International Journal of Advanced Economics and Sustainable Development | *ISSN 2766-2659*
Published by AIR JOURNALS | *https://airjournal.org/ijaesd*
12011 WestBrae Pkwy, Houston, TX 77031, United States
airjournals@gmail.com; enquiry@airjournal.org

RESEARCH ARTICLE

Electronic Banking and Banking Sector Performance in Nigeria

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Citations - APA

Jeremiah, F. E., and Ejedegba, R. U. (2025). Electronic Banking and Banking Sector Performance in Nigeria. *International Journal of Advanced Economics and Sustainable Development 6(1), 1-13 DOI: https://doi.org/10.5281/zenodo.17002786*

ABSTRACT

This study investigates electronic banking and performance of the banking sub-sector in Nigeria for the period 2009-2023. Data were analyzed using the Panel Random Effect model technique. The results revealed that mobile pay and ATM banking services increased the ROA of banks with only ATM increasing the banks' performance indicator significantly. Electronic banking penetration rate increases the banks' ROA significantly for the period reviewed while POS and web/internet banking services decrease the ROA of banks. The study, therefore, recommends that electronic banking channels should be more secured and strictly monitored, provided with adequate infrastructure with increased access to mobile phone services in order to optimally enhance banks performance in Nigeria.

Keywords: *Mobile Banking; Return on Assets; Pool Estimation Model; Banking Sector Performance*

Introduction

Electronic banking entails the processing of inquiries or transactions online without going to the branch concerned (Fozia, 2018). New technology has rapidly transformed the traditional ways of doing banking operations. Prior to 1980s, banks in Nigeria engaged in cash/coin banking and cheque/paper banking, which led to the use and emphasis on branch banking. The difficulties associated with branch structured cash/coin and cheque/paper banking led to reforms that culminated in electronic banking systems (Oluwatosin, 2017). The innovations and inventions in the field of Information and Communication Technologies (ICTs) facilitated the emergence of electronic banking popularly known as e-banking in the 1980s. The Automated Teller Machine (ATM) was conventionally introduced as an electronic delivery channel in 1989, and was first installed by National Cash Registers (NCR) for the defunct *Societe Generale* Bank of Nigeria (SGBN) in the same year.

Since after the structural adjustment programme in 1986, the monetary authorities have adopted various measures aimed at enhancing the banking industry and reduce the strains experienced by customers (Nzotta & Okereke, 2009). In order to meet the different tastes of customers and to achieve competitive advantage, banks have over the years, designed and offered different technology driven products and services for the market. These are what the CBN (2019) mostly referred to as electronic banking (e-banking) products and services. They include Automated Teller Machines (ATMs), internet banking, web and online transfer of funds, electronic bank statement, bill payment and mobile telephone banking.

Nigeria fully adopted electronic banking system in the early 2000s (CBN, 2019). Prior to 2003, a small number of banks operated their own propriety ATM fleets (Oluwatosin, 2017). The National Cash Registers (NCS) installed the very first ATM for the defunct *Societe Generale* Bank back in 1987 and the ATM commenced restricted use in 1989. Fast forward to the early 2000s, developments at home, such as the introduction of mobile telephone in 2001 and improved access to personal computers and Internet service facilities added to the growth of electronic banking in the country. The main shared ATM network in Nigeria, Inter-switch, began operations in 2003 with 5 ATMs from United Bank for Africa (UBA) and First Bank of Nigeria (FBN) (Onodugo & Ifeanyi, 2015). However, since 2009 when e-banking services became fully open to the public, ATM transactions have averaged N2.5 trillion for the period 2009 to 2021 while mobile pay services averaged N422 billion within the same period (NIBSS, 2021). In Nigeria, transactions made using ATM reached ₦28.2trillion as at end of the year in 2023 (CBN, 2023). For the same year 2021, web-pay was valued at ₦500 billion. NIBSS (2021) released the annual payments statistics for the year ended 2021 and banks' assets was put at N237.9 trillion while banks density was 6,918 per 100,000 population (CBN, 2021).

