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FINANCIAL TECHNOLOGY AND ECONOMIC GROWTH NEXUS: QUARTERLY EVIDENCE FROM NIGERIA

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Abstract

Studies exploring the financial technology (FinTech) and economic growth nexus in Nigeria utilised indirect measures of FinTech along with bundle indicators of financial inclusion, disregarding the discrete index's effect. This study aimed to expand the FinTech frontier by utilising the direct measures of FinTech, such as automated teller machines, web pay, mobile banking, and point of sale with unbundled financial inclusion indicators, to examine their individual degree of effect. We employed the ARDL model to estimate the long-short causal individual effects. The findings reveal several vital insights: direct measures of FinTech positively influence financial inclusion and economic growth. Automated teller machines negatively influence economic growth and financial inclusion because of high maintenance costs and security concerns, leading to the closure of ATMs galleries, both within and outside bank branches. This closure resulted in infrastructural deficits that hindered the inclusive financing of growing banked populations. Individual financial inclusion indicators positively influence economic growth, while economic growth and the usage index nexus are non-significant. This study recommends the implementation of regulatory and supervisory frameworks to address the usage, availability, and penetration of FinTech to encourage and inculcate saving habits at the base of the pyramid and their protection from predatory practices.

Contribution/Originality: This study offers novel insights by employing direct measures of FinTech, examining the individual components of financial inclusion, and utilising a specialised model (the Lungs model) to assess the FinTech, financial inclusion, and economic growth nexus in Nigeria. This approach contributes to a more comprehensive understanding of the complex nexus.

JEL Classifications: B22; B23; F65; G21; I30; O15; O16

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1. Introduction

Solow's 1956 neoclassical growth theory reveals the significance of financial technology in the design of macroeconomic policies. According to Solow (1956), advancement in technology, the saving rate, and political will are the key determinants of growth, and the level of technological advancement is considered an exogenous variable. The stability of the 21st-century economic and financial climate is anchored, among other things, in technological advancement for economic and financial service product expansion to the underbanked, unbanked, and financially excluded population. Largely comprising rural dwellers, generically rebranded as "Base of the Pyramid (BoP)" (Udoh et al., 2016). According to the United Nations Special Envoy report (2013), approximately 200 million SME enterprises in emerging economies are financially and data-excluded, which restricts their competitiveness and ability to prosper.

FinTech, otherwise referred to as retail digital financial platforms or Internet finance, involves the integration of technology into the functionalities of the classical financial system for payment and settlement, insurance, transfers, and peer-to-peer lending (Appiah-Otoo & Song, 2021; Shim & Shin, 2016). Despite an all-embracing advancement by microfinance institutions, banks, loans, and savings societies, among others, to spread out financial services to the BoP, approximately 2.5 billion adults globally are still data poor and financially excluded (Hannig & Jansen, 2010).

