e-banking devices found in supermarkets, kiosks, and areas lacking bank

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branches or ATMs. Banks such as First Bank, Opay, and Flutter wave issue POS machines to verified users with registered businesses and valid IDs. POS enhances record-keeping, reduces theft, encourages cashless transactions, and builds customer trust in pricing and service integrity. Moreover, POS usage generates income for agents via transaction fees and VAT for the government, requiring internet and power to function optimally.

Financial Institutions in Nigeria

Financial institutions in Nigeria are key pillars of the economy. They facilitate financial and monetary transactions such as cash disbursement, loans, savings, deposits, investments, insurance, and financial advisory. These institutions are broadly classified into two categories: banking financial institutions, which have a full banking license and can accept public deposits, and non-banking financial institutions, which operate without such licenses (CBN, 2020). Table 1 outlines the major players within this structure, including the Central Bank of Nigeria (CBN), commercial banks, microfinance banks, and deposit money banks.

At the apex of Nigeria's financial system stands the Central Bank of Nigeria (CBN). It regulates and supervises all other banks to ensure monetary stability and financial discipline. The CBN is solely authorized to issue legal tender in the country, and it also plays a vital role in advising the federal government on monetary policy. Through instruments such as the cash reserve ratio and open market operations, the CBN controls liquidity and combats inflation (CBN, 2021). Additionally, the CBN monitors and enforces compliance among commercial and microfinance banks under the regulatory framework defined in the CBN Act of 2007.

Commercial banks in Nigeria are the most patronized category of financial institutions. They provide services such as accepting deposits, granting loans, facilitating bill payments, and offering foreign exchange services. Commercial banks like Access Bank, First Bank of Nigeria, Guaranty Trust Bank, and Zenith Bank have extensive networks across urban and rural Nigeria. Their fundamental role is channeling surplus funds from savers to borrowers, stimulating economic activity and ensuring financial inclusion (Sanusi, 2010).

Microfinance banks play a crucial role in Nigeria's financial landscape by catering primarily to underserved populationslow-income individuals, the unemployed, and micro-entrepreneurs. These banks provide short-term, collateral-free loans and offer financial education to improve their clients' money management skills. Notable microfinance institutions include LAPO Microfinance Bank and Accion Microfinance Bank. Their impact is particularly significant in rural and semi-urban areas, where access to mainstream banking services is limited (CBN, 2020). Lastly, Deposit Money Banks (DMBs) encompass both commercial banks and other deposit-taking institutions like credit unions and trust companies. These banks play an integral role in Nigeria's financial intermediation process by savings and allocating them as credit to various sectors of the economy. Through this process, they facilitate the efficient flow of funds and contribute to overall economic growth (IMF, 2021).In summary, Nigeria's financial institutions, primarily regulated by the CBN, are indispensable to the country's economic infrastructure. They ensure monetary stability, foster economic development, and promote financial inclusion through

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diverse services tailored to various economic segments.

2.2. Theoretical Framework: Technology Acceptance Model

This study is grounded in the Technology Acceptance Model (TAM), initially developed by Fred Davis in 1985. TAM is a widely recognized information systems theory that explains how users accept and utilize new technologies, with implications for promoting economic growth. The model posits that users' adoption decisions are influenced by several key factors when introduced to a new technology. These include Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and the Attitude Toward Using the System (see Figure 2). These constructs collectively determine an individual's behavioural intention to use technology, thereby shaping actual usage behaviour.

