

Effect of Financial Innovations on Economic Growth in Nigeria

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Abstract

This study examines the effect of financial innovations on economic growth in Nigeria from 2009 to 2024. Economic growth was measured by real GDP, while ATM and NEFT transactions served as proxies for financial innovations. The study employed an ex post facto research design and utilized quarterly time series data sourced from the CBN's statistical bulletin. Descriptive statistics were used to summarize the data, while the ARDL model was applied to estimate the relationship between financial innovations and economic growth. The results showed that ATM had a positive and significant effect on economic growth in Nigeria, while NEFT had no significant effect on growth. Based on these findings, the study recommended upgrading ATM networks with advanced features to enhance efficiency and address short-run liquidity gaps. Furthermore, stronger collaboration between banks and fintech firms was recommended to improve the reliability and accessibility of digital payment platforms, thereby maximizing their contribution to economic growth. Also, the Central Bank of Nigeria (CBN) and other financial regulators should strengthen the linkage between digital payment systems and the real economy, thereby promoting wider access to financial services, particularly among rural and informal sector participants, to ensure that the benefits of NEFT extend beyond the formal banking sector.

Keywords: *Fintech Innovation, Economic Growth, Automated Teller Machine, National Electronic Funds Transfer, Real Gross Domestic Product.*

Introduction

Technology has gained global prominence as a major catalyst of economic growth by improving the access, service quality, and cost-efficiency of financial systems. Fintech innovations such as digital payments, mobile money, decentralized finance, and blockchain are redefining economies by improving service delivery and deepening financial penetration (Mazer & Rowan, 2022). Developed countries such as the United States, the United Kingdom, the European Union, Japan, and South Korea have incorporated advanced technologies, including Artificial Intelligence, quantum computing, blockchain, and cloud computing, into their financial systems. At the same time, regulatory frameworks are being strengthened to handle emerging risks and ensure a stable and competitive financial system. China has emerged as a leader in fintech innovation with AliPay, WeChat Pay, and the Digital Yuan, while in Brazil, India, and Southeast Asia, fintech drives financial access through microfinance and technology-driven programmes (Jones, 2021; Li et al., 2023).

In Africa, the adoption of fintech solutions, reflected by the introduction of M-Pesa in Kenya in 2007, has paved the way for countries to bypass traditional banking systems, enabling mobile

phone users to perform basic financial transactions without owning a bank account, thereby redefining financial service delivery to underserved and unbanked populations. Likewise, in Nigeria, fintech innovation has expanded rapidly, fueled by a dynamic fintech landscape consisting of companies like Flutterwave, Paystack, Interswitch, and Paga, which have improved financial access, supported the growth of Small and Medium-sized Enterprises (SMEs), and simplified domestic and international transactions.

Economic growth can be viewed from the perspective of the total market value of all formally recognized final goods and services produced within a country in a given period, usually a year. In this context, it is considered a quantitative and continuous increase in per capita output or income. This method of measuring growth highlights contributing factors and analyzes it from the standpoint of real GDP, which means estimating the value of all goods and services produced after accounting for inflation, and is in line with the widely accepted view of economic growth as a continuous increase in a country's output over time (Mankiw, 2021; Todaro & Smith, 2020; Akalpler, 2023).

Financial innovation supports economic growth by enhancing the accessibility, efficiency, and delivery of financial services, thereby reducing transaction costs, improving access to credit, and encouraging investments and other business activities. By integrating more individuals and businesses into the formal financial system, these innovations boost the productive capacity of the economy. Fintech innovations also promote financial stability by extending services to underserved areas and mitigating systemic risks, thereby creating the conditions necessary for sustained and inclusive economic growth (Olaniyan & Bello, 2022). These innovations have accelerated the adoption of the Automated Teller Machine (ATM) and National Electronic Funds Transfer (NEFT) platforms in Nigeria, particularly in underbanked rural and semi-urban areas (CBN, 2021).

The Automated Teller Machine (ATM) represents an important innovation in Nigeria's financial system, which is now widely deployed across urban and semi-urban locations, and has started to penetrate rural areas. The platforms provide round-the-clock access to essential banking services such as cash withdrawals, funds transfers, balance enquiries, and bill payments. As part of Nigeria's cashless policy and financial inclusion strategy rolled out in 2012, several efforts have been made to deploy ATMs to underserved communities, thereby bringing formal financial services closer to previously excluded populations. (Adesete et al., 2021; Mtar & Belazreg, 2021). Likewise, the National Electronic Funds Transfer (NEFT) system is a secure and efficient wholesale payment platform established in Nigeria in 2004 by the Nigeria Inter-Bank Settlement System (NIBSS), with support from other financial institutions and regulatory oversight from the Central Bank of Nigeria (CBN). The platform is powered by NIBSS, and it enables electronic funds transfers between banks across the country. The NEFT facilitates low-cost, seamless, and efficient interbank transfers, thus supporting Nigeria's cashless economy, improving payment system efficiency, promoting financial inclusion, allowing funds to be transferred between accounts domiciled at different banks, supporting electronic payments for business transactions, reducing reliance on cash, and enabling bulk payments such as salaries for government institutions and other organizations (CBN, 2023).