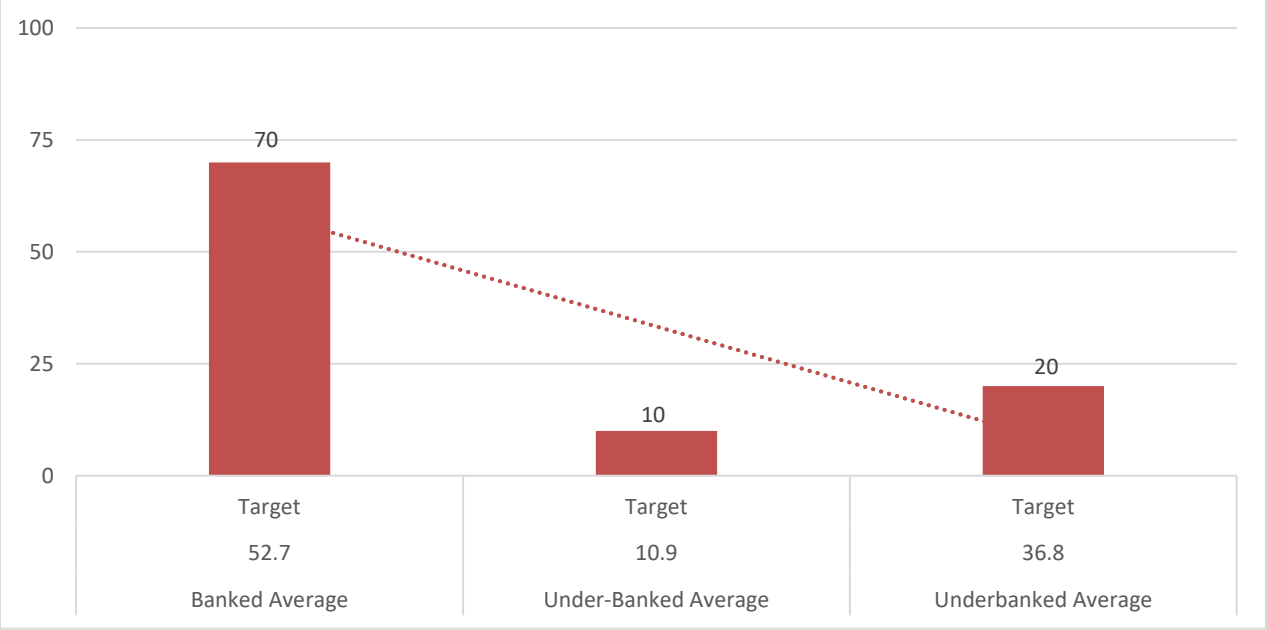
In Nigeria, about 38.3 million adults are data and financially excluded, out of which 21.3 million are adult women, representing 20%, and 17 million are men. The World Bank (2014) report disaggregated financial exclusion into voluntary and involuntary exclusion, as such decisions not to adopt financial services, either due to a lack of urgent need to use them or because of cultural and religious convictions, result in voluntary exclusion. Others blame their involuntary exclusion of poverty, income inequality, burdensome documentation, market failures, and free market flaws (Park & Mercado, 2015) (see Figure 1).

To deal with the effects of widespread involuntary exclusion, the CBN reintroduced the inclusion strategy in 2012 to improve adult access to financial products-services from 21.6% reported in 2010 to 70% in 2020, access to savings from 24.0% to 60%, credit from 2% to 40%, insurance from 1% to 40%, and pension from 5% to 40% (see Figure 2). The first step in formal financial inclusion is to maintain an account with any financial institution or other service provider (Demirguc-Kunt et al., 2018; Udo, 2023).

The findings of Bara et al. (2016) and Bourne et al. (2010) reveal a financial inclusion and account ownership causal nexus. By contrast, Arner et al. (2020) and Demir et al. (2020); Paripunyapat et al. (2018), among others, argue that account ownership is more of data inclusion since numerous bank accounts and mobile money accounts are inactive, signifying exclusion. An all-inclusive structure diminishes the proliferation of informal credit sources and protects financially excluded groups from unethical financial activities. Udo, et, al (2023); Manyika, et, al (2016), Kiilu (2018), Azizah (2018), Choirin (2018), and Motsatsi (2016) attributed the increase in dormant accounts with banks and mobile money providers to financial illiteracy, poverty and income inequality.