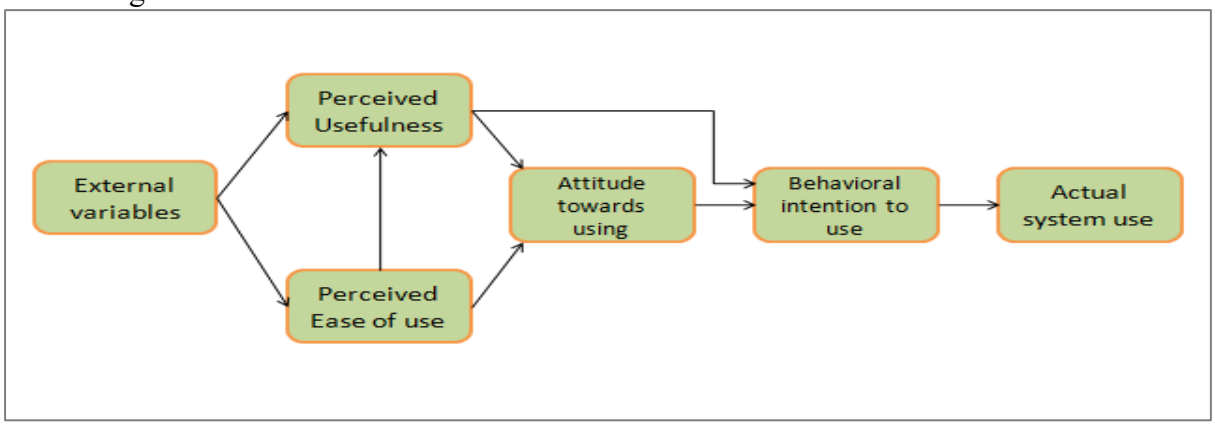

Figure 2. Technology Acceptance Model (Darvis, 1985)

According to the Technology Acceptance Model (TAM), an individual's actual use of a technological system is determined by their behavioral intentions, which are influenced by their attitudes, perceived usefulness (PU), and perceived ease of use (PEOU). The model asserts that a user's attitude toward adopting a system is central to their decision to accept or reject it. This attitude is shaped by two primary beliefs: perceived usefulness and perceived ease of use, with PEOU exerting a direct influence on PU. As noted by Lai (2016), the evolution of payment systems is primarily shaped by the tension between rapid technological advancement and the inherent resistance to adopting new products or services.This study is anchored on TAM because it provides a comprehensive framework for understanding the factors that drive user acceptance and utilization of technologyparticularly in promoting economic growth in developing countries like Nigeria. Since economic advancement is a key motivation for technological adoption at the national level, TAM offers a robust theoretical foundation for examining the uptake of electronic banking systems within such economies.

In all, however, the perception and attitude of bank customers in Nigeria are influenced by the e-banking system design characteristics, which offer them the opportunity to transact from anywhere, rather than visiting the banking hall and paying considerable sums to clients without meddling with physical cash. Based on the foregoing explanations, the TAM theory is considered suitable for this study, hence its adoption as a theoretical hinge for the study.

2.3. Empirical Review

Praise and Mike (2019) conducted a study to assess the impact of electronic payment systems on financial deepening indicators in Nigeria, with particular emphasis on Automated Teller Machine (ATM) usage. Employing an ex-post facto research design, the study utilized Granger

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causality tests, correlation analyses, and other preliminary diagnostics. Quarterly time series data spanning 2009 to 2017 were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletins. Financial deepening was measured using two dependent variables: the ratio of broad money supply to GDP (M2GDP) and the credit ratio to the private sector to GDP (CPSGDP). Independent variables included transaction volumes for ATMs, web payments, mobile payments, and point-of-sale (POS) systems. The findings revealed a bi-directional causality between ATM transactions (LATM) and credit to the private sector (LCPSGDP), alongside a unidirectional relationship between ATM transactions and broad money supply (LM2GDP). These results are consistent with existing literature and theoretical expectations, reinforcing the link between financial deepening and electronic payment systems in Nigeria. The authors recommended implementing supportive policies to enhance the adoption of diverse electronic channels and emphasized the need for robust regulatory frameworks to mitigate potential risks associated with these technologies.

Iwedi, Owakah, and Wofuru-Nyenke (2023) explored the influence of financial technology on financial inclusion in Nigeria, using quarterly data from 2009 to 2019 obtained from the CBN Statistical Bulletin (2021). Financial technology was proxy by indicators such as POS usage, ATM transactions, web banking, and mobile banking technologies, while financial inclusion was measured using the deposit ratio. The study employed the Vector Autoregression (VAR) estimation technique for analysis. The findings indicated that web banking technology exerted a positive and statistically significant effect on financial inclusion. Although ATM, POS, and mobile banking also showed positive impacts, these were not statistically significant. The study concluded that increased adoption of fintech platforms has the potential to enhance financial inclusion in Nigeria. Consequently, the authors recommended that policymakers support the expansion of affordable 3G and 4G networks, especially in rural areas, to boost access to mobile banking. They also advocated for enhanced financial literacy initiatives by banks to improve customers' understanding of financial management and planning.

