
Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

Olatinwo Adesola¹, Shittu Ibrahim², Olufemi Saibu³

^{1,2,3}Department of Economics, University of Lagos, Akoka, Lagos, Nigeria

ABSTRACT: This study examined the effect of digital financial inclusion on tax revenue in Nigeria. It was motivated by the rapid expansion of digital financial services and the need to determine whether this growth had improved domestic revenue mobilization. The research involves analyzing time series data with a low frequency, covering the years 2000 to 2023, encompassing a dataset spanning 24 years involving 96 quarterly observations on the Nigerian economy which was gathered from Nigeria Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) bulletin.

Analysis was based on the endogenous growth theory and employed the Autoregressive Distributed Lag (ARDL) model to estimate the short-run and long-run relationships among the variables. The ARDL bounds test confirmed the existence of a long-run relationship, while the error correction term indicated that about 61% of short-run disequilibrium was corrected annually. The results showed that digital financial inclusion had a negative and statistically significant effect on tax revenue in both the short and long run. It suggested that the growth of digital financial services had not translated into improved tax revenue during the study period. In contrast, foreign direct investment exerted a positive and significant effect on tax revenue. This indicated that sustained investment inflows expanded the tax base and enhanced government revenue. Diagnostic tests confirmed that the estimated model was stable, correctly specified, and econometrically robust. The study concluded that the revenue benefits of digital financial inclusion depended on stronger tax administration, improved regulatory coordination, and greater integration of digital financial platforms with the national tax system.

KEYWORDS: Autoregressive Distributed Lag model, Digital financial Inclusion, Financial Services, Tax Revenue

1. INTRODUCTION

Over the past decade, Nigeria has experienced rapid growth in digital financial services due to advances in mobile and financial technology, and supportive regulatory reforms (Omodero and Okafor, 2021). Unlike before, millions of previously unbanked citizens now access financial services through mobile wallets, internet banking, point-of-sale terminals, and agency banking networks (Haruna et al., 2026). Digital financial inclusion is the process of ensuring that individuals and businesses, particularly underserved and vulnerable groups, have affordable, convenient, secure, and sustainable access to and effective use of a broad range of formal financial services delivered through digital channels and infrastructure (Omodero and Ekundayo, 2025). These services include payments, savings, credit, insurance, and investment products, supported by appropriate consumer protection, financial literacy, and regulatory frameworks that enable users to improve their economic opportunities and overall well-being. Digital financial inclusion extends beyond opening bank accounts. It encompasses affordable access to savings, payments, insurance, credit, and investment products through digital channels. These services facilitate entrepreneurship, reduce transaction costs, and improve participation in the formal economy (Omodero and Okafor, 2021).

Tax revenue represents the backbone of public finance and serves as the primary means through which governments mobilize domestic resources to fulfill their constitutional and developmental responsibilities (Haruna et al., 2026). By providing a reliable stream of funds, it enables the provision of essential public goods and services such as education, healthcare, infrastructure, security, and social protection, while also supporting macroeconomic stabilization and the redistribution of income. Effective tax revenue mobilization is therefore fundamental to sustainable economic growth, good governance, and national development (Mpofu, 2022).

In a comprehensive sense, tax revenue may be defined as the aggregate amount of compulsory and non-refundable payments collected by government authorities from individuals, households, and business entities pursuant to established tax laws and regulations over a specified period. These collections arise from a wide range of tax bases, including personal and corporate incomes, profits, the consumption of goods and services, property ownership, and international trade transactions. Unlike fees or

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

charges for specific services, taxes are paid without any direct or immediate benefit accruing to the taxpayer. Consequently, tax revenue constitutes a critical instrument not only for financing public expenditure but also for achieving broader fiscal, social, and economic objectives, such as promoting equity, influencing economic behavior, correcting market failures, and fostering inclusive and sustainable development.

Tax revenue remains a major source of government financing for infrastructure, education, healthcare, and social protection. Unfortunately, Nigeria continues to face challenges of low tax compliance, a large informal sector, tax evasion, and administrative inefficiencies (Omodero and Okafor, 2021). Digitalization offers opportunities to improve tax administration by increasing transaction traceability and reducing leakages (Ren et al., 2025).

Tax revenue is widely recognized as a pivotal driver of economic growth, as it provides governments with the financial capacity to invest in productive public expenditures that enhance the long-run growth potential of the economy (Nguyen et al., 2025). Through the mobilization of tax resources, governments can finance critical infrastructure, education, healthcare, technological innovation, and social protection programmes that raise productivity, improve human capital, and create an enabling environment for private-sector development (Mpofu, 2022). Moreover, a robust and efficiently administered tax system promotes macroeconomic stability and reduces excessive reliance on debt and volatile external funding (Haruna et al., 2026). Consequently, the ability of a country to generate adequate and sustainable tax revenue is a fundamental determinant of its capacity to achieve inclusive and sustained economic growth.

Hence, the aim of this study is to analyze economic implications of tax revenue efforts through digital financial inclusion in Nigeria. Its main goal is to examine the effects of digital financial inclusion on tax revenue in Nigeria.

2. LITERATURE REVIEW

Nigeria has emerged as one of Africa's largest digital financial markets, driven by rapid advances in financial technology (fintech), increasing mobile phone penetration, improvements in payment infrastructure, and deliberate policy initiatives aimed at expanding financial inclusion. Over the past decade, the digital transformation of Nigeria's financial system has fundamentally altered the manner in which individuals and businesses access financial services, conduct transactions, and interact with government institutions (Central Bank of Nigeria, 2022). These developments have generated scholarly interest in understanding whether digital financial inclusion contributes to enhanced tax revenue generation through the formalization of economic activities, improved transaction transparency, and strengthened tax administration.

Digital financial inclusion refers to the provision and effective utilization of affordable financial products and services through digital platforms, including mobile banking, internet banking, electronic payment systems, agency banking, digital wallets, and mobile money services (Ozili, 2021). Unlike traditional financial inclusion, digital financial inclusion leverages technological innovations to reduce geographical, infrastructural, and socioeconomic barriers to accessing financial services (Ajakaiye and Adeyeye, 2022). In Nigeria, the expansion of digital finance has been largely facilitated by initiatives of the Central Bank of Nigeria (CBN) such as the National Financial Inclusion Strategy, fintech innovations, and the increasing adoption of smartphones and internet-enabled services (Central Bank of Nigeria, 2022).

