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Digital Financial Inclusion and its Macroeconomic Effects on Consumption in Nigeria

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Abstract

Digital financial inclusion (DFI) has emerged as a transformative tool for deepening access to formal financial services in emerging economies. This study explores the extent to which DFI influences macroeconomic variables, specifically consumption. The study covered the period 2005 – 2023 and used the ARDL regression models. The dependent variable was household consumption final expenditures. The independent variables include POS, ATM, INF, EXR, and DIL. The study found that the independent variables have positive and significant relationship with consumption in Nigeria. However, INF and EXR were found to have negative and significant relationship. The study concluded that digital financial inclusion has demonstrable macroeconomic benefits for Nigeria if well managed. Amongst others, the study recommends that consumption should be regulated when using digital financial technologies, in favour of locally manufactured goods.

Keywords: *Digital financial inclusion, Gross domestic savings, Household consumption final expenditure, Point of sale, Automated teller machine, Digital loan*

Background to the Study

In developing economies like Nigeria, financial exclusion has long been a barrier to equitable economic participation and macroeconomic stability. Over 36% of Nigerian adults remained financially excluded as of 2020 (Akinrinola et al., 2023). However, the rise of digital financial services, particularly mobile banking, mobile wallets, agent banking, and fintech innovations, has opened new frontiers for inclusive finance. Digital financial inclusion (DFI) refers to the use of digital platforms such as point-of-sale, ATM, and mobile apps to provide affordable, accessible, and secure financial services to underserved populations (Atta & Ibrahim., 2024). Despite the growing adoption of digital payment technologies, their impact on savings and consumption remains contested. For instance, Omojola et al. (2022) observed that digital payments positively affect indirect tax revenue, which is primarily driven by consumption patterns in Nigeria. As a developing country, this finding seems to challenge the assertion by Eguavoen & Adekunle (2025) that developing nations may not experience savings growth at the same rate as developed countries.

Contrary evidence also emerges from Asia, where studies in countries like China and Thailand, both classified as developing economies, report increased savings facilitated by digital financial tools (Eze, 2024). However, Onyejiaku et al. (2024) argued that digital payment technologies could deteriorate household welfare, citing Kenya as a case study. In contrast, Ouma et al. (2017) found a significant positive relationship between digital financial services and savings levels across Sub-Saharan Africa.

Previous studies have focused majorly on the relationship between digital financial inclusion and gross domestic products over the years. Few studies on the relationship between digital financial inclusion and savings/consumption in Nigeria. This study explores the extent to which DFI influences macroeconomic variables, specifically consumption expenditure. This metric is crucial for national economic planning, income redistribution, and long-term capital accumulation. The central question is: To what extent has digital financial inclusion shaped consumption expenditure behaviors in Nigeria?

Research Questions

i. What is the relationship between POS and household final consumption expenditure?
ii. Do ATM machines have any significant relationship with household final consumption expenditure?
iii. Do digital loans affect household final consumption expenditure?
iv. Is there any significant relationship between inflation and HFCE?
v. Does exchange rate affect HFCE in Nigeria?

Hypotheses

$H0_1$: There is no significant relationship between POS and household final consumption expenditure (HFCE) in Nigeria

$H0_2$: There is no significant relationship between ATM and HFCE in Nigeria

$H0_3$: There is no significant relationship between digital loans and HFCE in Nigeria
$H0_4$: There is no significant relationship between INF and HFCE in Nigeria
$H0_5$: There is no significant relationship between EXR and HFCE in Nigeria

Literature Review

Conceptual Framework and Theoretical Underpinnings

Concept of Digital Financial Inclusion

DFI involves leveraging digital tools to deliver financial products and services, especially to individuals who were previously excluded from the formal financial sector (Olaoye & Zerihun, 2023). It includes mobile money services, internet banking, digital credit, and insurance platforms accessible via smartphones or USSD codes. Digital financial inclusion minimizes the gap that previously existed between people who had access to financial services and those who did not. As

Aninwagu and Onyema (2025) asserted, digital financial inclusion has brought substantial financial empowerment to the people who were hitherto, excluded from the financial circle in Nigeria. Due to the increased financial access, there has also been increased consumption expenditure by the people according to Oladele et al. (2021). Hussaini et al. (2025) highlighted the connection between digital financial inclusion and consumption, noting that an increase in financial inclusion has also increased the consumption of demand of the people since they have access to easier ways of receiving and spending money.