Osakwe et al. (2024) investigated the effects of ATM and mobile banking on the performance of deposit money banks in Nigeria using time series data from 2009 to 2021, sourced from the CBN Statistical Bulletin. In the study, electronic banking was represented by ATM and mobile banking data, while the performance of deposit money banks was proxy by total bank deposits. Analysis was conducted using the Ordinary Least Squares (OLS) regression method via E-Views software. The results demonstrated that both ATM usage and mobile banking significantly and positively influenced the performance of deposit money banks. The study concluded that electronic banking has facilitated greater access to banking services and enabled banks to expand their customer base. Based on these findings, the authors recommended that Nigerian banks intensify efforts to expand and maintain ATM networks and continue investing in the development of mobile banking platforms.

METHODOLOGY

Sources of Data

Secondary data were utilized, with Return on Assets (ROA) data collected from the annual financial statements of Nigerian banks spanning 2000 to 2023. Data on Automated Teller Machines (ATMs), Point of Sale (POS) terminals, mobile banking, internet banking, and the Financial Deepening Ratio were obtained from the 2023 Central Bank of Nigeria (CBN) Statistical Bulletin.

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Model Specification

The study modifies the model of Ugede et al. (2023) in light of the Technology Acceptance Model (TAM) theory. The model is outlined below:

$PFT_i = \alpha_0 + \beta_1 ATM_i + \beta_2 IBK_i + \beta_3 POS_i + \mu_t$ ……..……..(1)

Where: PFT = is financial performance represented by profitability (net profit); ATMS= total government expenditure as a ratio of GDP; IBK= Internet and Mobile banking; POS= Point of Sales; and μ= error term. Relying on the TAM theory, ARDL, and adapting the model of (Ugede et al., 2023), the model for this study is presented in the econometric form below:

$ROA_t = \beta_0 + \beta_1 IB_t + \beta_2 ATM_t + \beta_3 MB_t + \beta_4 POS_t + \beta_5 FDR_t + \beta_6 INTR_t + \Sigma(\beta_{1j}\Delta IB_{t-j}) + \Sigma(\beta_{2j}\Delta ATM_{t-j}) + \Sigma(\beta_{3j}\Delta MB_{t-j}) + \Sigma(\beta_{4j}\Delta POS_{t-j} + \Sigma(\beta_{5j}\Delta FDR_{t-j}) + \Sigma(\beta_{6j}\Delta INTR_{t-j}) + \mu_t$……..(2)

Where ROA= Return on Assets; IB= Internet Banking; ATM= Automated Teller Machine; MB= Mobile banking; POS= Point of Sales,FDR= Financial Deepening Ratio; INTR = Interest Rate$\beta 0$= constant; $\beta 1$-$\beta 5$= unknown coefficient;t= time (2000-2023); Long-run estimates is represented by lagged-level variables (IB_{t-1}, ATM_{t-1}, MB_{t-1}, POS_{t-1}, FDR_{t-1}, $INTR_{t-1}$) while the short-run estimates is captured by differenced terms (ΔIB_{t-j}, ΔATM_{t-j}, ΔMB_{t-j}, ΔPOS_{t-j}, ΔFDR_{t-j}, ΔINT_{t-j}).and μ= error term.

$FDR_t = \beta_0 + \beta_1 IB_t + \beta_2 ATM_t + \beta_3 MB_t + \beta_4 POS_t + \beta_5 INFL_t + \beta_6 INTR_t + \Sigma(\beta_{1j}\Delta IB_{t-j}) + \Sigma(\beta_{2j}\Delta ATM_{t-j}) + \Sigma(\beta_{3j}\Delta MB_{t-j}) + \Sigma(\beta_{4j}\Delta POS_{t-j} + \Sigma(\beta_{5j}\Delta INFL_{t-j}) + \Sigma(\beta_{6j}\Delta INTR_{t-j}) + \mu_t$……..(3)

Where FDR= Financial Deepening Ratio; IB= Internet Banking; ATM= Automated Teller Machine; MB= Mobile banking; POS= Point of Sales, INFL= Inflation Rate, INTR = Interest Rate$\beta 0$= constant; $\beta 1$-$\beta 5$= unknown coefficient$t$= time (2000-2023); Long-run estimates is represented by lagged-level variables (IB_{t-1}, ATM_{t-1}, MB_{t-1}, POS_{t-1}, $INFL_{t-1}$, $INTR_{t-j}$) while the short-run estimates is captured by differenced terms (ΔIB_{t-j}, ΔATM_{t-j}, ΔMB_{t-j}, ΔPOS_{t-j}, ΔFDR_{t-j}, $\Delta INTR_{t-j}$) and μ= error term.