Despite the benefits accruable to electronic banking services, it is yet to gain acceptance on a wide scale, especially in developing countries and adoption level is marginally insignificant (Agbala, 2022). At the inception of electronic banking, several stakeholders thought that the system would work easily for deposit money banks especially that most of the transactions went through mobile phones.

There is a clear correlation between e-banking and banking performance in developing countries like Nigeria. Many studies suggest that mobile pay banking, automatic teller machine, point of service, web pay banking service and electronic banking penetration rate are relevant for long term bank performance. Mobile banking plays an important role in the implementation of successful financial inclusion policies (Abubakar & Tasmin, 2012; Amiri, 2012; Ahmed, Yaser & Bashar, 2015; Farouk and Saheed, 2018; Fozia, 2018; Ashiru et al, 2023; Adu & Williams, 2023; Olise & Ejedegba, 2025).

Under the foregoing scenario, this paper seeks to examine the impact of electronic banking on banking performance in Nigeria. Specifically, the study will adopt several electronic banking services (indicators) to establish the nexus with banks performance in Nigeria.

Review of Related Literature

Conceptual Issues

Electronic Banking

Electronic banking is the engagement of information technology in banking operations. Electronic banking, stemming from the realm of e-commerce within banking and financial sectors, enables banks to provide payment services for their customers engaging in online shopping. This platform allows customers to conduct banking transactions electronically, eliminating the need for physical visits to traditional bank branches (Obi-Nwosu, Onuoha, and Okoye, 2021). Electronic banking may be described as a means by which banking products and services are provided through electronic devices such as phones, iPods, etc. Electronic banking is a secure platform that protects customers' personal and financial information from unauthorized access or fraud (Zayyanu, Umar & Taiwo, 2022). Financial institutions use advanced encryption and security measures to ensure that customers' information is safe and secure. Another advantage of internet banking is that it provides customers with a variety of banking services at their fingertips (Amaduche, Adesanya & Adediji, 2020). Customers can perform various transactions such as fund transfers, bill payments, loan applications, and account opening and closing, among others. Electronic banking also offers customers access to other financial services such as investment and insurance products, providing a comprehensive financial solution. Electronic banking has also benefited financial institutions by reducing the cost of providing banking services.

Mobile Banking

Mobile banking is the process of making financial transaction with the aid of a mobile phone. Asidok and Michael (2018) opined that mobile banking involves the use of banking and financial services with the help of a mobile telecommunication device. This is more or less fund transfer process between customers with funds available immediately for the beneficiary (Zayyanu, Umar and Taiwo, 2022). Card infrastructure is used for movement of payment instructions equally as secure SMS messaging to beneficiaries intended for confirmation of receipts. It has become a very popular as well as exciting innovation to the customers given that it requires low infrastructure to function and the speedy mobile phone penetration in the country (Adewoye, 2023). The following are some of the services under this product; funds transfer; recharge phones; changing passwords, bill payments (Asidok and Michael, 2018).

Although the product may appear exciting, it is surprising to note that most customers are yet to fully buy into it in Nigeria. To achieve this, the Central Bank and the other banks are tasked to increase awareness of the product to majority of savers in the economy (Siyanbola, 2013). The array of services provided may include the ability to perform banking and stock market transactions, manage accounts, and access tailored information (Kennedy and Jacky, 2013). Mobile banking is an electronic banking product that allows customers to access banking services through a dedicated telephone line from the comfort of their homes, offices etc. Services rendered here include; balance transfer, change of pin, authorization of inter-branch money transfer, transaction alert (withdrawal or deposit) and enquiry (Adewoye, 2023). Through this platform, customers can access their accounts using telephone lines as a conduit to connect to the financial institution's computer center. Some of the services rendered here include account balance, transfer, and change of pin. This product has also experienced low patronage as a result of inadequate awareness and education of the customer on how to maximize the use of their phones to transact simple banking operations (Siyanbola, 2013).