Financial Inclusion and Keynesian Multiplier

From a Keynesian perspective, greater financial inclusion increases the marginal propensity to consume (MPC), which fuels aggregate demand, employment, and growth. Conversely, access to savings platforms improves capital formation through increased investments. From the Keynesian perspective, increased financial inclusion plays a significant role in economic activity stimulation by increasing the marginal propensity to consume. When people, especially those who were initially excluded from the financial system, gain access to financial services such as bank accounts, credit cards, and other digital payment platforms, they are more likely to spend more proportion of their income. The increased consumption also increases aggregate demand which in turn increases production, leads to employment generation, and overall economic growth of the country (Ugwuanyi et al., 2022).

Theories of Consumption

The Keynesian Consumption Theory (Absolute Income Hypothesis)

This theory was proposed by the British economist John Maynard Keynes in his seminal work The General Theory of Employment, Interest and Money (1936). According to this theory, consumption is primarily determined by an individual's current level of income. That is, people base their consumption decisions largely on the income they receive in the present period, rather than on expected future income or past savings. The central idea of the Absolute Income Hypothesis is captured in the equation: Savings = Income – Consumption.

This implies that any income not spent on consumption is saved. As income increases, individuals tend to consume more; however, they do not consume all of the additional income. Instead, a portion of it is saved. Therefore, both consumption and savings rise with increases in income, but savings tend to increase at a faster rate than consumption. This results in a rising marginal propensity to save and a declining marginal propensity to consume as income grows (Ugwuanyi et al., 2022). This theory emphasizes the importance of income distribution in driving consumer spending and highlights why lower-income households, who have a higher marginal propensity to consume, are critical to stimulating aggregate demand in an economy.

Financial Intermediation Theory and Digital Financial Inclusion

Financial Intermediation Theory, according to Ejinkonye et al. (2023), centers on the role of financial institutions, such as banks, credit unions, microfinance institutions, and more recently, digital platforms such as fintechs, Automated Teller Machines, Point of Sale machines (POS), in bridging the gap between savers and borrowers. Financial intermediaries perform critical economic functions which include but not limited to mobilizing savings, allocating capital efficiently, reducing information asymmetries, managing risks, and providing liquidity. By pooling funds from numerous savers and channeling them toward productive investments, financial intermediaries facilitate economic growth, innovation, and financial stability (Ejinkonye et al., 2023).

In recent years, digital financial inclusion has expanded the scope and accessibility of financial intermediation, especially in developing and underserved regions as highlighted by Ozili (2024). Digital financial inclusion refers to the use of digital technologies, such as mobile money, online banking, fintech platforms, and blockchain systems, to provide affordable, accessible, and appropriate financial services to populations traditionally excluded from formal financial systems.

Linking Financial Intermediation Theory to Digital Financial Inclusion

Mobilization of Savings at Scale

For Onyejiaku et al. (2024), digital financial platforms, specifically, mobile money and savings apps, allow individuals, especially in remote or low-income areas, to deposit small amounts of money securely and conveniently. These digital savings are then aggregated by financial service providers, enabling financial intermediaries to mobilize a much broader base of capital than was previously possible.

Efficient Allocation of Credit

Through digital credit scoring, transaction histories, and data-driven and AI analytics, fintech companies and digital banks can assess creditworthiness more accurately and at lower cost. This reduces information irregularity and allows for more efficient allocation of funds to small businesses, farmers, or informal sector workers who might otherwise be excluded from traditional credit channels (Olaoye & Zerihun, 2023).

Transaction Cost Reduction
Olaoye and Zerihun (2023) also state that digital financial services significantly reduce the cost of financial transactions, making it easier for intermediaries to serve low-income and rural clients profitably. This supports the core idea in Financial Intermediation Theory that intermediaries thrive when transaction and search costs are minimized.

Risk Management and Financial Stability
Digital tools, such as mobile insurance and biometric authentication, enable better risk assessment and security for both users and intermediaries. This promotes trust in financial systems while enhancing the stability of the intermediation process (Eze, 2024).