Model 2 incorporates Financial Deepening Ratio (FDR) and interest rate (INTR) as control variables to account for the influence of financial intermediation and prevailing monetary conditions on profitability. Model 3 controls for inflation rate (INFL) and interest rate (INTR) to isolate the impact of macroeconomic volatility on financial inclusion and depth.

Measurement of variables

Table 1 below presents the measurement of variables, showing the likely a priori expectation and prior studies that have adopted these measures. Specifically, the variables considered were electronic banking and financial performance and include some control variables as expressed in the table below:

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Table 1: Measurement of variables

S/n	Variables	Acronyms	Measurement	Apriori sign	Justification
Dependent variable					
1	Return on Assets	ROA	Measured as profit after tax divided by total asset	Nil	Demaki et al. (2021)
2	Financial Deepening Ratio (FDR)		Measured as total saving divided by GDP	Nil	Praise, & Mike. (2019).
Independent & control variables					
3	Internet Banking	IB	Log value of transactions consummated through internet banking	+	Demaki et al. (2021)
4	Automated Teller Machine	ATM	Log value of transactions consummated through automated teller machine	+	Ugede et al. (2023)
5	Mobile banking	MB	Log value of transactions consummated through mobile banking.	+	Ugede et al. (2023)
6	Point of Sales	POS	Log value of transactions consummated through point of sales.	+	Ugede et al. (2023)
7	Inflation rate	INFL	Annual percentage change in the consumer price index, reflecting inflation.	-	Adeniran et al. (2017)
8	Interest rate	INTR	Annual lending rate charged by commercial banks in Nigeria.	-	Nwosa & Saibu (2012)

Source: Authors Compilation, (2025)

Technique of Data Analysis

Unit Root Test

This is a statistical test used to test if a data set that is time series in nature is stationary or non-stationary. A time series is said to be stationary when it lacks a unit root and has constant statistical properties (e.g., mean, variance, etc) over time,which implies the presence of non-stationarity, often due to a random walk or trend. This test is crucial because non-stationary time series can lead to unreliable statistical inferences and spurious results. The test for unit root is done using the Augmented-Dickey Fuller (ADF) test on the series at level, first and second-order differential series. The decision criterion is that a variable is stationary if the ADF statistic value is greater that the critical value at 5%.

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Bounds Co-Integration Test

The ARDL bounds test is a co-integration test used to determine if a long-run relationship exists between time series variables. It is particularly useful when dealing with variables that may be integrated of different orders I(0), I(1),I(2) or their combination series. The ARDL bounds test uses a decision rule based on comparing the calculated F-statistical to critical value bounds. If the F-statistic exceeds the upper bounds, co-integration exists, suggesting a long-run relationship between the variables, if otherwise no long-run relationship is assumed.

Autoregressive Distributed Lags (ARDL)

The study employs the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001) to examine the relationship between electronic banking and financial performance in the Nigerian banking sector. The ARDL methodology is particularly suitable when the variables exhibit mixed orders of integration, specifically I(0), I(1),I(2) or their combination series. The technique assumes the absence of autocorrelation and heteroscedasticity in the residuals, as well as the normality of the data distribution. The ARDL model extends traditional autoregressive frameworks by incorporating lags of both the dependent and independent variables. It emphasizes the influence of exogenous variables and determines the optimal lag structure based on endogenous and exogenous components. While conceptually related to the Vector Autoregression (VAR) model, ARDL differs by not requiring the inclusion of the endogenous variable as a regressor for the exogenous variables, making it a more flexible tool in specific econometric contexts. The ARDL model allows for both short-run and long-run effects to be estimated, making it a versatile tool for analyzing relationships in time series data. It is typically presented as:

$$Y_{it} = \sum_{j=1}^{m} a_{ij} y_{it-j} + \sum_{j=0}^{n} \beta_{ij} x_{it-j} + u_i + \mu_{it}$$

Where i= 1,2,3….. N, t indicates time, t = 1,2,….T, j is the number of lags for our estimation.