In Nigeria, fintech innovations such as ATM and NEFT have transformed how individuals and businesses access and use financial services. These platforms are expected to reduce transaction costs, enhance payment convenience, promote financial inclusion, and ultimately contribute to economic growth. Despite the increasing adoption of these innovations, Nigeria's economic growth trajectory remains inconsistent, with periods of expansion punctuated by stagnation and decline. This raises the question of whether financial innovations, particularly ATM and NEFT transactions, have translated into meaningful macroeconomic gains. The post-2009 sectoral reforms facilitated the adoption of these digital innovative solutions, thereby expanding

financial access and promoting savings, credit, and investment across the country. However, existing literature presents divergent results regarding the actual impact of these innovations on economic growth, due to differences in research methods, datasets, and timeframes. Therefore, this study examines the effect of financial innovations on economic growth in Nigeria.

This study formulated and tested the following null hypotheses:

Ho1: Automated Teller Machine transactions have no significant effect on economic growth in Nigeria.

Ho2: National electronic funds transfer transactions have no significant effect on economic growth in Nigeria

Literature Review

Concepts of Economic Growth

Economic growth is the steady increase in the production of goods and services in an economy over time, and it is usually measured by the percentage rise in real GDP adjusted for inflation. It is the total output of final goods and services produced in an economy within a given period, and is commonly measured by Gross Domestic Product (GDP). Nominal GDP is calculated using current market prices and may increase due to higher output or rising prices, while real GDP accounts for inflation to reflect actual economic performance. However, GDP excludes some items, such as illegal goods and services, which are not officially recorded. On the other hand, GDP at purchaser's prices is the sum of gross value added by all resident producers, plus product taxes and minus subsidies, without deductions for asset depreciation or natural resource depletion. Thus, economic growth can be looked at as a continuous increase in real GDP or per capita income, leading to improved living standards and economic development. This view underscores key drivers of growth, including investment, human capital, infrastructure, and sound government policies, thereby highlighting the need for African countries to draw lessons from China's growth model (Mtar & Belazreg, 2021; World Bank, 2021).

This study describes economic growth as the capacity of a country to produce goods and services within a period of time, often reflected in a consistent rise in real GDP that leads to improved human capital, living standards, and overall development.

Financial Innovation

According to Naeem et al. (2023), financial innovation, also known as fintech innovation is the creation, implementation, and spread of new financial securities, technologies, institutions, and markets aimed at addressing inefficiencies in the financial sector. They classified fintech innovation into product innovation, involving tools like credit cards, green bonds, and cryptocurrencies, and process innovation, which includes solutions such as online banking and digital funds transfers. Tahir et al. (2018) described fintech innovation as the introduction of new financial assets and markets, spurred by technological progress. They grouped fintech innovation into three categories: process innovation, which includes improved service delivery methods like ATM and mobile banking; product innovation, which involves new financial products such as derivatives and green bonds; and institutional innovation, which refers to the creation of novel financial institutions like discount houses and other firms in the sector. These innovations aim to improve the efficiency of financial institutions by enabling faster and more convenient lending and borrowing services. Fintech innovation involves the design and application of new financial products, services, and processes, driven by advancements in payment systems and financial instruments, which significantly contribute to progress in the financial sector. It is a process through which firms develop, promote, and deploy these innovations, thereby playing a key role in improving institutional performance by increasing

customer satisfaction, boosting sales, and encouraging greater consumer engagement (Wójcik-Czerniawska, 2023).

This study defines financial innovation as the design and deployment of new technologies, processes, products, and institutions within the financial system to improve service delivery. It includes platforms such as ATMs, NEFT, and other electronic payment systems, which improve efficiency, accessibility, service delivery, risk management, and income generation, while meeting changing customer needs, regulatory requirements, and market conditions.

Automated Teller Machines

The Automated Teller Machine (ATM) is a digital banking platform that allows customers to carry out basic financial transactions by means of a credit, debit, or prepaid card without the support of bank staff, thus providing a convenient and user-friendly interface where clients can readily conduct self-service transactions such as cash withdrawals, balance enquiries, bill payments, and funds transfers. The ATM card, also known as a smart card, bank card, client card, key card, or cash card, is a payment card issued by financial institutions to their customers that enables them to perform basic banking transactions via ATMs (Ehiedu et al., 2022).

This study describes an ATM transaction as a digital banking activity, such as cash withdrawals, deposits, funds transfers, and balance enquiries, conducted via electronic machines using a smart card, without assistance from bank staff.

National Electronic Funds Transfer (NEFT)

A National Electronic Funds Transfer (NEFT) transaction refers to an electronic funds transfer process conducted through a batch-based system that enables the transfer of funds between bank accounts across a country. It is a batch-based digital funds transfer system and an electronic payment system that enables individuals and businesses to transfer funds safely and efficiently between bank accounts across a country (Ozurumba & Charles, 2019). NEFT transactions operate like other international electronic funds transfer systems, as users can access the services through their bank online platforms, mobile applications, or by visiting bank branches. The system supports a wide range of transactions, including personal remittances, bill payments, and business transactions, ensuring seamless funds transfers across the country, thus promoting financial inclusion and accessibility to banking services, especially in rural and underserved areas (Jaffar et al., 2024). Thus, NEFT is a simple, safe, fast, and low-cost platform, especially for retail banking transactions, adopted in countries such as Nigeria and India to improve domestic interbank funds transfers.