2.1 Digital Financial Inclusion in Nigeria

Empirical evidence suggests that Nigeria has made remarkable progress in expanding access to digital financial services. According to the Enhancing Financial Innovation and Access survey (EFInA, 2023), formal financial inclusion increased substantially over the past decade, largely due to digital payment platforms, agent banking, and fintech services. Nevertheless, significant disparities persist across rural–urban locations, gender, income groups, and educational attainment, indicating that digital financial inclusion remains unevenly distributed (Omodero and Ekundayo, 2025). Ozili (2021) argued that digital financial inclusion has transformed the financial landscape in Nigeria by lowering transaction costs, improving access to credit, encouraging savings, and facilitating business transactions. The study emphasized that digital finance enables micro, small, and medium-sized enterprises (MSMEs) to participate in the formal financial system, thereby creating verifiable financial records that can support taxation and regulatory oversight. However, it was noted that inadequate digital infrastructure, cybersecurity concerns, and limited digital literacy can constrain the full realization of these benefits.

Similarly, Ajakaiye and Adeyeye (2022) found that increasing digital financial access significantly enhances business formalization among small enterprises. Their analysis indicated that enterprises utilizing digital payment channels are more likely to register their businesses, maintain financial records, and interact with government agencies, thereby increasing the potential tax base. These findings reinforce the argument that digital financial inclusion contributes indirectly to tax revenue generation by reducing informality within the economy.

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

Despite these positive developments, scholars argue that financial inclusion alone does not automatically translate into increased tax revenue. For example, Omodero and Okafor (2021) asserted that the effectiveness of digital financial inclusion in enhancing tax collection depends largely on institutional quality, tax administration efficiency, regulatory coordination, and the willingness of taxpayers to comply voluntarily. The implication of this is that in environments characterized by weak governance or limited data integration among government agencies, the benefits of digital financial inclusion may not be fully realized.

2.2 Fintech Development and Tax Revenue Generation

Nigeria currently hosts one of Africa's largest fintech ecosystems, with companies providing digital payments, lending, savings, investment, and insurance services. Fintech innovations have significantly reduced transaction costs while improving the speed, convenience, and security of financial transactions (Abdullahi and Muhammad, 2025). These innovations also generate digital footprints that can facilitate tax administration and improve government oversight of economic activities.

Omodero and Okafor (2021) investigated the relationship between digital financing and taxation in Nigeria and reported that fintech innovations contribute positively to tax administration by improving transaction traceability and reducing opportunities for tax evasion. Their study argued that digital payment systems create electronic records that enhance transparency and enable tax authorities to identify taxable transactions more effectively. Consequently, fintech development has the potential to broaden Nigeria's tax base while reducing administrative costs associated with tax collection. Recent evidence by Haruna et al. (2026) further supports this argument. Using panel data on ICT development and tax performance, the authors found that improvements in digital infrastructure and technological adoption significantly increase government revenue by strengthening tax administration and enhancing compliance. The study concluded that digital transformation represents an important component of domestic resource mobilization strategies in Nigeria.

Nevertheless, fintech expansion also presents regulatory challenges. The rapid emergence of digital lending platforms, cryptocurrency exchanges, and cross-border digital transactions has complicated tax administration. Existing tax legislation often struggles to capture the evolving nature of digital economic activities, thereby creating opportunities for tax avoidance and regulatory arbitrage. Consequently, scholars advocate continuous modernization of Nigeria's tax framework to accommodate emerging digital business models.

2.3 Agency Banking and Tax Revenue

Agency banking has become one of the most successful financial inclusion initiatives in Nigeria. Introduced to extend banking services to underserved communities, agency banking allows licensed agents to provide cash deposits, withdrawals, transfers, bill payments, and account opening services on behalf of financial institutions.

Empirical evidence demonstrates that agency banking significantly increases financial inclusion, particularly within rural communities where conventional banking infrastructure remains limited. According to EFINA (2023), agency banking has contributed substantially to expanding financial access among previously excluded populations. The growth of agency banking has important implications for tax administration. By integrating informal businesses into formal financial networks, agency banking increases the availability of transaction records that can facilitate taxpayer identification and compliance monitoring. Ajakaiye and Adeyeye (2022) observed that increased utilization of agency banking services encourages business formalization, thereby enlarging the pool of potential taxpayers.

However, the relationship between agency banking and tax revenue remains largely indirect. While agency banking facilitates financial inclusion and enhances transaction transparency, its contribution to tax revenue depends on complementary institutional reforms, including taxpayer registration systems, digital tax administration platforms, and effective interagency data sharing.

2.4 Mobile Money and Digital Payments

Mobile money has transformed financial service delivery across many African countries. Although Nigeria initially experienced slower adoption compared with countries such as Kenya and Ghana, recent regulatory reforms have accelerated the growth of mobile money services through mobile money operators and payment service banks.

Several empirical studies identify mobile money as an important mechanism for reducing financial exclusion and promoting economic formalization. Mobile money platforms generate electronic transaction histories that improve financial documentation for individuals and enterprises operating outside the traditional banking sector. According to the International Monetary Fund (2023), expanding digital financial services through mobile platforms enhances financial inclusion while simultaneously strengthening government capacity to mobilize domestic revenue. Digital transactions reduce anonymity in commercial exchanges, thereby increasing opportunities for tax authorities to monitor taxable economic activities.

However, several challenges affect the adoption of mobile money. Limited interoperability among payment platforms, network failures, cybersecurity risks, and inadequate digital literacy continue to constrain widespread adoption of mobile money services (Nwankwo et al., 2026). These barriers reduce the extent to which mobile money can contribute to effective tax administration.

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

2.5 Point-of-Sale (POS) Systems and Electronic Payments

The rapid expansion of Point-of-Sale (POS) terminals represents one of the most visible indicators of Nigeria's digital financial transformation. POS terminals have become essential payment channels for retail businesses, particularly following restrictions on cash withdrawals and broader cashless policy initiatives introduced by the Central Bank of Nigeria. Electronic payment systems create detailed digital transaction records that significantly improve transparency. Businesses using POS systems generate verifiable sales records, thereby reducing opportunities for underreporting income and facilitating more accurate tax assessments (Nwankwo et al., 2026).