Automated Teller Machine (ATM) Banking

Automated Teller Machine consists of a computer-controlled device that can be instructed to dispense cash and equally provide other services to customers who are identified with a personal identification number (PIN). The introduction of this service has greatly reduced the physical carriage of cash and frequent visits to the banks. With ATM, cash is dispensed at any time of the day and it must not necessarily be located within the banking premises (Gambo, 2020). It could be located even in stores, shopping malls, and fuel stations etc. This is different from the customary method where customers queue, and sometimes, for a very long period to withdraw cash or transfer

funds. The ATM is one of the most popular e-transaction solution in Nigeria (Nwakoby *et al.,* 2020). Its popularity stems from its convenience as it has rendered withdrawing cash, or checking of account balance a lot easier (Ighoreje and Okoroyibo, 2020). However, despite its popularity, the effect of ATM has not been as expected as there is still huge amount of cash in circulation in the economy.The introduction of ATM has done very little in reducing the amount of cash in the economy (Osakwe *et al*, 2024). This could be attributable to the fact that most Nigerians use ATM only for cash withdrawal. The vast majority of customers ignore the fact that ATM machines can perform other functions like fund/cash transfer, mobile phone credit recharge and bills payment (Osakwe *et al*, 2024). According to Ighoreje and Okoroyibo (2020), Automated Teller Machine (ATM) is an electronic device that provides a range of banking services to customers without the need for face-to-face interaction with a bank teller. It is designed to operate with the use of a plastic ATM card, which is linked to the customer's bank account. This card is placed in the card slot of the machine, and the customer is asked to input their personal identification number (PIN), which is a security measure to make sure that the account is only accessed by the account holder (Osakwe *et al*, 2024). Once the customer is authenticated, the ATM provides a range of services, including cash withdrawals, balance inquiries, and funds transfers between accounts. Some ATMs also allow customers to deposit cash and check directly into their accounts, and some offer additional services such as bill payment and prepaid card purchases (Osakwe *et al*, 2024).

Point of Service (POS) Banking

Point of sale is a portable device or machine that enables payment for goods and services using a bank card (Aginam, 2024). In Nigeria, POS is used in supermarkets, petrol stations, boutiques, churches, etc. It is a valid means of payment amongst urban dwellers. As an electronic payment system, using the POS requires the cardholder to insert a bank card in the machine, input his personal identification number (PIN) and the amount to be debited and then press enter (OK) to effect payment (Aginam, 2024).

Web Pay/Internet Banking

Web Payments is an emerging web standard developed to simplify online payments and enable a broader set of players to participate easily in the payment ecosystem on the web. The standards are flexible; work with various types of payment systems and are intended to work on any browser on any device, payment method, or payment service provider. This flexibility enables development simplicity, deployment consistency, and future compatibility with emerging payment technologies (Okonkwo and Ekwueme, 2022). Web payment or internet banking is a form of electronic funds transfer system used in various emerging and advanced nation of the world. It is a nationwide electronic payment system that allows individuals, businesses, and financial institutions to transfer funds from one bank account to another securely and efficiently. Frank and Binaebi (2019) proposed that electronic funds transfer is a banking method through which individuals execute fund transfers, inquire about account balances, settle bills, and manage assets such as stocks online. This involves the utilization of banking products and services directly by customers over electronic and communication networks. Electronic banking, in essence, refers to leveraging the internet as a delivery mode for services, encompassing activities like opening deposit accounts, electronic bill payments, online transfers, withdrawals, and any other transactions conducted through online banking. According to Muotolu and Nwadialor (2019), electronic finance (e-finance) can be defined as the provision of financial services and market activities using electronic communication and computation. It is a medium that involves the use of electronic devices such as the Internet, wireless connections, networks, ATMs, phones, and cell phones in the delivery of banking services.

A number of studies have examined the linkage between electronic banking channels and banks' performance both in Nigeria and outside Nigeria. One common feature of the previous studies is their consistent use of any of the e-banking channels such as mobile, POS, ATM or internet banking services. However, our review shall disaggregate the empirical works carried out on each e-banking channel with a view to identifying the gap in literature.