This study describes NEFT transactions as an electronic funds transfer process conducted through a batch-based system that enables funds transfers across different banks in the country. It is commonly used for domestic money transfers, allowing individuals and businesses to send and receive money between bank accounts.

Empirical Review

Adebisi et al. (2023) examined the influence of digital payment methods on sustainable growth in Nigeria, utilizing quarterly data spanning from 2015 to 2021. The research concentrated on four payment methods: Point of Sale (PoS), mobile payments, Automated Teller Machines (ATM), and transactions conducted online, employing household consumption expenditure (CSP) as an indicator of sustainable growth. Data were collected from the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN). The study used various econometric methods, such as the Augmented Dickey-Fuller (ADF) test for stationarity, cointegration analysis, Vector Autoregression (VAR), Vector Error Correction Model (VECM), and Ordinary Least Squares (OLS) multiple regression. Their findings showed that ATM and mobile payment methods demonstrated a positive yet insignificant impact, whereas PoS and

web-based transactions showed a negative and statistically insignificant influence on sustainable growth. Despite employing multiple analytical models, the study's focus on household consumption expenditure (CSP) as the sole indicator of sustainable growth overlooked the wider economic implications typically represented by real GDP. In contrast, the present study used real GDP as a broader growth indicator, extended the dataset to 2024 to provide a more detailed investigation into the nexus between fintech innovations and economic growth in Nigeria.

Gambo et al. (2023) conducted a study on the impact of Nigeria's cashless policy on economic growth from 2011 to 2018. The study employed a correlational research design and sourced data from the Central Bank of Nigeria (CBN) statistical bulletins. Point of Sale (PoS), Automated Teller Machines (ATM), and web banking transactions were used as independent variables, while the dependent variable, Gross Domestic Product (GDP) served as the proxy for economic growth. Descriptive statistics were used to summarize key characteristics of the data, such as averages, standard errors, and minimum and maximum values for all variables. Multiple regression analysis was then applied to assess how ATM, PoS, and web banking influenced GDP. The findings showed that ATM transactions had a positive but statistically insignificant effect on GDP, whereas PoS and web banking had a negative impact. Although the study identified notable trends, its reliance on a correlational design, a short timeframe, and the lack of a model for testing long-term relationships weakened its depth, reliability, and capacity to reflect long-term effects. In contrast, the current study extended the study period to 2024 and adopted the ARDL model, thereby capturing both long-term and short-term dynamics and providing a more detailed analysis of the influence of ATM and NEFT transactions on economic growth.

Daasi (2023) examined the relationship between electronic banking and economic growth in Nigeria, focusing on the effects of ATMs, PoS, internet (web) banking, and mobile banking on the economy from 1990 to 2021. Economic growth was measured using Gross Domestic Investment (GDI), while electronic banking was represented by PoS, mobile banking, internet (web) banking, and ATM transactions. Regression analysis was used to evaluate the impact of electronic banking on both the banking sector and the Nigerian economy. The Augmented Dickey-Fuller (ADF) test was applied to test for stationarity, and the Engle-Granger test was used to assess the long-term relationship among the variables. The ARDL Bound test confirmed the presence of long-run relationships. Also, several diagnostic tests were carried out, including the Jarque-Bera test for normality, the Durbin-Watson test for autocorrelation, and stability tests to ensure the consistency of the model. Furthermore, the Granger causality test was employed to determine the direction of causality between electronic banking and the banking sector, while hypothesis testing assessed the significance of the relationships. The results revealed that PoS and ATM transactions had a positive short-term impact on GDI, mobile banking had a negative effect, and internet banking had an insignificant short-term influence. Although the study applied diverse econometric techniques, its reliance on GDI limited its ability to capture the broader dimensions represented by real GDP. In contrast, the present study employed real GDP, and extended the dataset to 2024, thereby offering a more recent analysis of ATM and NEFT transactions on economic growth in Nigeria.

Osuigwe (2022) examined the effect of financial innovation on economic growth in Nigeria. The study adopted an ex-post facto research design and relied on secondary data sourced from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS), covering the period from 2008 to 2021. Descriptive statistics were used to assess data normality, including measures such as the mean, standard deviation, and the Jarque-Bera test. To check for stationarity, the study applied the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Ordinary Least Squares (OLS) regression analysis was then used to examine the relationship between financial innovation indicators and economic growth. The analysis

included the R-squared statistic to determine the explanatory power of the model, the F-test to evaluate the overall significance, the t-test for the individual coefficients, and the Durbin-Watson test to assess autocorrelation. The results showed that transactions through PoS, ATM, mobile banking, and web (internet) banking had a positive and significant effect on Nigeria's economic growth and annual GDP. Although the study provided useful insights, it relied on OLS regression, which restricted its ability to capture short-run and long-run effects, while the use of annual GDP narrowed the scope by overlooking higher frequency variations in the impact of digital financial services. In contrast, the present study extended the study period to 2024, used quarterly data, and applied the ARDL approach to capture both short-term and long-term effects of financial innovations on economic growth.