Omodero and Ekundayo (2025) found that increased adoption of electronic payment systems significantly improves tax collection efficiency by enhancing transaction traceability and reducing revenue leakages. The authors further noted that macroeconomic stability, digital infrastructure, and institutional capacity moderate the effectiveness of electronic payment systems in improving tax performance.

Nevertheless, it has been noted that heavy reliance on POS systems alone cannot eliminate tax evasion (Abdullahi and Muhammad, 2025). Businesses operating partially in cash may continue to conceal portions of their transactions, particularly within Nigeria's extensive informal economy. Consequently, electronic payment systems should be integrated with broader digital tax administration reforms.

The eNaira and Digital Tax Administration

In 2021, Nigeria became the first African country to introduce a Central Bank Digital Currency (CBDC) through the launch of the eNaira. The eNaira was designed to promote financial inclusion, improve payment efficiency, reduce transaction costs, and strengthen monetary policy transmission (Chukwuere, 2021). From a taxation perspective, the eNaira offers significant opportunities for improving tax administration. Digital currency transactions create secure, traceable, and immutable transaction records that could facilitate taxpayer identification, improve audit processes, and reduce tax evasion (Ozili, 2023). Although empirical evidence regarding the eNaira remains relatively limited due to its recent introduction, early studies suggest that widespread adoption could enhance government revenue mobilization by improving transaction visibility and reducing the size of the informal economy (Omodero and Ekundayo, 2025). However, adoption rates have remained relatively low, limiting its immediate contribution to tax revenue generation. The slow adoption of the eNaira has been attributed to limited public awareness, inadequate merchant acceptance, and privacy concerns (Ozili, 2023). Other limitations are technological constraints, and competition from established mobile banking and fintech applications. Consequently, its long-term contribution to tax administration remains largely dependent on broader user acceptance and continued technological improvements.

Overall, empirical evidences from Nigeria indicate that digital financial inclusion contributes positively to tax revenue generation through several interrelated mechanisms. First, digital financial services promote business formalization by integrating individuals and enterprises into the formal financial system. Second, electronic payment platforms generate transaction records that improve transparency and reduce opportunities for tax evasion. Third, fintech innovations enhance tax administration by facilitating digital tax collection, taxpayer identification, and compliance monitoring. Finally, agency banking, mobile money, POS systems, and emerging technologies such as the eNaira collectively strengthen government capacity to mobilize domestic revenue. However, literature also demonstrates that digital financial inclusion is not a sufficient condition for improved tax performance, hence the need for this study.

3. METHODOLOGY

This study employs an ex-post facto research approach and utilizes secondary data analysis to provide draw empirical evidence and policy inference. The research design places significant emphasis on detailing the methods for data collection, including the measurement and sources of the various data. Additionally, the research design focuses on the development of a theoretical model, the pre-test analysis illuminating the chosen estimation technique and the subsequent post-test estimation.

3.1 Measurement of variables

This study considers two key variables - digital financial inclusion, and tax revenue. The literature has used these three variables in different ways and for different purposes. For instance, the literature classifies digital financial inclusion into three dimensions: availability, penetration, and usage, and classifies taxes as either distortionary (direct tax) or non-distortionary (indirect tax). This study explores all these indices to determine the extent to which promoting digital financial inclusion can strengthen tax revenue. This study also examines the holistic implications of digital financial inclusion on both tax and economic well-being. It is possible that different dimensions of digital financial inclusion will have differential effects on tax revenue, and different components could produce distortionary and non-distortionary effects on aggregate demand but not on aggregate supply components.

3.2 Theoretical Framework

This work uses the endogenous growth model described by Romer (1994). The model begins with the conventional growth model that incorporates physical and human capital as fundamental growth drivers in a standard production function which is given in (1):

$$Y = f(K, H) \quad (1)$$

Where Y represents output and K is physical capital, and H is human capital or knowledge. Equation (1) implies that output can be produced using both human and physical capital and both exhibit constant return to scale i.e. α and β , they cannot perfectly substitute or complement to each other. Also equation (1) suggests that increasing the both inputs by same proportion will lead to same proportional increase in output level to capture. Hence, (1) can be explicitly written as

$$Y = AK^\alpha H^\beta \quad (2)$$

where A stands for the technology innovation which capture factor productivity.

It is assumed to be constant at least in the short run but could augment both human and physical capital productivity by improving their efficiency.

Where α and β are the output elasticity of the two inputs capital and $\alpha + \beta = 1$.

3.2.1 Incorporation of Digital financial inclusion variable in endogenous growth model

Innovation adoption could alter the productivity of the production process. Such innovation adoption changes the constancy of technology (A) and increase the total productivity of both physical and human capitals hence A can also become endogenized over time (t). Technology is a form of investment. Consequently, technology as investment augments the existing stock of capital and captures the technological progress which can be given as:

$$A_t = (1 - g)K_{t-1} + I_{k,t} \quad (3)$$

Where g is the rate of technological progress and $I_{H,t}$ represents investment in new technology. This technology could be digital technology deployed in financial system to improve financial system efficacy and productivity. Hence equation (3) can be modified as:

$$A_{DFI,t} = (1 - g)DFI_{t-1} + I_{DFI,t} \quad (4)$$

Where DFI is Digital financial inclusion. Hence equation (1) can be written as:

$$Y = A_{DFI,t}(K^\alpha H^\beta) \quad (5)$$

DFI plays a pivotal role in the endogenous growth model by enhancing the efficiency of financial transactions, reducing transaction costs and improving resource allocation and also directly affecting output level as independent input variable in production process.

$$Y = A K^\alpha H^\beta DFI^{1-\alpha-\beta} \quad (6)$$

Therefore, DFI (such ATM, internet infrastructure and mobile phone) complement and or substitute computer and other electronic and physical capital used in the production of financial services. Hence DFI has direct effect as another input capital variable that can be used in conjunction with existing physical and human capital in production process.

$$Y_t = f(DFI, E_{DFI} * K, E_{DFI} * H)_t \quad (7)$$

Digital financial inclusion influences growth directly by fostering innovation and indirectly by improving human capital accumulation and technological progress hence equation (1) can be written as

$$Y = (E_{DFI} * K, E_{DFI} * H) K^\alpha H^\beta DFI^{1-\alpha-\beta} \quad (8)$$