PRESENTATION AND DISCUSSION OF RESULTS

Table 2: Presentation of unit root test

VARIABLES	CRITICAL VALUES 5%	ADF T-STATISTIC	ORDER OF STATIONARY	REMARK
ROA	-3.004861	-6.040818	I(1)	Stationary
FDR	-3.004861	-3.657415	I(1)	Stationary
ATM	-3.004861	-7.611512	I(1)	Stationary
IB	-3.004861	-5.272072	I(1)	Stationary
MB	-3.004861	3.284284	I(0)	Stationary
POS	-3.004861	-4.076227	I(1)	Stationary
INFL	-3.004861	-5.979019	I(1)	Stationary
INTR	-3.004861	-6.297886	I(1)	Stationary

Source: Author's Computation (2025)

Table 2 presents the unit root test to ascertain if the variables are stationary. This will ensure that the parameters are estimated using stationary time series data to prevent misleading results. Using the Augmented Dickey-Fuller (ADF) test, the study found that most variables, including

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ROA,FDR, ATM, IB, POS, INFL, INTR are stationary after first differencing (I(1)), while MB are stationary at level (I(0)). Due to these different orders of integration, we apply the Autoregressive Distributed Lag (ARDL) model Bound Test to explore the long-term relationships between the variables and determine if a long-run equilibrium exists.

Table 3: Bounds Co-integration test results

	F-Bounds Test		Null Hypothesis: No levels relationship		
Model 2	Test Statistic	Value	Sig.	I(0)	I(1)
	F-statistic	2.211	10%	1.99	2.94
	K	6	5%	2.27	3.28
			2.5%	2.55	3.61
			1%	2.88	3.99
Model 3	Test Statistic	Value	Sig.	I(0)	I(1)
	F-statistic	4.135	10%	1.99	2.94
	K	6	5%	2.27	3.28
			2.5%	2.55	3.61
			1%	2.88	3.99

Source: Author's Computation (2025)

Table 4: Autoregressive Distributed Lag (ARDL) Results

Financial Performance (FP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Model (i): Return on Assets (ROA)				
ATM	-0.034379	0.008046	-4.272698	0.0013
IB	0.004098	0.001607	2.497714	0.0384
MB	0.014664	0.007199	2.036904	0.0665
POS	-0.018305	0.006884	-2.658960	0.0222
FDR	0.196558	0.096602	2.034714	0.0667
INTR	0.001350	0.000785	1.719119	0.1136
C	0.102483	0.028795	3.559060	0.0045
Model (ii): Financial Deepening Ratio (FDR)				
ATM	0.021214	0.100246	0.211619	0.8377
IB	0.002772	0.018702	0.148247	0.8858
MB	-0.028621	0.071353	-0.401111	0.6988
POS	0.049245	0.067870	0.725578	0.4888
INFL	-0.000707	0.003183	-0.222211	0.8297
INTR	-0.004504	0.008971	-0.502088	0.6291
Coint. Eq. (-1)*	-0.482852	0.212217	-2.275275	0.0019

Source: Author's Computation (2025)

Table 3 presents the results of both models' ARDL Long Run Form and Bounds Test. In Model 2, where ROA is the dependent variable, the F-statistic value of 2.211 falls below all the upper-bound critical values at the 10%, 5%, 2.5%, and 1% significance levels. This result indicates that there is no evidence of a long-run co-integrating relationship between ROA and the explanatory variables (ATM, IB, MB, POS, FDR, and INTR). Therefore, the null hypothesis of

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no level relationship cannot be rejected for Model 2. In contrast, Model 3, which uses FDR as the dependent variable, reports an F-statistic of 4.135, which exceeds the upper-bound critical values at the 10%, 5%, and 2.5% significance levels, though not at the 1% level. This confirms the existence of a statistically significant long-run relationship between FDR and the independent variables (ATM, IB, MB, POS, INFL, and INTR).Thus, ARDL is appropriate for both models, supporting short-run in model 2, and model 3 long-run associations.

Table 4 presents the ARDL results, which help to evaluate the relationship between electronic banking variables and financial performance (ROA & FDR) in Nigeria. Results discussed according to the Hypothesis below:

Hypothesis 1 (H_{01}): There is no significant relationship between automated teller machines and financial performance in the Nigerian banking industry.

Hypothesis 1 (**H_{01}**) is rejected based on the statistically significant result from Model 1. On the contrary, it is accepted based on the insignificant outcome from Model 2. The findings highlight the complex and dual impact of Automated Teller Machines (ATMs) on financial performance in the Nigerian banking sector. In Model 1, where Return on Assets (ROA) serves as the proxy for financial performance, the ATM coefficient is negative (-0.034379) and statistically significant ($p = 0.0013$), suggesting that increased ATM deployment adversely affects short-term profitability. This aligns with Ighoroje and Okoroyibo (2020), who attributed reduced profitability to the high capital and recurrent costs involved in acquiring, installing, and maintaining ATM infrastructure. Moreover, expenses related to fraud prevention, security, and network servicing further contribute to operational burdens, especially in regions with low usage or limited infrastructure.