Financial Deepening and Inclusion
By leveraging mobile phones and digital identities, financial intermediaries can now reach unbanked populations at a fraction of the cost of physical branch expansion (Eze, 2024). This deepens financial inclusion, increases savings rates, and strengthens the role of intermediaries in inclusive economic development. In essence, digital financial inclusion revitalizes and extends the principles of Financial Intermediation Theory by enabling broader participation in the financial system. It enhances the ability of intermediaries to collect savings, allocate capital, and manage risks more efficiently and inclusively. As digital tools continue to advance, their integration into financial intermediation will be crucial in accelerating economic growth, reducing poverty, and fostering inclusive development, mostly in emerging and low-income economies.

Empirical Literature Review
Empirical studies have increasingly focused on the macroeconomic effects of digital financial inclusion, particularly in relation to household savings, consumption, poverty reduction, and economic growth.

In a related study, Atta and Ibrahim (2024) investigated the broader relationship between financial inclusion and economic development in Nigeria, using money supply and credit to the private sector as proxies for inclusion. Anchored in the finance-led growth theory, their analysis found both short-term and long-term linkages between financial inclusion and economic development, emphasizing the need for inclusive policies that address demographic disparities and enhance financial access. While the focus was not directly on savings, the implications of financial inclusion for aggregate welfare and savings mobilization are clear.

Onyejiaku et al. (2024) explored the effects of digital financial inclusion on poverty alleviation across African emerging economies from 1997 to 2023. Employing an Autoregressive Distributed Lag (ARDL) model, they used ATMs, mobile money, and mobile payments to measure digital financial inclusion, while household consumption expenditure served as a proxy for poverty reduction. The results show that ATMs and mobile money significantly reduce poverty, while mobile payments exhibit a negative effect, possibly due to increased

consumption and reduced savings. Their findings suggest that digital financial inclusion enhances welfare by facilitating investment and economic empowerment.

Similarly, Oyadeyi (2024) assessed the role of financial inclusion and banking innovation in driving economic growth in Nigeria using a novel combination of ARDL and Mixed Data Sampling (MIDAS) techniques on monthly and quarterly data from 2009 to 2021. The study revealed that financial inclusion indicators, especially POS and ATM transactions, positively influence economic growth. Although the effects of POS and web payments were not consistent across models, the POS channel had the strongest impact overall. These findings reinforce the idea that digital finance enhances economic activity, though they also suggest potential consumption biases that could impact household savings differently.

Olaoye and Zerihun (2023) provided further insight by analyzing the moderating role of information and communication technology (ICT) in the relationship between financial inclusion and poverty in Nigeria. Using econometric techniques such as the Generalized Method of Moments (GMM) and Fully Modified Ordinary Least Squares (FMOLS), they established that ICT enhances the poverty-reducing impact of financial inclusion. Notably, the study suggests that ICT infrastructure amplifies the positive effects of digital finance during macroeconomic shocks, promoting financial resilience and potentially increasing long-term savings among vulnerable populations.

Ozili (2024) examined the trends in women's digital financial inclusion in Nigeria using indicators from the Global Findex Database for the years 2014, 2017, and 2021. The study employed Two-Stage Least Squares (2SLS) and Generalized Method of Moments (GMM) regression techniques to explore the relationship between women's digital financial inclusion and economic growth. Digital inclusion indicators included mobile money account ownership, frequency of digital payments, and card ownership among women. The findings revealed a gradual improvement in women's mobile money account ownership over time, while other indicators declined in 2017 before rebounding in 2021. Credit card ownership among women remained stagnant across the period. Importantly, the study found a significant positive relationship between women's digital financial inclusion and economic growth, with internet usage also significantly enhancing digital inclusion. The study recommended expanding fintech infrastructure and internet accessibility to deepen women's digital financial inclusion and stimulate growth.

Obayori (2020) investigated the relationship between financial inclusion and economic growth in Nigeria from 1981 to 2018 using the Autoregressive Distributed Lag (ARDL) model. The analysis was preceded by the Augmented Dickey-Fuller (ADF) unit root test to assess the stationarity of variables. Results showed that access to and effective use of financial services significantly contributed to economic growth in both the short and long run. However, per capita income had a negative but statistically significant impact on growth. The study supported the finance-led growth hypothesis and recommended expanding financial inclusion, especially through electronic channels such as ATMs, POS, and mobile money, in

rural areas, alongside financial literacy programs to engage the low-income population in formal financial systems.