3.2.2 Tax as an input in production process

Similarly, tax could also be introduced into the endogenous growth model as both direct and indirect input variable: tax revenue is fraction of total income generated from the monetary value of all goods and services produced in nation hence it could be written as

$$T_t = \tau \cdot Y_t \quad (9)$$

Where T is the tax revenue, τ denotes the tax rate, and Y represents output. According to Barro (1990) in line with Aschauer (1988) the usually $y = Ak$ model of economic growth can be expressed in a manner to capture government as production agent that also contributes part of the capital to the production process. Therefore

$$y = A(k, g) \quad (10)$$

Or explicitly as

$$Y = Ak^\alpha g^\rho \quad (11)$$

Equation (8) implies that there is constant return to scale in both private (k) and public capital (g) hence the production function represented by equation1 can be written as

$$y = \phi(k, g) = k \cdot \phi\left(\frac{g}{k}\right) \quad (12)$$

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

Hence

$$y = \phi(k, g) = k \cdot \phi\left(\frac{g}{k}\right) = A \cdot \left(\frac{g}{k}\right)^{\rho} \quad (13)$$

Where $0 < \alpha < 1$ and g is the public capital input into production process and k is the private capital input. Assuming that government expenditure is financed through tax then

$$g = T = \tau y = \tau(k \cdot \phi\left(\frac{g}{k}\right)) = \tau(A \cdot \left(\frac{g}{k}\right)^{\alpha}) \quad (14)$$

$$g = \tau(A \cdot \left(\frac{g}{k}\right)^{\alpha}) \quad (15)$$

Substituting equation (13) into equation (11), then we have

$$y = Ak^{\alpha} \left(\frac{T}{k}\right)^{\rho} \quad (16)$$

And then

$$y = Ak^{\vartheta} T^{\rho} \quad (17)$$

Where $\vartheta = \alpha - \rho$. Technology innovation could also be affected by the level of tax imposed and also tax revenue could also be affected by technology adoption. The imposition of tax on technology affect the level of adoption, access and usage while technology adoption also aids tax collection. this suggest both tax and technology are endogenous growth process as both tax and technology affect output and output level affects them respectively. Hence the production process capture by equation (1) could be modified to include both tax and technology as independent variable input and also augment factors of human and physical capital.

3.3 Model Specification

To achieve the objective of examining the effect of digital financial inclusion on tax revenue in Nigeria, this study adopted and modified the model of Khatoun and Shabbar, (2022), by replacing Financial Inclusion Index (FII) with Digital Financial Inclusion Index (DFII).

The model will be specified as follows:

$$TAX = a_0 + a_1 DFI + a_2 Z + U \quad (24)$$

Where: TAX =Tax Revenue, DFI = Digital Financial Inclusion Index, Z = Control Variables, (Trade Openness, Foreign Direct Investment, and U = Error term.

To establish the differential effects of DFI on different form of taxes, equation (23) will be estimated with direct and indirect tax along with total tax. Similarly, the DFI will also be captured by the three dimensions of digital financial inclusion and by an aggregate index of digital financial inclusion, this will be done to check the potential effects of digital financial inclusion on different form of taxes.

3.5 Estimation techniques

To confirm the characteristics of the variables and determine the appropriate estimation technique for examining the study's objectives, two initial tests will be performed. These tests encompass descriptive statistics, and a multi-collinearity examination.

3.5.1 Descriptive Statistics

Analyzing various measures of central tendencies, dispersion, and peculiarities in the data is crucial, and descriptive statistics serves this purpose. It helps determine if the data follows a normal distribution by comparing measures like the mean and median equality. If the mean and median are close or equal, it implies low skewness and a kurtosis approaching three, indicating normal distribution; otherwise, the data is not normally distributed. Dealing with non-normally distributed data can introduce bias and misleading interpretations. Additionally, the probability value of the Jarque-Bera (JB) statistics is a key factor in testing normal distribution. Rejecting the null hypothesis occurs when the JB statistics' probability value is below 5%, while accepting the alternative hypothesis happens otherwise. Furthermore, the standard deviation, derived from descriptive statistics, gauges the extent of data dispersion from the mean, offering insights into datasets.

3.5.2 Diagnostic Tests

Conducting diagnostic tests is crucial to establish the validity and efficiency of the models employed in this study. The examination of the test coefficients' reliability will be undertaken through various statistical measures, including t-statistics, F-statistics, and a battery of residual diagnostic tests. These diagnostic tests encompass assessments for stability, normality of residuals, heteroscedasticity, and serial correlation. The t-statistics and F-statistics tests will specifically gauge the individual and overall significance of explanatory variables. Concurrently, the residual diagnostic tests serve the purpose of evaluating the model's suitability for policy implications, ensuring that it meets the necessary criteria beyond statistical significance. These examinations

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

aim to determine whether the assumed conditions are met or not. The tests encompasses autocorrelation, multicollinearity, normality and heteroscedasticity tests.

3.5.5 Data Measurement, Scope and Sources

The research involves analyzing time series data with a low frequency, covering the years 2000 to 2023, encompassing a dataset spanning 24years involving 96 quarterly observations on the Nigerian economy. The dataset utilized in this investigation comprises various factors, such as gross domestic product, poverty line (HDI), School enrolment rates, life expectancy, access to healthcare facilities, income and wealth distribution (Gini coefficient), inflation, unemployment and subjective indicators, (EWB), DFI Index which is captured by three dimensions' accessibility, usage and availability, while tax revenue is captured by direct tax and indirect tax respectively. All the variables were sourced from Statistical bulletin of Central Bank of Nigeria from various editions and World bank data. All the variables were measured in naira except those that are traditionally in different units. The variables were expressed in log forms to ensure that all the variables which were not expressed in naira like the number of ATM are transformed to a uniform scale. Detailed information regarding the measurements, sources, and anticipated relationships of the key variables which require precomputation is provided in Table 1.