Ezi et al. (2024) investigated the relationship between cashless payments and economic growth in Nigeria, from the first quarter of 2009 to the fourth quarter of 2022. The study aimed to analyze how the cashless payment system influenced economic growth. Cashless payments were represented by ATM, PoS, and web-based transactions, while real GDP was used to measure economic growth. The study adopted a quantitative research design and relied on quarterly data obtained from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). To ensure the reliability of the data, unit root tests were conducted to assess stationarity, and cointegration tests were applied to determine the existence of long-run relationships among the variables. The Dynamic Ordinary Least Squares (DOLS) method was used for the analysis, as it is well suited for handling non-stationary data and correcting for cointegration issues, thereby improving the robustness of the results. The results showed that ATM and web-based transactions had a positive effect on economic growth, while PoS transactions had a negative impact. Although the study employed the DOLS method which is suitable for non-stationary data and cointegration issues, but reliance on this single technique limited its robustness. In contrast, the present study extended the horizon to 2024 and adopted the ARDL approach to capture both short-term and long-term relationships, thereby providing a more robust analysis of how ATM and NEFT transactions influence Nigeria's economic growth.

Iwedi (2024) examined digital payment channels and economic growth in Nigeria, exploring the relationship between electronic payment platforms and economic growth. The study used quarterly time series data from the Central Bank of Nigeria (CBN) statistical bulletin, covering the period from the first quarter of 2012 to the fourth quarter of 2021. The study applied financial time series methods and used Ordinary Least Squares (OLS) regression to analyze the relationship between digital payment platforms, represented by ATM, PoS, electronic wallet, and mobile banking transactions, and economic growth, measured by GDP. Granger causality tests were also conducted to determine whether past values of these payment channels could predict future economic growth. The findings showed that ATM and mobile banking transactions had a positive effect on economic growth, while PoS and electronic wallet transactions had a negative impact. Based on these results, the study highlighted the importance of improving digital infrastructure, supporting financial literacy, and establishing enabling regulatory policies to strengthen the contribution of digital payments to economic growth. The study provided useful insights, but its reliance on OLS constrained its capacity to capture both short-run and long-run effects, and the absence of a cointegration test raised concerns about the reliability of the results. In contrast, the present study extended the horizon to 2024 and adopted the ARDL model, which captured both short-term and long-term dynamics, thereby offering a more robust assessment of how ATM and NEFT transactions affect economic growth in Nigeria.

Otuonye and Miftahu (2023) studied how electronic banking innovations affected economic growth in Nigeria from 2008 to 2022, using time series data. The study employed an ex-post facto design and used the Augmented Dickey-Fuller (ADF) test to check if the data were

stationary. To examine both short-run and long-run relationships among the variables, it applied the Autoregressive Distributed Lag (ARDL) bounds test. It also used the Error Correction Model (ECM) to measure how quickly the system returned to equilibrium after a shock. The Granger causality test was conducted to determine if there were predictive relationships between the variables, while the Jarque-Bera test was used to assess the normality of the data. The results revealed that ATM and internet banking had a positive and significant long-term effect on Nigeria's economic growth. In contrast, mobile banking and PoS had a negative but still significant impact. These findings suggested that digital banking channels played a key role in shaping economic growth and improving citizens' welfare in the country. However, while the study offered valuable insights, it differed from the present research, which extended the study period to 2024, thereby providing more recent perspectives on the impact of fintech innovations on economic growth in Nigeria.

Aikor (2024) investigated the impact of the cashless policy on small and medium enterprises (SMEs) contributions to economic development in Nigeria between 2008 and 2019. The study adopted a mixed-methods research design, using both quantitative and qualitative data collection methods. Quantitative data were analyzed using multiple regression analysis and the Ordinary Least Squares (OLS) approach, with unit root tests used to assess the viability of the model. Qualitative data were gathered from statistics provided by the NBS and the CBN annual reports. The study results showed that, in the long run, NEFT and PoS had a significant impact on the contribution of SMEs to GDP, the benchmark used for measuring economic development. While Aikor (2024) examined the impact of the cashless policy on SMEs' contributions to economic development in Nigeria between 2008 and 2019, the present study explored the broader effect of specific fintech innovations on economic growth, using real GDP as a measure and extending the time frame to 2024.

Chinanuife et al. (2024) conducted a study on the nexus between internet banking and domestic investment in Nigeria using quarterly data from the World Bank and CBN, converted from annual to quarterly with the ARIMA-based disaggregation method from 2012 to 2022. Internet banking was represented by interest rate, PoS, ATM, mobile money, and NEFT transactions, while domestic investment was the dependent variable. Stationarity was tested with the ADF unit root test, OLS was used for estimation, and co-integration and correlation tests examined long-run relationships and associations. Descriptive statistics summarized data characteristics, and a Conditional Error Correction Model (ECM) captured short-run and long-run dynamics. Diagnostic tests included normality, heteroscedasticity, serial correlation, and model specification, while CUSUM tests assessed stability. The results showed that NEFT and PoS had significant positive short-run effects on domestic investment; however, NEFT was insignificant in the long run, and PoS turned negative and significant. ATM and Mobile Money shifted from negative to positive, while interest rate was insignificant in the short run but had a significant negative long-run effect. Although both studies focused on Nigeria, Chinanuife et al. (2024) examined domestic investment, whereas the current study measured economic growth using real GDP and extended the timeframe to 2024.