Aninwagu and Onyema (2025) explored the relationship between financial inclusion and economic resilience in Nigeria using data from 1990 to 2023. Ordinary Least Squares (OLS) analysis revealed that inflation had a negative and statistically significant effect on GDP growth, suggesting that rising inflation reduces growth. Similarly, increased internet penetration was also associated with a significant decline in GDP growth, contrary to expectations. SME financing had a positive but statistically insignificant effect on economic growth. The study recommended implementing strict anti-inflationary monetary policies, enhancing digital literacy through ICT integration in education, and introducing more targeted financial support schemes for SMEs to foster resilience and growth.

Oladele et al. (2021) examined the impact of financial inclusion on unemployment, poverty, and price stability in Nigeria using the ARDL approach with time series data. The results revealed that in the long run, credit, deposit, and investment penetration were positively but insignificantly related to unemployment, while in the short run, they had a negative and significant relationship. Bank branch penetration was found to reduce unemployment in the long run but increase it in the short run. Regarding poverty, deposit, branch, and investment penetration showed negative and significant relationships in both the short and long term, indicating that financial inclusion helps reduce poverty. However, its impact on price stability was mixed. The study concluded that financial inclusion contributes significantly to poverty reduction but has limited long-term effects on unemployment, and thus recommended enhanced deposit mobilization and credit access to promote job creation and reduce poverty.

Omoruyi et al. (2024) assessed the impact of digital financial services, specifically transaction volumes across mobile banking (MB), point-of-sale (POS) systems, ATMs, and internet banking, on Nigeria's economic development between 2009 and 2022. Using descriptive statistics, correlation analysis, and multivariate OLS regression, the study found that mobile banking and ATM transaction volumes positively and significantly contributed to economic development. Conversely, POS transaction volume had a negative and significant impact, while internet banking transactions had an insignificant effect. The study concluded that mobile banking and ATM services are vital drivers of economic growth, and recommended expanding these services while addressing the high transaction costs and infrastructure limitations associated with POS terminals.

Hussaini and Dikko (2025) investigated the relationship between digital financial inclusion and poverty reduction in rural Nigeria, focusing on the North-West region. Based on data from 538 financially included rural households collected through a structured questionnaire, the study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) for analysis. The findings indicated a strong and statistically significant positive relationship between digital financial inclusion and poverty reduction. The authors advocated for more robust digital financial services tailored to rural settings, including mobile-based platforms and wider internet access, to enable real-time and location-flexible financial transactions.

Ugwuanyi et al. (2022) conducted a comprehensive panel study to assess the impact of financial inclusion, disaggregated into traditional and digital dimensions, on economic growth across 29 Sub-Saharan African countries between 2012 and 2020. Employing Panel Feasible Generalized Least Squares (FGLS), System Generalized Method of Moments (GMM), and Panel Vector Autoregression (VAR) Granger causality tests, the study explored both access and usage sub-dimensions of financial services. The findings indicated that both traditional and digital financial inclusion positively and significantly impact economic growth, although traditional finance had a more pronounced effect, especially in terms of access. In contrast, the usage dimension revealed little difference in effect between traditional and digital channels. Furthermore, while both forms of financial inclusion were significant in middle-income countries, only digital financial inclusion was statistically significant in low-income countries. Granger causality analysis revealed a stronger causal relationship from economic growth to traditional financial inclusion than the reverse. The study concluded that while digital finance is a promising frontier, traditional banking infrastructure remains essential in Sub-Saharan Africa and should not be neglected.

Chude and Chude (2022) examined the effect of financial inclusion on Nigeria's economic growth from 1981 to 2021. The study focused on four key indicators: total bank loans, number of bank branches, commercial bank deposits, and automated teller machine (ATM) services. Using the Ordinary Least Squares (OLS) method along with unit root tests, cointegration techniques, and an Error Correction Model (ECM), the analysis revealed mixed outcomes. While bank branches and commercial bank deposits had a positive and statistically significant effect on economic growth, total bank loans exhibited a negative and significant relationship, suggesting inefficiencies in credit allocation. ATM services were not explicitly highlighted in the final results. The authors recommended improved loan screening processes, increased bank branch expansion, and broader deployment of Point-of-Sale (POS) terminals to improve access to financial services and drive inclusive economic growth.