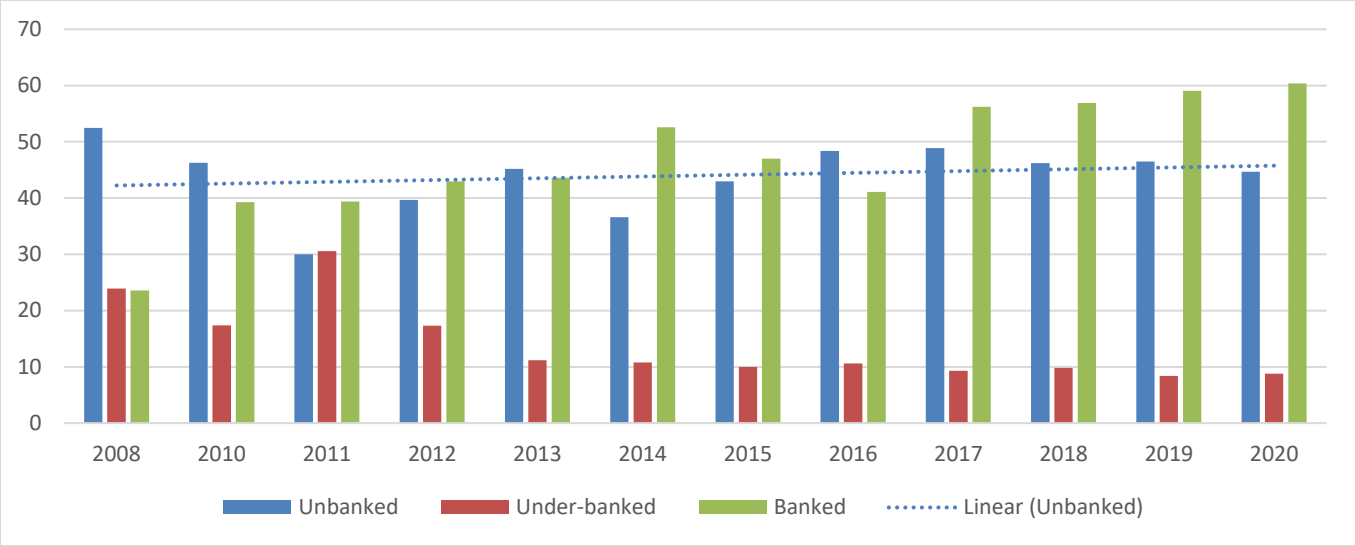
The 2022 Nigerian Inter-Bank Settlement System report, revealed that active accounts with a bank, credit union, microfinance organisation, and mobile money service provider rose from 14.41% to 97.485 million and 111.54 million in 2022. Total savings increased by 13.8%, from ₦114.13 million in 2019 to ₦138.91 million in May 2022. Covid-19 safety measures of social and economic lockdown and the recent currency redesign reinforced the importance of cost-effective, affordable, available, and flexible agency banking channels as vital parts of the financial ecosystem for inclusive growth. By including the financially excluded individuals, households, and small-medium businesses in mainstream economic and financial systems. The result of FinTech integration into Nigeria's economic and financial climate is its financial inclusion.

Figure 1 Status of Financial Inclusion Gap



Source: National Financial Inclusion Strategy (NFIS) (2020).

Figure 2 National Financial Inclusion Strands (2008 - 2022)