Theoretical Framework

Technology Acceptance Model

The technology acceptance model was developed by Fred Davis in 1986 and published in 1989 as part of his doctoral research at the Massachusetts Institute of Technology. The framework was developed to explain how people accept and use new technology. It describes how individuals respond to, accept, and adapt to new technological innovations or initiatives. The model identifies two key factors that influence technology acceptance by individuals: perceived usefulness and perceived ease of use. Perceived usefulness refers to the belief that using a given

technology will improve job performance. In other words, if individuals believe that the technology will help them achieve better results, they are more likely to accept it. On the other hand, perceived ease of use refers to the belief that using the technology will require little or minimal effort. If the technology is easy to use, users are more likely to adopt it. These two beliefs shape individuals' attitudes toward the technology, which then influence their intention to use it and, ultimately, their actual usage (Davis, 1989).

The technology acceptance model is a widely used theory in information technology research, particularly in understanding how individuals adopt and use technology in the workplace. According to the model, a person's intention to use a technology (acceptance) and their actual use (usage behaviour) depend on their beliefs about how useful and user-friendly the technology is. As a result, technologies that are easy to use and offer clear benefits, such as usability, usefulness, credibility, and desirability, are more likely to be accepted. External factors like personal differences, system characteristics, social influences, and enabling conditions also affect perceived usefulness and ease of use (Asenge et al., 2019).

The technology acceptance model assumes that individuals are rational decision-makers who base their acceptance of a technology on its perceived usefulness and ease of use. It also posits that external factors such as system characteristics, individual training, and organizational support influence these perceptions, which in turn determine whether a person accepts the technology. However, the model is considered too simplistic as it ignores social, cultural, and organizational factors, assumes that acceptance occurs in a one-time process, and overlooks practical constraints like time limits, habits, and workplace conditions that influence the use of technology. Nevertheless, the technology acceptance model remains highly relevant today. It is still widely used to study individuals' acceptance of digital platforms such as ATM, NEFT, and other electronic transactions. This is especially important in emerging economies like Nigeria, where understanding individual behaviour is crucial for promoting the adoption and effective use of digital technologies (Adelekan, 2020).

Methodology

This study used an ex post facto research design to examine the effect of financial innovations on economic growth in Nigeria. It analyzed quarterly time series data from 2009 to 2024, totaling 64 observations, which were sourced from the Central Bank of Nigeria (CBN) statistical bulletin. The study summarized data characteristics with descriptive statistics such as the mean, standard deviation, skewness, kurtosis, and the Jarque-Bera test. The Augmented Dickey-Fuller (ADF) unit root test was conducted to assess the stationarity of the variables, which is necessary before examining long-run equilibrium relationships.

To examine the relationship between financial innovations and economic growth, the Autoregressive Distributed Lag (ARDL) model, developed by Pesaran et al. (2001), was adopted. Economic growth, the dependent variable, was measured by real GDP, while financial innovation was represented by ATM and NEFT. All the variables were transformed using natural logarithms to standardize the data and enable elasticity-based interpretation. The models were structured to assess both the long-run and short-run impacts of financial innovation on real GDP. For model validation, various diagnostic tests were conducted, including the Breusch-Pagan–Godfrey test to detect heteroscedasticity in the variance of the error terms, the Variance Inflation Factor (VIF) to detect multicollinearity among the predictor variables, and the CUSUM test to assess model stability. The following model was estimated.

$$GDP = f(ATM, NEFT) \dots\dots\dots (1)$$

$$GDPT = \alpha_0 + \alpha_1 ATM_t + \alpha_2 NEFT_t + \dots\dots\dots (2)$$

$$\log(GDPT) = \alpha_0 + \alpha_1 \log(ATM_t) + \alpha_2 \log(NEFT_t) + \mu_t \text{-----} (3)$$

Where;

GDP = Gross domestic product

ATM = Automated Teller Machine

NEFT = National Electronic Funds Transfer

α_0 = Intercept or autonomous parameter estimates for financial innovation

$\alpha_1 - \alpha_4$ = Coefficient of financial innovation on economic growth

μ_t = white noise error terms.

Building the equations into an ARDL model, we have:

$$\Delta GDP_t = \mu + \alpha_1 GDP_{t-1} + \alpha_2 ATM_{t-1} + \alpha_3 NEFT_{t-1} + \sum_{i=1}^{p-1} \lambda_1 \Delta GDP_{t-i} + \sum_{i=0}^{q-1} \lambda_2 \Delta ATM_{t-1} + \sum_{i=0}^{q-1} \lambda_3 \Delta NEFT_{t-1} + \varepsilon_t \text{-----} (4)$$

Once a long-run association was established between the variables in equation (4), the study went ahead to examine the long-run effects and the short-run dynamics using the unrestricted ARDL model.

Decision Rule

The hypothesis was tested using a 5% (0.05) significance level, where the null hypothesis was rejected if the p-value of the t-statistic was less than 0.05, indicating a statistically significant relationship between the variables, otherwise accept.