Soetan et al. (2021) adopted a qualitative approach to explore the lived experiences of financial service users and providers in Nigeria. Using semi-structured interviews with 26 bank customers and 7 senior bank executives, the study developed a conceptual framework identifying three key themes influencing financial service experience: service maintenance, service technology, and service dynamics. The study found that inadequate transparency, particularly concerning hidden bank charges, and poor customer service undermined trust and satisfaction. Moreover, although financial technologies offer significant potential, their adoption is hindered by usability issues and limited digital literacy. The study emphasized the need for financial institutions to improve service delivery, invest in customer education on digital tools, and enhance the mobile money agent network. The findings offer actionable insights for policymakers and financial service providers to improve service design and implementation strategies, thereby advancing financial inclusion. These empirical studies reveal that while digital financial inclusion generally fosters savings and economic development, certain platforms like POS and mobile payments may increase consumption and undermine savings in the short run.

Methodology

This study employed the ARDL model of regression analysis using annual timeseries data from 1990 to 2023 sourced from the Central Bank of Nigeria, and National Bureau of Statistics. The study was anchored on the *Keynesian Consumption Theory* which posits that consumption is a primary function of income.

Model Specification

The aim of the study was to investigate the impact of digital financial inclusion on consumption expenditure in Nigeria over the years. To achieve this, the study used the linear regression model.

The theoretical framework for the model is stated as thus:

$HFCE = f(POS, ATM, DIL, INF, EXR)$ ----------(1)

$HFCE = a_0 + a_1POS + a_2ATM + a_3DIL_2 - a_4INF - a_5EXR + e_1$----------(2)

$Log\,HFCE = a_0 + a_1logPOS + a_2logATM + a_3logDIL - a_4LogINF - a_5LogEXR$---------(3)

e_1 is the error term

a_1-a_3 = the coefficients of the independent variables measuring the slopes.

a_0 = intercept parameter estimates

The inflation (INF) and exchange rate (EXR) serve as control variables for the study.

Pre-estimation Test

Unit Root Test

To validate the adequacy of the variables used in the model, the study employs the Augmented Dickey-Fuller (ADF) test to examine the stationarity of the data. This step is critical because performing regression analysis on non-stationary time series data can lead to spurious results thereby undermining the reliability and validity of the findings.

Bounds Test for Cointegration

Cointegration refers to the existence of a long-term equilibrium relationship between economic variables. It implies that if variables share the same order of integration, their linear combination will also be stationary, indicating a persistent connection over time. This study uses the bounds test for cointegration to access the long-term relationship between the variables. This is due to the presence of mixed stationarity in the unit roots tests.

Data Analysis Techniques

The research employs the use of time series data for a period of 33 years ranging from 1990-2023. The study uses the digital financial inclusion variables such as POS, ATM, and digital loans as the independent variables while the household final consumption expenditure (HFCE) serves as the dependent variable.

Post Estimation Tests
The study conducts the following post estimation tests:

Normality Test: In order to test if the residuals of the analysis are normally distributed, the Jarque-Bera test statistic was employed. In this study, a normality test can help assess if the residuals from the regression analysis follow a normal distribution. Deviations from normality could indicate that the model may not be appropriate or that there are underlying issues affecting the data.

Serial correlation, also known as autocorrelation, occurs when the residuals from a regression model are correlated with each other. This violates the assumption of independent residuals, which is necessary for the validity of statistical inferences.

Heteroscedasticity occurs when the variance of the residuals in a regression model is not constant across all levels of the independent variables. This violates the assumption of homoscedasticity, which is necessary for the efficiency of OLS estimates.
The Eviews version 12 was used for the analysis.

Results and Discussion
Descriptive Statistics
Table 1: Model I

			LOG_HFCE			
	LOG_ATM_	LOG_DIL_	_	LOG_POS_	LOG_INF_	LOG_EXR_
Mean	1.992595	4.902429	7.581985	0.057986	3.896178	2.867025
Median	1.864050	4.940213	7.569959	0.343590	3.858538	2.885192
Maximum	3.485845	5.108971	7.693454	2.373044	4.018525	3.264520
Minimum	0.683097	4.627910	7.372828	-3.473768	3.848593	2.494649
Std. Dev.	0.913235	0.137866	0.087195	2.011124	0.057048	0.246281
Skewness	0.407842	-0.598823	-0.633586	-0.441650	0.927458	0.091393
Kurtosis	1.973748	2.324458	2.883119	1.924587	2.306197	1.587182
Jarque-Bera	0.859266	1.496813	1.282013	1.049063	6.373371	2.790514
Probability	0.650748	0.473120	0.526762	0.591832	0.041309	0.247769
Sum	23.91114	93.14615	144.0577	0.753815	151.9509	94.61182
Sum Sq. Dev.	9.173983	0.342129	0.136854	48.53544	0.123670	1.940942
Observations	33	33	33	33	33	33

Source: Author's computation using Eviews (2025)

Descriptive statistics provide an overview of the dataset used in any data analysis, allowing for an initial understanding of the data's characteristics and confirming its relevance for further analysis according to George (2018).