Momanyi (2020) applied descriptive research design to study the effect of mobile banking on profitability of commercial banks in Kenya. The target population was the 43 commercial banks operating in Kenya as at December 2019. The total amounts transferred through mobile banking for the past five years were collected and the number of active mobile banking users was regressed against bank performance as measured by the return on assets. The

study used secondary data from the Central bank of Kenya and Kenya National Bureau of Statistics. Analysis involved multiple regressions of variables under study. From the regression model of 5 years, the study found a positive relationship between mobile banking and banks profitability. The study results showed that Mobile Banking had an influence on profitability of commercial banks in Kenya. The study concluded that mobile banking offers banks several opportunities for increasing revenues. The study recommended that commercial banks should continue to adopt new technologies which will improve their profitability. They also suggested that policy makers should consider mobile banking in their formulation of policies because of the technological developments and the expected switch from physical branch networks to technologically supported banking services that will improve profitability which will convert to better tax revenues for the government.

Omotosho (2021) analyzed user experience of mobile banking applications in Nigeria using a text mining approach. The study analyzed textual data mined from 37,460 reviews written by mobile banking application users in Nigeria over the period November 2012 – July 2020. On a scale of 1 to 5 (5 being the best), the average user rating for the twenty-two apps included in the sample was 3.5; with the apps deployed by non-interest banks having the highest average rating of 4.0 and those by commercial banks with national authorization having the least rating of 3.4. Results from the sentiment analysis revealed that the share of positive sentiment words (17.8%) more than double that of negative sentiment words (7.7%). Furthermore, the research found that about 66 per cent of the emotions expressed by the users were associated with 'trust', 'anticipation', and 'joy' while the remaining 34 per cent relate to 'surprise', 'fear', 'anger', and 'disgust'. These results implied that majority of the users were satisfied with their mobile banking experience.

Cho, Lee, Hwang and Kim (2023) microscopically compared the effects between bank branch closures and changes in net profit using a time-series analysis. Specifically, they quantitatively analyzed actual customer attrition behavior with a time-series analysis across the three quarters before and after the closure of 88 branches of major commercial banks in South Korea in the Seoul metropolitan area and nearby cities. The findings proved that branch closures and multi-channel effects in the financial sector were gradually being resolved through immediate technology acceptance, contrary to popular concern.

Osakwe, Obi-Nwosu, Anachedo and Ekenma (2024) investigated how automated teller machines (ATM) and mobile banking affects performance of deposit money banks in the Nigerian economy. The study made use of time series data which were obtained from the Central Bank of Nigeria Statistical Bulletin from 2009 to 2021. The Central Bank of Nigeria (CBN) data on automated teller machine and mobile phones banking were used to proxy electronic banking while total deposits in banks proxied the performance of deposit money banks. The analysis was done using ordinary least square econometric technique with the aid of E-views statistical package. The results showed that the automated teller machine has a positive and significant effect on the performance of deposit money banks and mobile banking has a positive effect on the performance of deposit money banks in Nigeria. It was concluded in the study that e-banking has equally increased banking access to customers and also created room for banks to expand their operations to more customers.

Kolawole et al (2024) examined the causal relationship as well as short-term and long-term dynamic effects between digital financial service components on the performance of the quoted commercial banks. The study employed a cross-sectional descriptive survey research and ex-post facto research. Descriptive statistics were used to analyze responses and opinions, while inferential statistics including the dynamic Panel Autoregressive Distributed Lag (PARDL) approach and Panel Granger Causality Test. The Granger Causality analysis revealed that Agency banking exhibits a strong causal link to ROA, while internet banking, ATM banking, internet banking and POS activities all have positive impacts on ROA. In the short term, these variables also showed positive coefficients, suggesting immediate effects on ROA. Overall, agency banking, ATM banking, internet banking, and POS activities were crucial drivers with strong statistical significance, while mobile banking has limited influence on ROA.