Table 1: Variables and Measurement

S/N	Variables	Aprior Expectations	Measurement/Proxy	Source
1	Real Gross Domestic Product		Measured as the total value of goods and services produced in the country.	Gibson et al. (2022)
2	ATM	Positive effect	Measured as the total value of ATM transactions conducted through banks.	Malit (2024).
3	NEFT	Positive effect	Measured as the total value of electronic NEFT fund transfers between bank accounts across the country.	Ijeoma et al. (2020)

Results and Discussions

This section presents the results of the analysis and discusses their implications.

Table 2: Descriptive Statistics

	GDP	ATM	NEFT
Mean	31846879	918136.4	12807517
Median	27068703	500373.0	1138087.
Maximum	81229105	3912185.	67180414
Minimum	10010311	25330.00	0.000000
Std. Dev.	16799693	1002323.	21997676
Skewness	0.944579	1.275137	1.404208
Kurtosis	3.252639	3.600470	3.310767

Jarque-Bera	9.687328	18.30523	21.29006
Probability	0.007878	0.000106	0.000024
Sum	2.04E+09	58760731	8.20E+08
Sum Sq. Dev.	1.78E+16	6.33E+13	3.05E+16
Observations	64	64	64

Source: E-Views 13, 2025.

The descriptive statistics of GDP, ATM, and NEFT reveal notable differences in their distribution patterns. With a mean of 31,846,879 and a median of 27,068,703, GDP shows slight positive skewness, reflecting a skewness value of 0.94. Its kurtosis of 3.25 is close to the normal distribution benchmark, but the Jarque-Bera probability of 0.0079 indicates a departure from normality. This suggests that while GDP values are relatively stable, some higher-than-average observations push the distribution upward.

ATM transactions show a mean of about 918,136 compared to a median of 500,373, indicating moderate right skewness, supported by a skewness value of 1.28. The data exhibit high variability, with a standard deviation of about 1,000,000 and the kurtosis value of 3.60 suggests a leptokurtic distribution, meaning heavier tails than normal. The Jarque-Bera probability of 0.0001 confirms significant non-normality, meaning that ATM usage is uneven, with some extreme values influencing the distribution.

NEFT transactions demonstrate the highest level of distortion. The mean value of 12,807,517 is far greater than the median of just 1,138,087, reflecting a strong right skew with a skewness value of 1.4. The kurtosis, at 3.31, is extremely high, indicating very fat tails and the presence of extreme outliers. The Jarque-Bera test ($p = 0.0000$) strongly rejects normality. This shows that NEFT transactions are highly volatile and dominated by a few very large values, suggesting unequal adoption patterns in which the majority of transactions remain relatively small compared to a few very high-volume cases.

Table 3: Correlation Matrix

	GDP	ATM	NEFT
GDP	1	0.90440	0.84016
ATM	0.904405	1	0.82744
NEFT	0.840162	0.82744	1

Source: E-Views 13, 2025.

Table 3 shows the correlation matrix of the relationship between GDP, ATM, and NEFT transactions. All the correlation coefficients are positive and strong, which means the variables move together in the same direction.

GDP has a very strong correlation with ATM transactions (0.90) and a slightly lower but still strong correlation with NEFT transactions (0.84). This suggests that increases in GDP are closely associated with higher usage of both ATM and NEFT, with ATMs showing a closer link. Likewise, ATM and NEFT are also strongly correlated (0.82), indicating that as ATM transactions increase, NEFT transactions also tend to increase, though the relationship is weaker compared to their individual links with GDP.

Overall, the results imply that financial innovations channels (ATM and NEFT) are strongly linked with GDP performance, meaning growth in the economy is reflected in the expansion of innovations and electronic payment systems. It also suggests complementarity between ATM and NEFT usage, but ATM transactions appear more directly linked to GDP fluctuations than NEFT transactions.

Table 4: Variance Inflation Factors (VIF)

Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.23E+12	22.57830	NA
ATM	0.202005	17.84623	1.720016
NEFT	0.341603	12.65979	1.986390

Source: E-Views 13, 2025.

Variance Inflation Factors (VIFs) assess the degree of multicollinearity among the variables in the correlation matrix. Thus, they represent the factor by which the correlations amongst the predictors inflate the variance. A centered VIF less than 5 means that there is little to no multicollinearity between the predictor and the remaining predictor variables

Table 5: Summary of Unit Root Test

Variables	Adj. T-Statistic	Prob. Values	Order of Integration
GDP	-7.661241	0.0000	I(1)
ATM	-9.494646	0.0000	I(0)
NEFT	-8.359673	0.0000	I(0)

Source: Researcher's Computation using E-view 13, 2025

From the unit root test results in Table 5, GDP has an adjusted t-statistic of -7.66 with a probability value of 0.0000 . Since the null hypothesis of a unit root is rejected at conventional significance levels, GDP becomes stationary after first differencing, indicating that it is integrated of order one, $I(1)$. This implies that GDP is not stationary at levels but attains stationarity after being differenced once.

For ATM transactions, the adjusted t-statistic of -9.49 and probability value of 0.0000 indicate strong stationarity at levels. Thus, ATM is integrated of order zero, $I(0)$. This shows that fluctuations in ATM usage are stable over time without the need for differencing, reflecting a more consistent pattern compared to GDP.