Table 1: Summary of the Data, interpretation and the Sources

Variable Name	Measurement	Expected Sign
Digital financial Inclusion Index	Three dimensions: Accessibility, Usage and Availability to be calculated using PCA	Positive
Direct Tax	Personal Income Tax, Corporate Income Tax, Capital Gains Tax	Positive
Indirect Tax	Value Added Tax, Excise Duties, Custom	Positive

4. RESULTS & ANALYSIS

Table 1 presents the estimated short-run and long-run coefficients from an ARDL model analysing the influence of digital financial inclusion and foreign direct investment (FDI) on Nigeria's tax revenue. The model includes both symmetric short-run effects and a long-run equilibrium structure. At the centre of this dynamic adjustment is the error correction term (ECT), which plays a crucial role in determining the speed at which Nigeria's tax revenue returns to equilibrium following a shock or deviation. The findings are interpreted in light of Nigeria's evolving digital economy, investment climate, and fiscal structure.

In the short-run dynamics, the coefficient of the error correction term is estimated at -0.6109, statistically significant at the 1% level ($p = 0.0007$). This figure denotes the speed of adjustment back to long-run equilibrium after a deviation occurs in the previous period. The negative sign satisfies a key ARDL requirement, confirming the model's stability and the existence of a valid long-run relationship between the variables. Specifically, the magnitude of 0.6109 implies that approximately 61.09% of any disequilibrium in tax revenue is corrected within one year, leaving only 38.91% of the shock to persist into subsequent periods. This is a relatively fast rate of adjustment, indicating that the Nigerian tax system has the internal capacity and policy responsiveness to absorb shocks from financial disruptions such as fluctuations in digital transactions or capital inflows and steer tax revenue back toward its long-run path.

Table 2: Analysis of Digital Financial Inclusion on Tax Revenue in Nigeria

Short Run Symmetric				
DV: Δtax_t	Coefficient	Standard error	t-statistics	p-value
c	6.0701***	1.5010	4.0439	0.0011
Δdfi_t	-1.1084***	0.1952	-5.6795	0.0047
$\Delta lfdi_t$	0.8641***	0.1956	4.4182	0.0032
ect_{t-1}	-0.6109***	0.1402	-4.3561	0.0007
Long Run Symmetric				
c	2.8819	3.4908	0.8256	0.4212
dfi_t	-2.1993**	0.9114	-2.4130	0.0282
$lfdi_t$	0.6416**	0.2078	3.0869	0.0152

Diagnostic Tests	
$R^2 = 0.5898$ $\bar{R}^2 = 0.5350$ $DW = 2.0614$	
$X_{LM}^2 = 2.1717[0.1406]$	$X_{BGP}^2 = 4.7277[0.3164]$ $X_{JB}^2 = 0.7525[0.6864]$ $X_{RS}^2 = 2.3379[0.1263]$
$F - statistic = 6.1331[0.0051]$ STABILITY=CUSUMSQ	
ARDL bound test	
$F - statistic = 5.2889[I(0) = 3.79, I(1) = 4.85 @ 5\%]$	

Source: Author's compilation (2026)

Notes: DV: dependent variable, SE: standard error, DW: Durbin Watson statistics. statistics ***,** and * indicate significance at 1%,5% and 10%, respectively. X_{LM}^2 , X_{BGP}^2 , X_{RS}^2 , X_{JB}^2 represent LM test for serial correlation, Breusch-Pagan Godfrey test for heteroscedasticity, Ramsey rest test for model specification and Jarque-Bera normality test, respectively. $I(0)$ and $I(1)$ represent lower and upper bound, respectively. [] indicates respective probability values, ECT; Error correction term.

The implication of this adjustment speed is significant. It suggests that tax administration in Nigeria, though complicated with inefficiencies, retains some level of institutional robustness. When shocks such as exchange rate volatility, foreign capital surges, or fintech disruptions occur, corrective mechanisms such as administrative enforcement, digitization of tax portals, or fiscal stabilization efforts help restore tax receipts. For instance, in the aftermath of COVID-19 lockdowns, when cash-based tax collection declined, Nigeria's shift toward e-tax payment platforms and digital remittance gateways likely facilitated a recovery. The ECT coefficient thus quantifies this resilience and provides empirical backing for the argument that digital reforms in Nigeria's tax administration are beginning to yield some stability in revenue generation. This further represents a moderate-to-rapid speed of adjustment, highlighting the dynamic responsiveness of Nigeria's tax revenue system. Such speed of adjustment is realistic in an emerging economy like Nigeria where policy responses and fiscal reforms such as digital tax enforcement, audit recovery programs, and programs led by the National Revenue Service (NRS) (formerly Federal Inland Revenue Service) are increasingly capable of restoring equilibrium within a reasonably short time frame. The significance and strength of the ECT confirm the validity of the long-run relationship and the dynamic efficiency of the model.

Turning to the short-run coefficients, the estimate for digital financial inclusion index is -1.1084, statistically significant at the 1% level ($p = 0.0047$). This indicates that, in the short term, increases in digital financial inclusion led to a decline in tax revenue. Although this finding may appear counterintuitive, it reflects the complexity of Nigeria's digital transition. As digital financial services expand via mobile banking, agent banking networks, and fintech apps many transactions shift into channels that are not immediately captured by tax systems. Without proper integration between digital financial platforms and national tax databases, the potential for real-time tax monitoring remains underutilized.

This negative effect could also be explained by the fact that many new users of digital platforms operate in the informal economy. While their financial behaviors become digitized, they may still evade tax obligations due to weak enforcement and a lack of mandatory Tax Identification Number (TIN) registration. For instance, small traders using mobile POS systems may enjoy improved business performance without corresponding tax remittance, especially if they are unaware of or not enrolled in tax compliance systems.

In contrast, the short-run coefficient for foreign direct investment is 0.8641, with a p-value of 0.0032, indicating a statistically significant and positive effect. This means that increases in foreign direct investment log-transformed to capture elasticity are associated with short-term gains in tax revenue. This finding can be attributed to the immediate fiscal benefits of foreign capital inflows, particularly when they are directed toward productive sectors such as construction, telecommunications, and manufacturing. Taxes are often collected at multiple entry points, including customs duties on imported capital goods, PAYE taxes from expatriate workers, and VAT on supplier transactions. These short-run fiscal inflows help support Nigeria's non-oil tax revenue base, which has been a critical goal of fiscal reform.