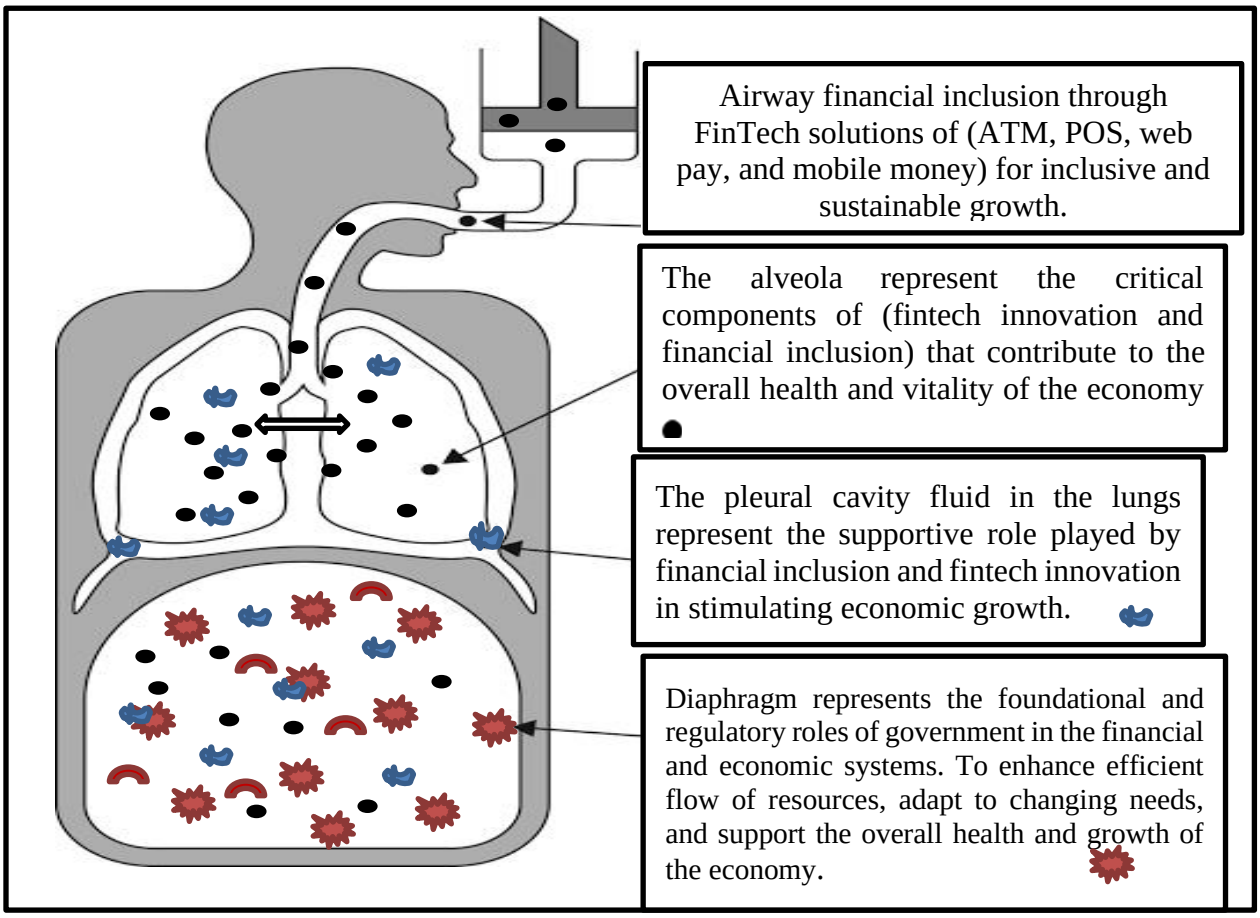
Author (2023)

The basic pivot of inclusiveness includes (a) access to a broader spectrum of financial services; (b) consumer privacy, data protection, and the provision of convenient, affordable, and secure services with dignity; (c) delivery of focused services to the underbanked and unbanked; and (d) a competitive financial system sustained by robust financial infrastructure and a defined regulatory framework, among others (Fadun 2014).

This study developed a lung model to explain FinTech, inclusion, and economic growth ties in Nigeria (see Figure 3). The lungs are the foundational group of organs and tissues that facilitate the exchange of oxygen from the environment into the bloodstream and removal of extra carbon dioxide. In the lungs model, FinTech (oxygen) and financial inclusion (airways) use resources and provide growth opportunities for the economy. FinTech eradicates barriers to financial exclusion and expands access to affordable and flexible financial services for the BoP.

Financial inclusion is the airway in the lungs, providing a path for FinTech (oxygen) to circulate throughout the body (economy). By providing access to financial resources, the base of the pyramid, largely rural dwellers, actively participates in productive economic and financial activities. The Nigerian economy, like the body that receives oxygen, must function effectively. Access to financial services enables businesses to revolutionise, stimulate economic growth, diminishes the proliferation of informal sources of credit and protects the new entrance from usurious moneylenders.

Figure 3: Lungs Model



Source: Author (2023)

Empirical country-specific studies by Demir et al. (2020), Igoni et al. (2020), and Udo et al. (2019a) reveal diverse results. In a cross-country study, Charles (2023) and Kamalu et al. (2019), Mlanga (2019), Iqba et, al (2017, 2018), Niankara, and Muqattash (2019), among others, also reported diverse results. Patrick (1966) argued that a nation's level of development influences its technological advancement, economic growth, and financial development. Chortareas et al. (2013); Udo, et al. (2023) collaborate with Patrick's claims, acknowledging the effects of cultural, geopolitical, national characteristics and governance systems on FinTech adoption.