Likewise, NEFT transactions, with a t-statistic of -8.35 and a probability value of 0.0000 , also reject the null hypothesis at levels. This confirms that NEFT is stationary at level and integrated of order zero, $I(0)$. Hence, both ATM and NEFT series are $I(0)$, while GDP is $I(1)$, suggesting that any long-run relationship between these variables would require methods such as the ARDL bounds test that can handle mixed integration orders.

Table 6: ARDL Bound Test

F-Bounds Test

Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	71.29018	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Actual Sample Size	64	Finite Sample:	
		n=64	
		10%	3.465
		5%	4.07
		1%	5.59

Source: E-View 13 Output, 2025

The ARDL bounds test results show that the F-statistic greatly exceeds the upper bounds. Thus, the study accepts the null hypothesis and concludes that there is no evidence of a long-run cointegrating relationship between GDP, ATM, and NEFT transactions. The implication is that changes in ATM and NEFT usage have no significant long-run association with GDP. This validates the application of the ARDL model framework to capture both the short-run dynamics and the long-run equilibrium relationship among the variables.

Table 7: ARDL Estimation

Dependent Variable: GDP

Method: ARDL

Selected Model: ARDL(4, 3, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	0.188324	0.086211	2.184447	0.0341
GDP(-2)	-0.203477	0.088825	-2.290763	0.0266
GDP(-3)	0.107387	0.094802	1.132748	0.2632
GDP(-4)	0.971467	0.093346	10.40716	0.0000
ATM	1.183056	0.490510	2.411890	0.0199
ATM(-1)	-2.405107	0.541002	-4.445650	0.0001
ATM(-2)	-0.192263	0.668421	-0.287637	0.7749
ATM(-3)	1.141497	0.660775	1.727513	0.0908
NEFT	0.020954	0.023164	0.904592	0.3704
NEFT(-1)	0.003401	0.023950	0.142021	0.8877
NEFT(-2)	0.017922	0.024956	0.718134	0.4763
NEFT(-3)	0.015918	0.024969	0.637479	0.5270
NEFT(-4)	0.028735	0.021240	1.352866	0.1827
C	1024897.	526565.0	1.946383	0.0577
R-squared	0.997075	Mean dependent var		33248671
Adjusted R-squared	0.996249	S.D. dependent var		16411769
S.E. of regression	1005162.	Akaike info criterion		30.68016
Sum squared resid	4.65E+13	Schwarz criterion		31.16884
Log likelihood	-906.4048	Hannan-Quinn criter.		30.87131
F-statistic	1206.356	Durbin-Watson stat		1.015521
Prob(F-statistic)	0.000000			

Source: E-View 13 Output, 2025

The very high R-squared (0.997) indicates that GDP movements are well explained by the selected regressors, confirming the relevance of digital payment systems to the performance of the economy. The results also validate the earlier ARDL bounds test, which established no long-run relationship between GDP, ATM, and NEFT. This implies that the short-run

fluctuations are drivers of economic growth, thus highlighting the structural role of financial innovations in Nigeria's economy.

The results show that GDP has strong dependence on its own past values, as indicated by the highly significant coefficient on GDP(-4) (0.97, $p = 0.0000$), while GDP(-1) and GDP(-2) are also significant. This confirms the dynamic nature of GDP, where past performance heavily influences current outcomes. The high R-squared value (0.997) and significant F-statistic suggest that the model explains nearly all variations in GDP, although the relatively low Durbin-Watson statistic (1.02) may signal some autocorrelation.

For ATM transactions, the contemporaneous coefficient is positive and significant (1.18, $p = 0.0199$), indicating that ATM usage has an immediate growth-inducing impact on GDP. However, the lagged terms show mixed short-run effects: ATM(-1) is negative and significant (-2.41, $p = 0.0001$), meaning that ATM usage in the previous period may slow GDP growth, whereas ATM(-3) is strongly positive (1.14, $p = 0.0908$), demonstrating that the effect becomes positive after a few periods. This implies that ATM expansion involves short-run costs but generates stronger economic benefits in the medium term. Finally, NEFT transactions does not significantly drive GDP, with a positive but highly insignificant coefficient (0.021, $p = 0.3704$).