The descriptive test above shows the variables used are generally normally distributed, as reflected by the probabilities associated with their Jarque-Bera statistics in both models. Additionally, the data shows a leftward skew, and kurtosis values reveal that POS, INF, EXR, ATM. DIL, and HCFE have moderate kurtosis (mesokurtic) for the model. This suggests that the variables are free from significant outliers and generally follow a normal distribution, reinforcing their suitability for the study's analysis.

Unit Root Analysis

Unit root tests, according to Yilanci & Pata (2020), refer to statistical tests used to determine if a time series dataset has a unit root or not. The presence of a unit root indicates that the time-series is not stationary. Unit root also means that the variable is not deterministic in nature.

Table 2.

Variables	At levels (Prob)	First difference (Prob)	Comments
LogHCFE	0.0214	0.0000	I(0) Stationary at levels
LogPOS	0.2275	0.0000	I(1) Stationary at first difference
LogATM	0.9600	0.0000	I(1) Stationary at first difference
LogDIL	0.4868	0.0000	I(1) Stationary at first difference
LogINF	0.3711	0.0000	I(1) Stationary at first difference
LogEXR	0.0762	0.0000	I(1) Stationary at first difference

Source: Author's computation (2025)

The tables shows that the unit root tests of the variables are mixed, showing stationarity at both levels and first difference. This suggests that the use of Auto-Regressive Distributed Lag Model (ARDL) is the most appropriate models and analytical procedure for the analysis.

Bounds Test for Cointegration

The bounds test for cointegration tests for long term relationship between the dependent and the independent variables used in the study (Rehman et al, 2020).

Table 3: Bounds test for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.242647	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Authors computation from Eviews (2025)

The bounds test for cointegration for the model showed that the model has a long-term relationship amongst the variables used. Using the F-stat at 5% confidence interval, the model reveal that the F-statistics is higher than their 5% asymptotic variables (lower critical bound) indicating that there is a long run relationship amongst the variables used in the models.

Table 4: ARDL ECM Tests
Model: HFCE

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_POS (-1))	0.784175	0.196807	3.984498	0.0163
D(LOG_ATM_(-2))	0.740984	0.176689	4.193717	0.0138
D(LOG_DIL_(-3))	0.387522	0.186774	2.074819	0.0066
D(LOG_INF_(-2))	-1.052112	0.166239	-6.328912	0.0000
D(LOG_EXR_(-2))	-0.290211	0.117632	2.467109	0.0000
CointEq(-1)*	-0.627774	0.323868	-5.643574	0.0000

R-squared	0.726152	Mean dependent var	-0.017931
Adjusted R-squared	0.680464	S.D. dependent var	0.666082
S.E. of regression	0.321180	Akaike info criterion	-1.202151
Sum squared resid	0.079811	Schwarz criterion	-0.640515
Log likelihood	11.01291	Hannan-Quinn criter.	-1.261993
Durbin-Watson stat	2.011022		

* p-value incompatible with t-Bounds distribution.

Source: Author's computation using Eviews (2025)

The ARDL ECM results of the models shows the relationships between the dependent and the independent variables over the period. The result reveals that the adjusted R-square, which shows the goodness-of-fit, is 0.72. This shows that 72% of the changes in the HCFE variable are explained by the changes in the independent variables. The f-test also shows that the model, taken as a whole, is statistically significant. This implies that the model is reliable for the current analysis. The models equally show that the error correction mechanism (ECM) is 0.63. This implies that there is 63% annual speed of adjustments of the variables to equilibrium.