Nwayen, Ukpong and Uwah (2024) investigated the relationship between financial technology (FINTECH) and listed deposit money banks in Nigeria, this study used an ex-post facto research design, utilising annual reports and accounts of listed deposit money banks on the Nigerian Stock Exchange (NSE) as well as secondary data obtained from the Central Bank of Nigeria Bulletin for the independent variables. Profitability, as determined by Return on

Assets, was taken from the audited financial reports of five listed deposit money banks out of eleven banks quoted on the Nigerian Exchange Group, with the five listed deposit money banks chosen through judgmental sampling techniques over a ten-year period (2010-2019). Among the banks were Zenith Bank Plc, Unity Bank Plc, Fidelity Bank Plc, United Bank for Africa Plc, and Wema Bank Plc. With SPSS 20 statistical software, the data were analyzed using descriptive statistics, regression analysis, and correlation analysis. The outcome demonstrated that mobile pay and automated teller machines had a statistically negligible effect on the profitability of Nigeria's listed banks.

Okpara, Eke and Amenzee (2024) examined the impact of financial inclusion on performance of Deposit money Banks in Nigeria. Specifically, the study looks into the impact of bank branch spread, ATM spread and bank loans to small and medium enterprises on financial inclusion. The study adopted the ex-post facto research design and data was gotten from the financial statement of listed deposit money banks and CBN statistical bulletin. The study investigated twelve (12) listed deposit money banks from the period of 2018-2022. Panel least squares was used to estimate the models of the study. The findings of the study revealed that the penetration of financial services through bank branches has no significant impact on bank performance in Nigeria; The penetration of financial services through ATM spread has positive and significant effect on bank performance in Nigeria; The usage of financial services via SMEs loans has no significant impact on bank performance in Nigeria; The study concluded that financial inclusion has mixed influence on financial performance of banks in Nigeria. The study recommended that banks should continue to increase the number of branches in the rural areas to drive full financial inclusion which would in the long-run improve the financial performance of banks; The current drive of digital financial inclusion through ATM spread should be sustained to allow access of financial services to the unbanked population.

Opuala-Charles and Dibia (2023) investigated the relationship between financial inclusion and profit levels of Commercial Banks in Nigeria. Financial Inclusion was conceptualized by four independent variables namely; number of agents banking deployed (POS), number of ATM Machines, number of bank branches, and number of accounts opened. Inflation rate and cost of funds were used as control variables. Secondary time series data were used. The major analytical procedures adopted were the unit root analysis, cointegration, and the regression analysis. The results showed that the number of accounts per one thousand adults, and branches per hundred thousand adults exerts a positive influence on a bank's profitability. They observed that these were as a result of the increase in POS terminals across the country which has increased financial inclusion. Hence, the study recommended among others that more measures be taken to address financial exclusion of low-income groups from financial services.

Nworie and Okafor (2023) examined the challenges facing the use of Point of Sale (POS) Terminals in the Nigerian Banking System. The researchers adopted exploratory research design whereby secondary data were sourced from already published journal articles. Thematic approach was deployed in presenting the research findings. The study found that POS services help banks keep and enhance the loyalty of their obtainable customers, provide opportunity to the banks to increase market share and increase customer satisfaction. Among the factors identified as responsible for the low adoption of POS terminals in Nigeria are exorbitant transaction charges, lack of adequate infrastructure required to run POS, irregular network connectivity which erodes the trust of the users, and security of network communications. The study recommended that the charges and fees on the use of POS terminals should be considerably lessened in order to avoid discouraging banked and unbanked population from using such channel to access the services of the banking cubicle.

Ele, Ekwere and Uguru (2024) investigated the impact of financial technology on banking service delivery in Nigeria for the period 2005-2022. The specific objectives of the study were to determine the impact of POS technology online web payments technology on banking service the impact of ATM technology on banking service delivery in Nigeria, and to investigate the impact of mobile banking technology transactions on banking service delivery in Nigeria. The study adopted ex-post facto method, and employed the autoregressive distributed lag (ARDL) to estimate the model. It was found that ATM, POS and ONLIT impact on bank performance positively in Nigeria.