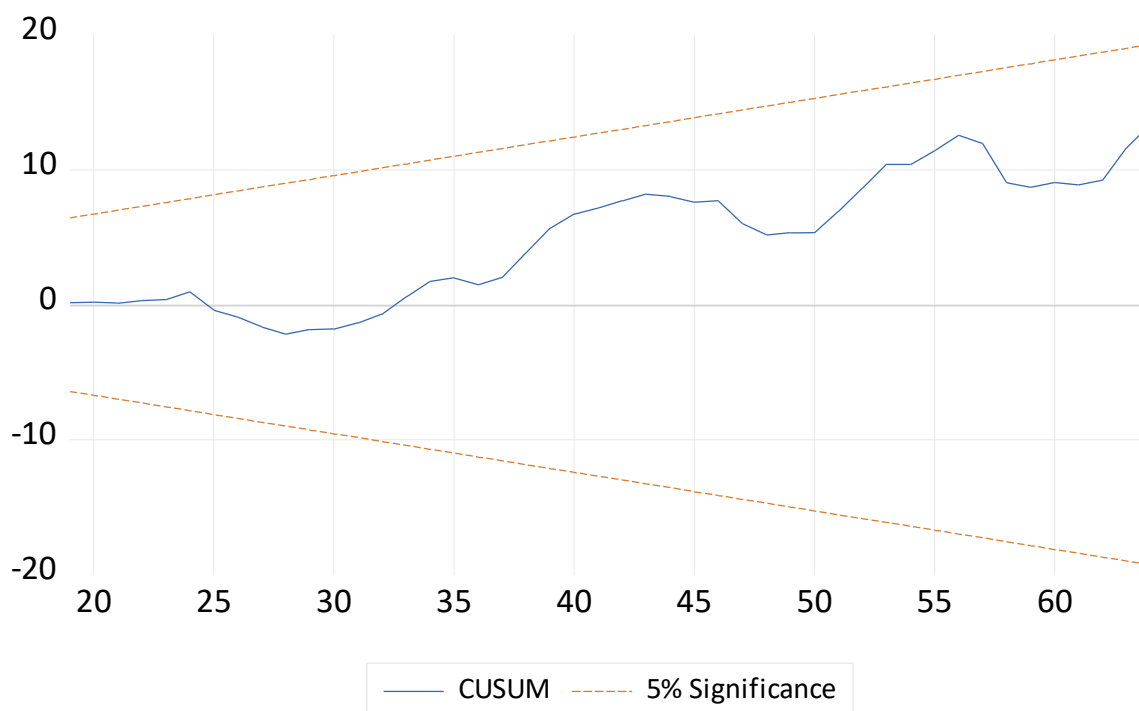
Table 8: Heteroskedasticity Test

F-statistic	0.959928	Prob. F(13,46)	0.5030
Obs*R-squared	12.80363	Prob. Chi-Square(13)	0.4631
Scaled explained SS	5.250723	Prob. Chi-Square(13)	0.9693

Source: Researchers Computation, 2025 (E-views 13)

Based on the Heteroskedasticity test in Table 8, the study fails to reject the null hypothesis, indicating that there is no Heteroskedasticity among the error terms in the model. The probability F-value of 0.5030 exceeds the 0.05 benchmark, thus confirming the absence of heteroskedasticity in the variables

Table 9: CUSUM Stability Test (Graph)



Source: Researcher's Computation, 2025 (EViews 13)

If the CUSUM line remains within the 5% to 10% critical boundaries, it indicates that the regression coefficients are stable throughout the study period. This means the relationship between the dependent and independent variables has not changed significantly over time, and the model can be considered structurally stable. However, if the CUSUM line crosses the critical boundaries, it suggests the presence of structural instability in the model. This instability may be due to economic shocks, policy changes, technological shifts, or other factors affecting the behaviour of the variables over time. In such cases, the estimated parameters may not be reliable for forecasting or long-term policy analysis.

The result indicates that the estimated model is stable over the sample period. Therefore, the coefficients do not exhibit significant structural change, meaning that the model is suitable for policy recommendations and forecasting.

Discussion of Findings

The ARDL results indicate that ATM transactions significantly influence GDP in Nigeria, though their effects differ in pattern and timing. Also, the study shows that NEFT transactions have no significant effect on economic growth in Nigeria, meaning the increasing use of electronic funds transfer systems has not yet translated into substantial macroeconomic gains. This suggests that while NEFT has improved payment efficiency and convenience within the financial system, its overall contribution to productive economic activities such as investment, production, and consumption remains limited.

In contrast, ATM transactions reveal mixed short-run effects: while current ATM use increases GDP, the negative effect from the first lag suggests short-term costs or inefficiencies, such as cash withdrawals leading to spending that does not immediately contribute to productive

economic activity. However, the strong positive effect at the third lag suggests that ATM-induced liquidity eventually stimulates broader economic activity in the medium term. These results align with Osuigwe (2022), who observed significant positive effects of ATM, mobile, and web banking on annual GDP, and with Otuonye and Miftahu (2023), who found positive long-term effects of ATM usage. Likewise, Daasi (2023) reported a positive effect of ATM on gross domestic investment. The findings also agreed with Chinanuife et al. (2024), who observed an insignificant long-term impact of NEFT on economic growth, although Aikor (2024) noted a positive and significant effect of NEFT on growth in Nigeria.

Conclusion and Recommendations

The study examines the effect of financial innovations on economic growth in Nigeria. The results reveal that ATM had a significant effect on economic growth, while NEFT had no significant effect on growth in the country. Therefore, it concludes that an increase in ATM will eventually increase economic growth in Nigeria.

Accordingly, the study recommends that:

- i. Since ATMs play an important liquidity role, banks should upgrade ATM networks with smarter functionalities (e.g., bill payments, funds transfers, deposit acceptance) to improve efficiency and reduce the observed short-run inefficiencies. In addition, collaboration between banks and fintech firms should be strengthened to improve the reliability and accessibility of digital payment platforms, thereby enhancing their contribution to GDP.
- ii. The Central Bank of Nigeria (CBN) and other financial regulators should strengthen the linkage between digital payment systems and the real economy. Efforts should focus on promoting greater financial inclusion, particularly among rural populations and participants in the informal sector, to ensure that the benefits of NEFT extend beyond the formal banking sector.

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