However, this positive impact from FDI is only effective when supported by robust corporate taxation practices and minimal leakages through tax avoidance schemes. In the Nigerian context, the result is encouraging but should be approached with caution, given that some sectors enjoying high FDI inflows, such as the petroleum industry, often operate under tax exemption regimes. The constant term in the short-run model ($C = 6.0701$, $p = 0.0011$) is also statistically significant, suggesting that baseline tax revenue (even in the absence of changes in DFI and FDI) is positive and perhaps reflective of institutional improvements in tax collection technology, including the digitization of payment systems, e-filing portals, and expansion of VAT enforcement zones.

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

Shifting focus to the long-run dynamics, the coefficient for DFI is -2.1993, statistically significant at the 5% level ($p = 0.0282$). This finding reveals a persistent negative relationship between digital financial inclusion and tax revenue in the long term. It reinforces the argument that if digital financial growth occurs in an environment of poor regulatory capacity, fiscal leakages may worsen over time. Many informal digital financial actors remain outside the radar of the NRS, and without mandatory reporting systems or transaction audits, a growing portion of the economy becomes effectively untaxed. Moreover, long-term digital exclusion in rural communities and weak digital literacy further reduce the ability of DFI to translate into a broader, more compliant tax base.

This result warns that digital financial inclusion alone does not guarantee fiscal transformation. The long-term benefits of DFI on revenue depend heavily on accompanying governance infrastructure, including e-identification systems, anti-money laundering enforcement, fintech regulation, and taxpayer education. In this context, the observed negative relationship is less a condemnation of digital finance and more a reflection of Nigeria's readiness gap in harnessing its full fiscal potential.

Conversely, the long-run coefficient for FDI is 0.6416 ($p = 0.0152$), indicating a positive and statistically significant association. This suggests that sustained foreign capital inflows have a constructive long-term effect on tax revenue, supporting the notion that FDI, when properly regulated, expands the tax base through job creation, higher consumption, and infrastructure development. This long-term benefit of FDI affirms the prediction of development theory that foreign capital, if productive and transparent improves public finance by increasing the formal size of the economy.

The constant term in the long-run equation is 2.8819 ($p = 0.4212$), and though it is not statistically significant, it suggests that there is no predictable autonomous trend in tax revenue without the influence of the independent variables. This neutrality underscores the importance of explanatory variables like DFI and FDI in determining Nigeria's tax performance trajectory.

The results from Table 1, particularly the speed of adjustment to equilibrium, offer several policy insights. The error correction coefficient (ECT) of -0.6109 reveals a revenue system that is dynamically stable, suggesting that well-targeted reforms can lead to rapid and predictable fiscal outcomes. Policymakers should leverage this responsiveness by accelerating the digitization of tax collection systems, enforcing compliance through real-time data integration with fintech platforms, and ensuring that all digital financial participants are linked to verifiable national identification and tax records.

Furthermore, the short-run and long-run negative coefficients for DFI imply that digital inclusion alone does not automatically improve tax outcomes. Thus, digital financial inclusion must be paired with tax education, regulatory oversight, and real-time reporting protocols. Financial service providers should be mandated to submit periodic transaction data to tax authorities, and e-commerce platforms should be incorporated into VAT collection frameworks.

On the other hand, the consistently positive effects of FDI justify the strengthening of Nigeria's investment climate while maintaining rigorous tax governance. Investment promotion agencies must balance incentives with accountability, ensuring that foreign investors contribute meaningfully to public revenue through effective taxation of profits, capital gains, and employment-based income. Nigeria should also expand its participation in global tax initiatives, such as the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (BEPS), to prevent profit shifting and revenue loss.

Finally, institutional reforms that increase the efficiency of the FIRS, enhance coordination with the Central Bank of Nigeria, and integrate digital tools such as blockchain auditing, can help Nigeria maximize the fiscal dividends of both digital and foreign financial integration. In conclusion, the ARDL results from Table 1 provide robust evidence that tax revenue in Nigeria responds both dynamically and asymmetrically to changes in digital financial inclusion and foreign direct investment. While the system demonstrates a high speed of adjustment toward equilibrium, suggesting administrative resilience, the direction and significance of individual variables imply that the benefits of digital and capital flows depend crucially on regulatory readiness, policy synergy, and institutional modernization. Without these, Nigeria risks missing the long-term fiscal opportunities that the expansion of her digital and investment landscapes present.

Diagnostic Test

Following the estimation of the ARDL model in Table 1, which investigated the effect of digital financial inclusion and foreign direct investment on tax revenue in Nigeria, a series of post-estimation diagnostic tests were conducted to assess the validity, reliability, and robustness of the model. These diagnostics are essential for verifying the statistical assumptions underlying the ARDL approach and for ensuring that the model results can be interpreted with confidence in both empirical and policy contexts.

The first and perhaps most fundamental test applied was the CUSUM of Squares (CUSUMSQ) stability test shown in Figure 1, which evaluates whether the estimated model parameters remain stable over the sample period. According to the visual diagnostic output referenced in the model summary, the plot of the cumulative sum of recursive residuals remained well within the 5% critical bounds. This result confirms that there were no significant structural instabilities or coefficient shifts throughout the study period. Such a finding is crucial in a macroeconomic context like Nigeria's, where external shocks, policy reversals, and regulatory

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

discontinuities are common. The result of the CUSUMSQ test suggests that the relationships captured between tax revenue, DFI, and FDI are stable and reliable across time and are not driven by isolated structural breaks or one-time policy events.

In addition to stability, the model was subjected to the Breusch-Godfrey LM test for serial correlation. The Breusch-Godfrey Lagrange Multiplier (LM) test was used to assess the presence of serial correlation in the model residuals. The test produced an LM statistic of 2.1717 with an associated p-value of 0.1406. Since the p-value exceeds the conventional 5% significance level, we fail to reject the null hypothesis of no serial correlation. This implies that the residuals are not autocorrelated and that the model does not suffer from omitted dynamic terms or feedback effects. The absence of serial correlation enhances the reliability of the estimated standard errors, ensuring valid t-statistics for hypothesis testing and confirming that the ARDL model is properly specified in its lag structure.