Akhisar et al. (2015) and Udo et al. (2023; 2019a,b), note that cross-sectional studies are inept at accounting for a specific country's level of technological, financial, and economic sector growth. Country-specific heterogeneous factors are grouped under socioeconomic, cultural, political, religious, and financial factors. Thus, country-specific studies are more rigorous in clarifying this nexus.

The extensive use of conventional regression analytical models in country-specific studies by Nwant et al. (2016), Akinwale (2018), Ndubuisi (2017), and Nwakobi et al. (2019) have raised concerns about the validity of their research findings. Inferences drawn based on a unique model are statistically suspicious, according to Gunst and Mason's 1980 argument (pp. 169–206). The adoption of a diverse paradigm to investigate this nexus will provide vital policy formulations (Grassa & Gazdar 2014; Udo et al., 2023). However, time-series data are skewed and leptokurtic (Brooks 2014). The spikes and variations render the linear model inappropriate for accurate and reliable assessment of this nexus.

This study adds to the extant literature by bordering "FinTech" frontiers to capture direct measures owing to the upsurge in FinTech in Nigeria as a result of the recent currency redesign policy and the covid-19 safety protocols. Most studies confine FinTech indicators to classical banks, ignoring FinTech evolution beyond classical financial borders. In Nigeria, mobile and Internet banking, point-of-sale, and web pay, among other retail digital financial platforms that control a sizable percentage of access, usage, and penetration of financial services, are maintained and supported by telecommunications firms.

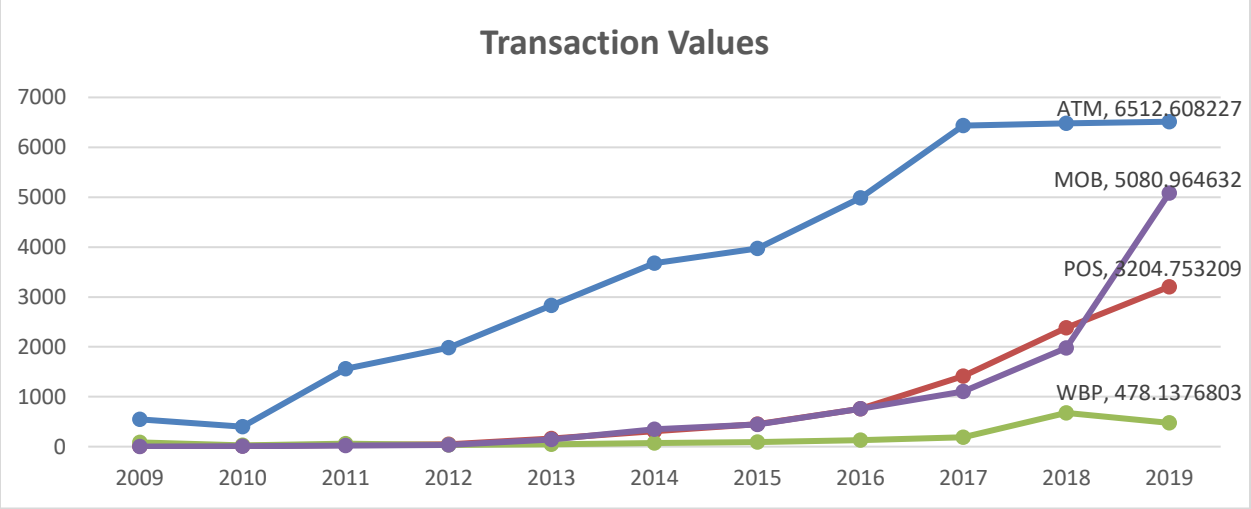
To assess the crux of "non-conventional banking and Fintech, an enlarged characterisation of the direct measure of FinTech was utilised as the value of transactions on each retail FinTech conduit of ATMs, POS, WBP, MOB, and Internet banking, among others. This study considered mobile banking [MOB], point of sale [POS], web pay [WBP], and automated teller machine [ATM] FinTech retail platforms for analysis. Qamruzzaman and Jianguo (2018), Ujunwa et al. (2021), and Udo et al. (2023) have adopted this approach. Prevailing studies in this area habitually focus on the aggregate FinTech index, ignoring direct non-conventional measures.