Table 5: Serial Correlation Tests

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.188901	Prob. F(2,5)	0.3166
Obs*R-squared	5.605631	Prob. Chi-Square(2)	0.0763

Source: Author's computation using Eviews (2025)

As Chaudhary et al (2022) explain, the serial correlation helps to understand how (and if) a variable affects itself when lagged. The implication is that if a variable affects itself over time, this will result to spurious results and cannot be used for predictive purposes. The serial correlation results for the model reveals that there is no issue of serial correlation among the variables used. This is shown by the probability of the F-stat being more than 0.05.

Table 6: Heteroskedasticity Tests

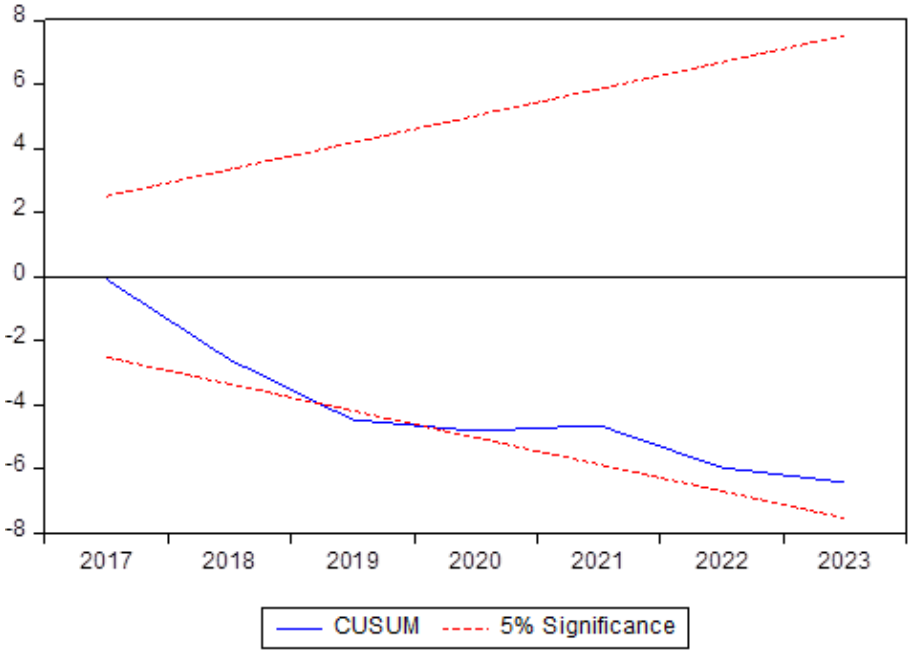
Heteroskedasticity Test: Breusch -Pagan-Godfrey

F-statistic	7.519194	Prob. F (4,7)	0.2102
Obs*R-squared	9.734431	Prob. Chi-Square (4)	0.1356
Scaled explained SS	3.460866	Prob. Chi-Square (4)	0.8831

Source: Author's computation using Eviews (2025)

The heteroskedasticity test reveals the variability of the variance or error term of the time series over the period. As one of the assumptions of regression analysis, heteroskedasticity shows that the error terms of the variables are not the same (and cannot be) if the analysis will be reliable. As the results shows, the probabilities of the f-stat are greater than 0.05. This shows that there is no reason to believe that the variables are homoscedastic in both models.

Figure 1: CUSUM Test



CUSUM test reveals the stability of the models and its applicability in the analysis. The CUSUM test reveals that the models are stable and therefore, applicable in the current analysis.

Tests of Hypotheses

The results of the ARDL ECM are used for the tests of hypotheses.

H_{01}: There is no significant relationship between POS and HFCE in Nigeria

The analysis shows that there is a positive relationship between HFCE and POS, which is expected apriori. The result shows that as POS transactions increases by a unit percentage, HFCE increases by 0.784175 percent and vice versa. The analysis reveals that POS is statistically significant as shown by the t-value prob (0.0163). We will therefore accept the alternative hypothesis, reject the null and conclude that there is a significant relationship between POS and HFCE over the period.

H_{02}: There is no significant relationship between ATM and HFCE in Nigeria

Again, the analysis shows that there is a positive relationship between ATM and HFCE. The result reveals that as ATM increases by a percentage unit, HFCE increases by 0.740984 percent and vice versa. The analysis reveals that ATM is statistically significant as shown by the t-value prob (0.0000). We will therefore reject the null hypothesis, accept the alternative and conclude that there is a significant relationship between ATM and HFCE over the period.