The Breusch-Pagan-Godfrey (BPG) test for heteroskedasticity further reinforces the model's reliability. The test yielded a test statistic of 4.7277 with a p-value of 0.3164, which is well above the 0.05 threshold. This result suggests that the null hypothesis of homoscedastic residuals cannot be rejected, implying that the error terms have constant variance across the sample period. In practical terms, this ensures that the coefficient estimates are efficient and that the standard errors are unbiased, further validating the statistical inference drawn from the model.

Additionally, the Jarque-Bera (JB) test for normality returned a test statistic of 0.7525 with a p-value of 0.6864. The high p-value implies that the residuals are normally distributed, which satisfies one of the key assumptions for valid inference in small sample regressions. The normality of residuals confirms that the estimated t-statistics and confidence intervals are reliable and that the ARDL model conforms well to the properties of classical linear regression.

Turning to the Ramsey Reset test, which assesses the adequacy of the functional form of the model, the test statistic was 2.3379 with a p-value of 0.1263. This result indicates that the model is not mis-specified and that no significant non-linear combinations of the explanatory variables have been omitted. In other words, the functional form of the ARDL model is appropriate, and the estimated relationships between tax revenue, DFI, and LFDI are structurally sound. This is especially important in macroeconomic modelling, where the risk of non-linear interactions and omitted variable bias is often high. Importantly, the model also passes the ARDL Bounds Test for co-integration, a critical requirement for validating long-run relationships within an ARDL framework. The calculated F-statistic from the bounds test is 5.2889, which exceeds both the lower and upper critical bounds of 3.79 and 4.85 at the 5% significance level. This result confirms the existence of a long-run co-integration relationship between tax revenue, digital financial inclusion, and foreign direct investment in Nigeria. This implies that, despite short-term fluctuations, these variables are bound together in the long term by an underlying equilibrium relationship. The confirmation of co-integration justifies the inclusion of the error correction mechanism in the model and supports the interpretation of long-run coefficients.

Taken together, these diagnostics present a compelling case for the robustness and validity of the ARDL model. The absence of serial correlation and heteroskedasticity, the confirmation of normality and functional correctness, the existence of co-integration, and the significant joint explanatory power all combine to confirm the econometric soundness of the model.

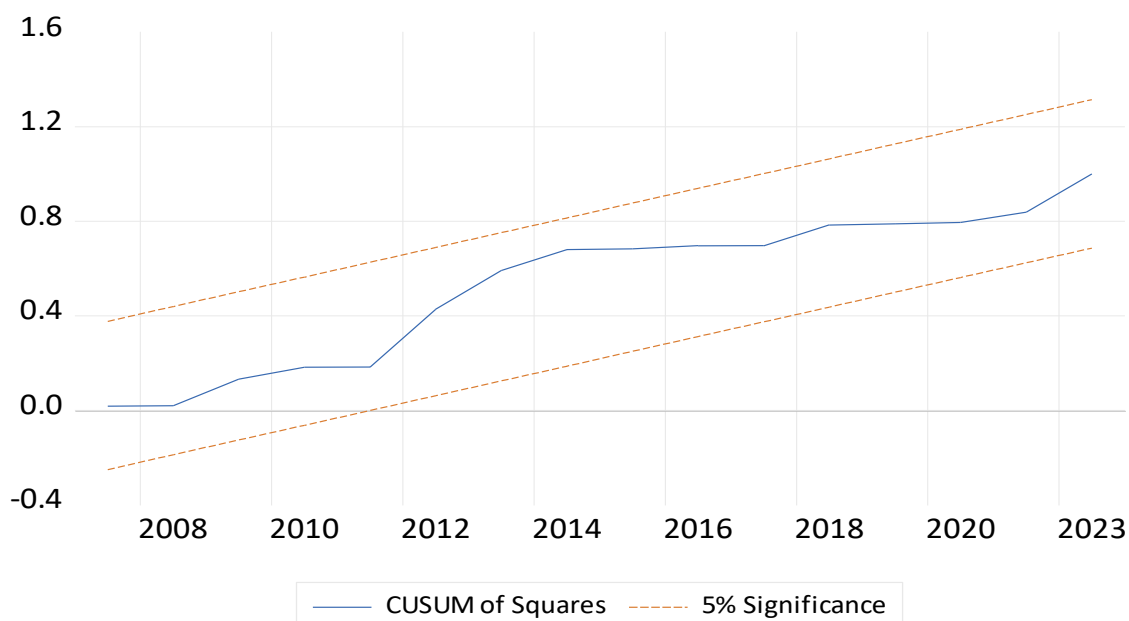


Figure 1: CUSUM of Squares (CUSUMSQ) stability test

Source: Author's compilation from E-views 12 output

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

Note: The blue line is the solid line, while the red lines that bounded the blue line are the critical bounds at 0.05. Figure 1 shows the plot of Cumulative sum square of recursive residuals.

Given the model's diagnostic strength and the fact that both DFI and LFDI demonstrate statistically significant coefficients in both the short and long run with DFI negatively affecting tax revenue and LFDI having a positive effect, we find compelling empirical evidence to reject the null hypothesis. In addition, the overall model significance, as captured by the joint F-statistic, is 6.1331 with a p-value of 0.0051, which is statistically significant at the 1% level. This result demonstrates that the explanatory variables (DFI and FDI) jointly have a significant effect on tax revenue. The high F-statistic and low p-value confirm that the model, as a whole, fits the data well and that the variation in tax revenue is not due to chance but is meaningfully explained by the included regressors. Therefore, we conclude that a statistically significant relationship exists between digital financial inclusion, foreign direct investment, and tax revenue in Nigeria.

This conclusion has profound implications for public finance and digital policy in Nigeria. It suggests that while foreign direct investment enhances the country's fiscal base, digital financial inclusion, if not properly regulated may erode revenue performance due to informalization and evasive practices. The confirmation of a stable and statistically valid long-run relationship calls for integrated policy responses, including fintech regulation, tax digitalization, and investment reform. Only through such coordinated institutional efforts can Nigeria sustainably align its digital financial trajectory with its revenue mobilization goals.