Adiga and Haruna (2024) examined the effect of electronic banking on the performance of deposit money banks in Nigeria. The study used secondary data sourced from the Central Bank of Nigeria (CBN) and the Nigeria Inter-Bank Settlement System (NIBSS). Data analysis was done using the OLS regression model to test the relationship between electronic banking aspects of web transactions and mobile transactions, and the performance of deposit money

banks measured via loans and advances and private sector deposits. The findings showed that both web and mobile transactions do not affect loans and advances and private sector deposits. Thus, the study concluded that electronic banking failed to influence the performance of deposit money banks in Nigeria, recommending that the regulatory authorities should adhere to and promote cashless policy as a way of facilitating the increased use of electronic banking components like the web and mobile transactions, which will in turn increase banks' loans and advances, and deposit base.

Iwedi (2024) explored the impact of digital banking technology adoption on the operational efficiency of commercial banking firms in Nigeria. It synthesizes existing literature to establish theoretical frameworks, including technological adoption and operational efficiency theory, customer experience and efficiency enhancement theory, and regulatory compliance and risk management theory. Empirical evidence is provided through quasi-experimental research design utilizing financial time series analysis. Findings indicate a significant and positive relationship between the adoption of digital banking technology and the efficiency of commercial banking firms. Panel unit root tests confirm non-stationarity at the level values of all variables, with stationarity achieved through differencing. Cointegration tests revealed a long-run equilibrium relationship between digital banking technology adoption and banking efficiency. Pairwise Granger causality tests suggested uni-directional causality from electronic fund transfer to operational efficiency. The study concluded that policymakers and stakeholders should prioritize strategies promoting digital banking technology adoption to enhance the efficiency and performance of commercial banking firms in Nigeria.

Aginam (2024) investigated the effect of Internet banking on the performance deposit money banks in Nigeria. Specifically, the study examined the effect of automated teller machine on the performance of deposit money banks in Nigeria, assess the effect of point of sale on the performance of deposit money banks in Nigeria, examine the effect of mobile banking on the performance of deposit money banks in Nigeria and investigated the impact of internet banking on the performance of deposit money banks in Nigeria. The study adopted an ex-post facto research design because the data for the study are secondary data that already exist in the archives of well acclaimed financial institutions such as the Central Bank of Nigeria. The result of the study revealed that automated teller machine had positive and significant effect on the performance of deposit money banks. Point of sale had positive and significant effect on the performance of deposit money banks. Mobile banking had positive and significant effect on return on the performance of deposit money banks and internet has significant effect the performance of deposit money banks in Nigeria. The study thus concluded that financial innovations have positive effect on the performance of deposit money banks and have improved the performance of deposit money banks in Nigeria.

Theoretical Framework

The theory of financial inclusion is the main theoretical framework of this study. The theory holds that rural unbanked people desire banking services and by making banking services to reach every unit of the population, banking services will become universal which can equally help to advance the objective of banking which is to increase profitability and at the same time enhancing access to financial services. This theory is very much applicable to this present research because the objective of advancing electronic banking is to make banking services accessible to rural population which is the main thrust of financial inclusion. It follows that when financial services are being promoted at the rural level through the offering of electronic banking services via agent banking, it will make the unbanked to be on a decreasing trend in most rural communities and at the same time there will be increased profitability (ROA) on the part of the banking institutions. Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs, transactions, payments, savings credits and insurance- delivered in a responsible and sustainable way.

Methodology

This research adopted the *ex-post-facto* research design, employing the use of secondary time series data. It entails gathering of time series data that have cross-sectional properties i.e. data from five different banks and embarked on diagnostic tests of unit root, cointegration as well as pooled estimation. The model adapted followed the route of Itah and Ene (2021). Thus, the model is mathematically specified as follows:

$$ROA = f(MOB, ATM, POS, WEB, EBP) \quad (1)$$

The equation (1) is functionally specified thus:

$$ROA_{it} = \alpha_0 + \alpha_1 MOB_{it} + \alpha_2 ATM_{it} + \alpha_3 POS_{it} + \alpha_4 WEB_{it} + \alpha_5 EBP_{it} + \mu_i \quad (2)$$

Where:

ROA = Return on asset of banks (selected banks)
MOB = Value of transactions made via mobile pay banking
ATM = Value of transactions made via Automated Teller Machine
POS = Value of transactions made via point-of-service (POS)
WEB = Value of transactions made via web pay banking service
EBP = Electronic banking penetration rate

A priori expectation: $\alpha_1 - \alpha_5 > 0$.