$H_{03:}$ There is no significant relationship between digital loans and HFCE in Nigeria

The analysis shows that there is a positive relationship between DIL and HFCE over the period. The result shows that as DIL increases by a percentage unit, HFCE also increases by 0.387522 percent and vice versa. The analysis reveals that DIL is statistically significant as shown by the t-value prob (0.0066). We will therefore reject the null hypothesis, accept the alternative and conclude that there is no significant relationship between DIL and HFCE over the period.

H_{01}: There is no significant relationship between INF and HFCE in Nigeria

The result of the analysis shows that there is a negative relationship between INF and HFCE over the period. The result shows that as INF increases by a percentage unit, HFCE also decreases by -1.052112 percent and vice versa. The analysis reveals that INF is statistically significant as shown by the t-value prob (0.0000). We will therefore reject the null hypothesis, accept the alternative and conclude that there is no significant relationship between INF and HFCE over the period.

H_{01}: There is no significant relationship between EXR and HFCE in Nigeria

Finally, the result of the analysis shows that there is a negative relationship between EXR and HFCE over the period. The result shows that as EXR increases by a percentage unit, HFCE also decreases by -0.290211 percent and vice versa. The analysis reveals that EXR is statistically significant as shown by the t-value prob (0.0000). We will therefore reject the null hypothesis, accept the alternative and conclude that there is no significant relationship between EXR and HFCE over the period.

Discussion of findings

The analysis reveals the extent of digital financial inclusion and its macroeconomic effects on Nigeria's household consumption expenditure. It shows that there is a negative but significant relationship between POS, ATM, and DIL on consumption expenditure in Nigeria over the period.

The study found that there is a positive and significant relationship between HFCE and all the independent variables – POS, ATM, and DIL. The result shows that POS, ATM, and DIL contribute significantly towards increases in household consumption. With the availability of digital technologies designed for financial inclusion, the household consumption has increased. Iwedi (2023) also found a similar result studying the relationship between household consumption and economic growth, thereby agreeing with the present study.

The analyses reveal that the digital financial inclusion (DIL), although has grown and deepened, it has also increased the consumption rate of the household over the period. From the consumption point of view, the RGDP is improving but with the decrease in the gross domestic savings, the economy will not have enough for reinvestments. This will eventually

have a negative impact on the RGDP in the future. However, the analysis reveals that inflation and exchange rates have negative and significant relationship with HFCE. This implies that with increases in the rate of inflation, prices of goods and services also increase thereby limiting the purchasing ability of the households, even though, they have access to more funds due to financial inclusion.

The same way, the analysis shows that HFCE can be negatively impacted by exchange rate variations. Using Dollar as the base exchange rate, increases in the Dollar value against the local currency increases the prices of imported products – together with the prices of other products associated with foreign products. This has both direct and indirect effect on the consumption of the people. These findings agree with the works of Obayori (2020) and Omoruyi et al. (2024) who noted that inflation and exchange rate negatively affect the aggregate consumption of the people.

Conclusion

Digital financial inclusion has demonstrable macroeconomic benefits for Nigeria. Analysis reveals that the effects of digital financial inclusion variables on consumption are positive and significant, indicating that the DFI has opened up the economy better. However, economic variables such as inflation and exchange rate have negative and significant impact on household consumption. Therefore, policymakers must harness the digital revolution to foster inclusive and sustainable economic development. This ensures that other key variables such as inflation and exchange rate variations do no decrease the gains of digital financial inclusion.

Recommendations and Policy Implications Based on the Findings

The digital technologies designed for financial inclusion have been found to have a far-reaching effect on the macroeconomies of Nigeria over the period, 2005 – 2023. Based on the findings, the study recommends:

i. There must be concerted efforts in developing digital financial products as they have shown to improve consumption. Consumption also increases aggregate demand, production, job creation, and general economic growth.

ii. Consumption expenditure should be regulated when using digital financial technologies such as POS, ATM, and DIL. Regulating this will help improve the savings culture, leading to improved gross domestic savings that is required for investments.

iii. That the consumption, although important as a macroeconomic variable, should be regulated to favour local manufacturers in other to retain the gains of digital financial inclusion. Therefore, the authorities must devise strategies to use the digital financial inclusion mechanisms to boast local production by encouraging the consumption of locally made goods, since consumption is greatly influenced by digital financial inclusive technologies.

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