5. SUMMARY AND CONCLUSION

This study examined how digital financial inclusion influences tax revenue in Nigeria. Within the framework of endogenous growth theory, it employed the Autoregressive Distributive Lag (ARDL) Technique. The findings revealed that a stable long run relationship exists among digital financial inclusion, foreign direct investment and tax revenue. The error correction was negative and statistically significant, indicating that whenever short run shocks occurs, the system gradually returns to its long run equilibrium, with about 61% adjustment taking place within a year. This suggests that Nigeria tax revenue possesses a reasonable capacity to recover from temporary disruptions.

The empirical results further show that digital financial inclusion has a significant negative effect on tax revenue in both short run and long run. Although digital financial services have expanded rapidly across the country, the expected improvement in tax revenue has not yet been realized. This outcome may be linked to the continued dominance of informal economic activities, limited integration between digital financial platforms and tax administration systems, weak regulatory enforcement, and low levels of taxpayer compliance among many digital financial service users. These findings suggest that expanding access to digital financial services alone is not sufficient to improve government revenue unless it is followed by institutions and more effective tax administration.

On the other hand, foreign direct investment was found to significantly and positively contribute to tax revenue in both the short run and long run. This implies that sustained inflow of foreign investment help broaden the tax base by stimulating economic activity, and increasing taxable business transactions.

Based on these findings, the study concludes that the success of digital financial inclusion as a tool for improving tax revenue depends largely on the institutional environment within which it operates.

5.1 Policy recommendations

Based on the findings of this study, the government should strengthen the link between digital financial services and the tax administration system so that the increasing use of digital payments can contribute more effectively to tax revenue. This can be achieved by improving collaboration among the National Revenue Service, financial institutions, and fintech companies. This will enhance transaction monitoring, identification of tax payers, and overall tax compliance.

In addition, greater efforts should be made to encourage businesses operating in the informal and digital economy to become part of the formal tax system. Simplifying business registration, expanding the use of digital Tax Identification Numbers (TINs), and increasing public awareness of tax obligations can help improve voluntary compliance. Government should also continue to attract productive foreign direct investment by maintaining a stable business environment while ensuring that tax incentives are carefully managed so that investment growth contributes meaningfully to domestic revenue generation

REFERENCES

- 1) Abdullahi, Y. Z., & Muhammad, A. (2025). Digital financial services and rural market access in Northwestern Nigeria: evaluating the economic impacts of fintech inclusion. *Journal of Social Review and Development*, 4(3), 47-53.
- 2) Ajakaiye, O., & Adeyeye, V. A. (2022). Digital financial inclusion and enterprise formalization in Nigeria. *Nigerian Institute of Social and Economic Research*.

Analysis of Effects of Digital Financial Inclusion and Tax Revenue in Nigeria

- 3) Aschauer, D. A. (1988). The equilibrium approach to fiscal policy. *Journal of Money, Credit and Banking*, 20(1), 41-62.
- 4) Barro, R. J. (1990). Government spending in a simple model of endogeneous growth. *Journal of political economy*, 98(5, Part 2), S103-S125.
- 5) Central Bank of Nigeria, (2022). National financial inclusion strategy: 2022 update. <https://www.cbn.gov.ng>
- 6) Chukwuere, J. E. (2021). The eNaira-Opportunities and challenges. *Journal of Emerging Technologies*, 1(1), 72-77.
- 7) EFINA. (2023). Access to Financial Services in Nigeria 2023 Survey. <https://a2f.ng/efina-reportnigerias-formal-financial-inclusion-grows-to-64-in-2023/>
- 8) Haruna, R. A., Joseph, Y., Adedoyin, E. T., & Sanni, P. A. (2026). Tax policy and the growth of Nigeria's digital economy: A panel data analysis of ICT and revenue linkages. *Kashere Journal of Management Sciences*.
- 9) International Monetary Fund. (2023). Nigeria: Fostering financial inclusion through digital financial services. <https://www.imf.org>
- 10) Khatoon, A., & Shabbar, S. (2022). Does Financial Inclusion Create Tax Revenue for the Government? A Panel Study on Developing Countries. *Pakistan Journal of Economic Studies (PJES)*, 5(2), 389-406.
- 11) Mpofu, F. Y. (2022). Industry 4.0 in financial services: Mobile money taxes, revenue mobilisation, financial inclusion, and the realisation of sustainable development goals (SDGs) in africa. *Sustainability*, 14(14), 8667. doi:<https://doi.org/10.3390/su14148667>
- 12) Nguyen The B, Oanh TTK, Le QD, Nguyen THH (2025). Nonlinear impact of financial inclusion on tax revenue: evidence from the Monte-Carlo simulation algorithm under the Bayesian approach. *Journal of Economic Studies*, Vol. 52 No. 2 pp. 393–411, doi: <https://doi.org/10.1108/JES-01-2024-0010>.
- 13) Nwankwo, E. E., Ameke, B. C., Uzundu, C. S., & Njideka, C. R. (2026). The Impact of financial inclusion on poverty reduction and economic growth in Mgbakwu and Isuaniocha communities. *ANSPOLY Journal of Advanced Research in Science & Technology (AJARST)*, 3(1), 111-119.
- 14) Omodero, C. O., & Okafor, M. C. (2021). Digital financing and taxation in the 4th industrial revolution: Evidence from Nigeria. *Universal Journal of Accounting and Finance*, 9(6), 1594-1601.
- 15) Omodero, C. O., & Ekundayo, G. (2025). The Road to Tax Collection Digitalization: An Assessment of the Effectiveness of Digital Payment Systems in Nigeria and the Role of Macroeconomic Factors. *International Journal of Financial Studies*, 13(3), 178.
- 16) Ozili, P. K. (2021). Financial inclusion research around the world: A review. *Forum for Social Economics*, 50(4), 457–479.
- 17) Ozili, P. K. (2023). eNaira central bank digital currency (CBDC) for financial inclusion in Nigeria. In *Digital economy, energy and sustainability: Opportunities and Challenges* (pp. 41-54). Cham: Springer International Publishing.
- 18) Ren, P., Moumbark, T., Appiah, E., & Koudalo, Y. M. A. (2025). Financial Inclusion, Mobile Money, and Tax Revenue in Africa. *SAGE Open*, 15(1), 1. <https://doi.org/10.1177/21582440251315222>
- 19) Romer, P. M. (1994). The origins of endogenous growth. *Journal of Economic perspectives*, 8(1), 3-22.



There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.