Conversely, Model 2, which assesses the relationship between ATMs and the Financial Deepening Ratio (FDR), reveals a positive but statistically insignificant coefficient (0.021214; $p = 0.8377$). This indicates that, while ATM deployment might have the potential to enhance financial inclusion, there is no robust empirical evidence to support a stable, long-term effect within the sample period. This contradicts the findings of Muotolu and Nwadialo (2019), who reported a significant positive contribution of ATMs to financial outreach. The current result implies that unless ATM services are strategically expanded, particularly to underserved and rural areas, mere deployment may not be sufficient to drive broader financial system participation. To strengthen ATM impact on inclusion, banks must couple infrastructure investment with targeted policies that address accessibility, user education, and regional disparities in banking service utilization.

Hypothesis 2 (H_{02}): There is no significant relationship between internet banking and financial performance in the Nigerian banking industry.

Hypothesis 2 (**H_{02}**) is rejected based on the statistically significant result from Model 1. On the contrary, it is accepted based on the insignificant outcome from Model 2. The findings emphasize the impact of internet banking on financial performance in the Nigerian banking industry. In Model 1, where Return on Assets (ROA) serves as the proxy for financial performance, the long-run coefficient of internet banking is positive (0.004098) and statistically significant ($p = 0.0384$), indicating that internet banking adoption contributes positively to bank profitability. This supports the findings of Orji et al. (2018), who identified the substantial role of internet banking innovations in enhancing operational efficiency and profitability. The digital transformation enabled by internet banking reduces dependence on physical infrastructure,

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lowers administrative costs, and allows banks to reach a broader customer base, ultimately strengthening financial performance. Additionally, it facilitates more precise customer targeting and improved risk management through data-driven insights.

In contrast, Model 2, which utilizes the Financial Deepening Ratio (FDR) as a proxy for broader financial engagement, shows a positive but statistically insignificant coefficient (0.002772; p = 0.8858). This suggests that while internet banking may support financial inclusion in theory, its actual impact on financial deepening remains weak within the context of this analysis. This outcome diverges from prior studies by Nwakoby et al. (2020) and Okafor (2020), who acknowledged the positive effects of digital banking on profitability but noted its constrained influence on inclusive financial access, particularly in areas with limited infrastructure or low digital literacy. The result implies that although internet banking enhances profitability, its role in driving deeper, long-term financial inclusion may be limited unless complemented by broader structural and policy interventions aimed at expanding digital access, increasing trust in digital platforms, and improving financial literacy.

Hypothesis 3 (H_{03}): There is no significant relationship between mobile banking and financial performance in the Nigerian banking industry.

Hypothesis 3 **(H_{03})** is rejected based on the statistically significant result from Model 1. On the contrary, it is accepted based on the insignificant outcome from Model 2. The findings highlight the dual nature of mobile banking in the Nigerian banking industry. In Model 1, which uses Return on Assets (ROA) as a measure of financial performance, mobile banking (MB) shows a positive coefficient of 0.014664 with a p-value of 0.0665, indicating a statistically significant impact at the 10% level. This suggests that increased adoption and utilization of mobile banking enhance bank profitability over time. Mobile platforms enable financial institutions to reduce operational costs, automate services, and expand outreach to under banked and remote populations without the high fixed costs of physical branches. Services such as fund transfers, balance checks, micro-savings, and bill payments offered via mobile applications contribute to customer engagement, transactional growth, and improved return on assets. These benefits collectively support the notion that mobile banking contributes positively to financial performance, even though early-stage challenges such as user on boarding and technical constraints highlighted by Ighoroje and Okoroyibo (2020) may initially hinder returns.