Presentation and Analysis of Result

Panel Unit Root Test

First, unit root test was conducted on all the variables of the model to ascertain whether stationarity exists within them to avoid spurious results. Table 1, presents the results of the unit root tests.

Table 1: Panel Unit Root Test without Structural Breaks

Method LLC test	LNROA	LNMOB	LNATM	LNPOS	LNWEB	LNEBP
Level	-2.46346	-1.22547	-4.76280	-0.11366	-1.28870	-1.20817
(p-value)	*(0.0069)**	*(0.1102)*	*(0.0000)**	*(0.4548)*	*(0.0988)*	*(0.1135)*
1st Difference	-4.27001	-48666	0.10071	-3.41829	-5.30273	3.30505
(p-value)	*(0.0000)**	*(0.0002)**	*(0.5401)*	*(0.0003)**	*(0.0000)**	*(0.0041)**

Source: Author's computation, 2025

Note: *Probabilities of the tests statistics are presented in parenthesis.*
** indicates that the test statistic is significant at the 5% level*

The panel unit root test presented in table 1 above are relatively consistent and imply that all variables are I(1) i.e. they are all stationary after first differencing except for ROA and ATM transactions that were stationary at level. However, these unit root tests assume cross-sectional independence and do not incorporate structural breaks. Consequently, the tests may have little power if the estimated data suffers from cross-sectional dependency (CD) (Sadorsky, 2014). Therefore, the second step is to run Pesaran's (2004) CD test. The null hypothesis is that there is cross-section independence while the alternate hypothesis is that there is cross-section dependence. The result is displayed in Table 2.

Table 2: Cross-Sectional Dependency Test

Variable	*CD-test*	*p-value*
LN ROA	*4.5629*	*0.0000*
LN MOB	*11.402*	*0.0000*
LN ATM	*11.402*	*0.0000*
LN POS	*11.402*	*0.0000*
LN WEB	*11.402*	*0.0000*
LN EBP	*11.402*	*0.0000*

Source: Author's computation, 2025.

Table 2 gives sufficient significant evidence to reject the null hypothesis of cross-section independence for all the variables (ROA, MOB, ATM, POS, WEB and EBP). This implies that the data are independent of each other and takes due cognizance of bank peculiarities. The cross-sectional independence of the data is also a result of the peculiar return on asset of the banks, which showed clear difference for the years under study. The study assumes cross-section independence for the variables.

5.2 Cointegration Test

Variables are said to be cointegrated if there is a linear combination between them that generates non-trending residuals. The Kao Engle-Granger (1987) based test requires that every variable must be I(1) in order to be cointegrating between variables. Therefore, the Kao residual cointegration test holds that I(1) variables are said to be cointegrated if their residuals are I(0) – in other words, variables in the model move together and do not diverge over time. However, Johansen's (1988) definition of cointegration proposes that models containing I(0) and I(1) variables can be cointegrating as long as the I(1) series are cointegrating. As the basis for this analysis, we employ the Kao panel cointegration test which follows the Engle-Granger test. The test uses the residual of the model to test the cointegrating relationship as shown in Table 4.2 below:

Table 3: Kao Residual Cointegration Test for Pooled Data

	Kao Residual ADF test statistic (*p-value*)		Residual variance	HAC variance
ADF test	-3.6938	(0.0001)***	0.4052	0.290035

Source: Author's computation

Table 3 presents the outcome of the cointegration test. The result suggests that cointegration exists between the variables. The long run relationship affirms that electronic banking has long run implications on the performance of the banking sector in Nigeria. This means that the effect of electronic banking on the banking sector can vary depending on the outcome of the electronic banking variables in the long run. The long-run equilibrium relationship between electronic banking and banking sector performance implies that we estimate the long-run coefficients. However, the estimation cannot be carried out without taking due note of the type of estimation method available to test the panel data models. Thus, Hausman test was carried out.