In contrast, Model 2, which uses the Financial Deepening Ratio (FDR) to capture broader financial inclusion, reveals a negative long-run coefficient of -0.028621 with a p-value of 0.6988. This statistically insignificant result suggests that mobile banking does not exert a meaningful long-term influence on financial deepening within the Nigerian context. While mobile banking has the potential to expand access to financial services, the current model suggests its use remains transactional rather than transformative. As noted by Okon and Amaegberi (2018), mobile banking often facilitates routine, short-term transactions. However, it falls short in driving sustained financial engagement, such as credit access, savings mobilization, or long-term financial planning. Structural barriers such as limited digital infrastructure, low user awareness, and the constrained functionality of mobile platforms may further limit mobile banking's role in promoting inclusive financial sector development. Overall, the evidence underscores that mobile banking is profitable when effectively scaled and managed, but its capacity to foster deep, sustainable financial inclusion remains constrained without complementary reforms, expanded service offerings, and strategic alignment with broader financial inclusion goals.

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Hypothesis 4 (H_{04}): There is no significant relationship between point of sales and financial performance in the Nigerian banking industry.

Hypothesis 4 (**H_{04}**) is rejected based on the statistically significant result from Model 1. On the contrary, it is accepted based on the insignificant outcome from Model 2. The findings reveal a nuanced relationship between Point-of-Sale (POS) systems and financial performance in the Nigerian banking industry. In Model 1, which uses Return on Assets (ROA) as a proxy for profitability, POS exhibits a statistically significant negative coefficient of –0.018305 ($p = 0.0222$). This suggests that increased POS deployment or usage adversely affects bank profitability in the long run. This outcome aligns with the findings of Gambo (2020), who attributed the negative relationship to the high costs associated with POS infrastructure covering procurement, installation, maintenance, fraud mitigation, and customer support. Furthermore, regulatory fee caps and low-value transaction volumes are standard in Nigeria's POS ecosystem, which may limit revenue generation, especially in competitive urban markets or underutilized rural areas.

In contrast, Model 2, which evaluates financial deepening, reveals a positive but statistically insignificant POS coefficient of 0.049245 ($p = 0.4888$). While the positive direction suggests potential for POS systems to promote financial inclusion by extending banking services to underserved populations, the absence of statistical significance implies that this impact is not robust within the study's framework. Nevertheless, this aligns with the broader perspective in the literature, such as Taiwo and Agwu (2017), which acknowledges the enabling role of POS in enhancing digital access, promoting cashless transactions, and increasing touch points in low-infrastructure environments. However, the full financial inclusion potential of POS technology may remain unrealized without supportive measures, including reliable network infrastructure, user education, and tailored policy incentives. Overall, the results underscore the dual nature of POS systems in the Nigerian banking landscape. While they facilitate access and digital transactions, their cost structure and operational demands can undermine profitability unless effectively optimized. Strategic recalibration is necessary to balance their inclusionary benefits with sustainable financial performance.

CONCLUSION AND RECCOMMENDATIONS

This study explored the impact of electronic banking channels ATM, Internet Banking (IB), Mobile Banking (MB), and Point-of-Sale (POS) on the financial performance of the Nigerian banking industry from 2000 to 2023, using Return on Assets (ROA) and Financial Deepening Ratio (FDR) as key indicators. Collectively, these results reveal a dual narrative: electronic banking technologies in Nigeria are profitable when properly implemented and scaled, particularly internet and mobile banking, yet their capacity to drive inclusive financial deepening remains limited. Banks must therefore adopt a balanced strategy, one that maximizes the efficiency and revenue benefits of digital platforms while also addressing broader inclusion goals through policy alignment, infrastructure expansion, customer education, and service innovation tailored to underserved populations.

The study recommends the following: first, while internet and mobile banking demonstrated long-term profitability gains, their limited influence on financial deepening suggests the need for targeted digital literacy campaigns and rural outreach programs to convert transactional use into deeper financial engagement. Second, given the inverse impact of ATM and POS infrastructure channels on profitability, particularly due to high operational costs, collaborative investments in under banked areas and technology maintenance partnerships can improve

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returns while expanding access. Third, regulatory authorities, such as the Central Bank of Nigeria, should revise and standardize POS transaction fee structures to strike a balance between affordability for users and revenue sustainability for providers. Additionally, incentives can be introduced to support POS deployment in rural and underserved communities. Fourth, financial institutions should invest in product innovation within mobile and internet banking platforms. Expanding service offerings to include savings plans, credit access, and investment tools will enhance customer retention, drive value-added engagement, and support financial deepening beyond basic transactions. Finally, a national framework for digital financial inclusion should be developed, incorporating reliable data tracking, performance indicators, and periodic evaluations. This will help measure the real impact of e-banking initiatives on both profitability and financial inclusion, guiding future policy directions and sector reforms.

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