Table 4: Hausman Specification Test for FE and RE Estimations

	Chi-Sq. (*p-value*) statistic		Chi-Sq. d.f	Decision
Hausman Test Stat.	2.8419	(0.5846)	4	p>0.05 accept null (RE)

Source: Author's computation, 2025

The results clearly indicate that estimations using the random effect (RE) approach is most preferred. Therefore, it would appear that conventional estimation using the fixed effect slope coefficients are unsuitable on statistical grounds. Specifically, Hausman test results justified preference for Random Effects method.

Table 5: Random Effect Estimates

Variables	Coefficient	Std. Error	t-Stat.	*p-value*
C	1.327714	0.700709	1.894815	0.0629
MOB	0.000149	0.000337	0.442070	0.6600
ATM	0.000273	0.000106	2.568003	0.0127
POS	-0.000379	0.000858	-0.442328	0.6598
WEB	-0.000550	0.001673	-0.328494	0.7437
EBP	0.018541	0.004415	4.199257	0.0001

Source: Author's computation, 2025

Table 5 presents the random effect estimates. The results show that mobile banking transactions (MOB) exerts positive effect on the banks' ROA with a coefficient of 0.000149 units, although not statistically significant. Positive relationship was also found between values of ATM transactions, EBP and ROA. The magnitude of effect was 0.000273 units for ATM and is statistically significant at 5 percent level. This implies that electronic banking measured by mobile and ATM banking transactions increases the profitability (ROA) of banks in Nigeria. On the other hand, negative relationship exists between POS transactions, web/internet transactions, electronic banking penetration rate and ROA. Specifically, POS and web/internet banking transactions decrease return on assets of the banks by 0.000379 and 0.00055 units respectively. The decrease were however, not significant given their respective *p-values* of 0.6598 and 0.7437 which are greater than the 0.05 critical value.

Electronic banking penetration (EBP) increased banks' performance by 0.0185b units. This implies that a unit change in electronic banking penetration rate increases the ROA of banks significantly given the p-value of 0.0001.

Conclusions

The importance of electronic banking in enhancing the performance of banks in Nigeria cannot be over-emphasized. Deposit money banks have no doubt benefitted from innovative banking services such as mobile, internet and even point-of-sale banking services. This study did a thorough analysis of electronic banking channels and their effect on the ROA of banks in Nigeria and made some useful findings. The conclusion from the findings is that electronic banking services have increasingly enhanced the performance (ROA) of banks in Nigeria, particularly through mobile and ATM banking channels. The ratio of electronic banking transactions to GDP (e-banking penetration rate) increasingly enhanced ROA of banks significantly which suggests that banks have been making significant progress in their profitability ratio given increased access to electronic banking channels.

Point-of-service (POS) and web/internet banking channels showed decreasing effect on banks' performance which suggests that banks may not be making enough profits from these channels. In order to ensure increased bank profitability, bank management should ensure amongst others, that point-of-service banking channels is secured, efficient and strictly monitored. The proliferation of POS services and the resultant negative effect on banks' profitability suggest that banks may not have been effectively monitoring this e-banking channel. The regulatory authority should enhance banking infrastructure that will make web-banking experience to be seamless and more secured. Mobile banking channel should be made to have significant effect on banks' performance metric by way of increasing access to mobile services especially in rural areas. The monetary authorities should intensify efforts in enhancing e-banking penetration through the introduction of more e-banking channels, improvement in the existing channels and engaging in customer sensitization especially in rural areas. Improvement in banks' performance is a function of enhanced electronic banking channels and all banks should ensure they actively engage in customer sensitization and enlightenment

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