This study adds to the extant literature by unbundling the inclusion indicators to access individual contributions to Nigeria’s economic growth and human capital development. The study also adds by developing a lung model and testing the symmetric FinTech, financial inclusion, and economic growth nexus, using the ARDL bound approach.

Figure 4 reveals that the transaction values of various retail platforms increased from January 2009-December to 2019 in Nigeria within the period under review. A possible explanation for the geometric increase could be the ease, availability, and affordability of features embedded in these digital platforms.

The value of ATM transactions increased from ₦548.6 billion to ₦6512.60 billion in 2009-2019. Similarly, the values of MOB, POS, and WBP transactions increased geometrically. The results show that ATM, POS, and MOB are the fastest channels to access and use financial products, despite the challenges of poor network coverage. This finding supports the results of Udo et al. (2023) in Nigeria and Charles (2023) in the Common Market for Eastern and Southern Africa (COMESA) countries.

Figure 4: Values of digital platform transactions in (₦ Billions)



Source: Author (2023)

2. Literature Review

Financial Inclusion

Financial inclusion fundamentally implies linking unbanked and underbanked individuals, businesses, and households to all-inclusive economic and financial services benefits (Siddik et al., 2019). Inclusive financing is the basic determining element of financial development, which does not infer inclusive financing because several individuals, businesses, and households may be financially excluded (Lenka, 2021). Both enhance economic growth by divergent magnitudes (Li and Wong, 2018). Inclusive financial and exclusion are instigated by several influences, such as the lack of awareness and literacy, religious beliefs, self-exclusion, income per capita, and bank concentration (Chuka et al., 2022; Sotomayor et al., 2018; Pazarbasioglu et al., 2020). According to Barboni et al. (2017), financial exclusion is a product of social exclusion and poverty.

Indicators of Financial Inclusion

The diversity in the characterisation of financial inclusion is evidenced by the lack of appropriate indicators. Beck et al. (2007) proxied inclusive financing access (credit facility, deposit) and usage (payment system) in a bid to zero down and develop an all-inclusive indicator. Similarly, Honohan (2008) adopted the percentage of households with active accounts with mobile and other financial service providers. Demirguc-Kunt et al. (2018), among others, adopted a set of precise indexes of savings, credit, and payment. Park and Mercado (2015) and Nguyen (2020) posit that the adoption of specific metrics can only offer a hazy picture of an economy's financial system inclusiveness and degree of coverage. Neaime and Gaysset (2018); Khan, Khan, Sayal, and Khan (2021); and Park and Mercado (2018) collaborated these findings.

Over the decades, diverse theoretical and empirical studies have attempted to develop and construct a comprehensive inclusive financing index. To develop an all-inclusive indicator of financial inclusion, the average of four dimensions (usage, outreach, cost of transactions, and ease of transactions) was used by Gupte et al. (2012). Following the UN Human Development Index Development Program (UNDP), the major methodological constraint according to Amidic et al. (2014) and Singh and Stakic (2020) is the arbitrary allocation of equal weights to the designated elements.

Amidic et al. (2014); Singh and Stakic (2020) revealed that such weights are based on the assumption that all indicators have the same impact on financial inclusiveness. In determining the apt weights, Amidic et al. (2014) and Clamara and Tuesta (2014) recommended factor analysis and principal component analysis (PCA), respectively, as a less arbitrary weights-assigning model that bank on existing data for the several indicators of financial inclusion.

However, studies developing the financial inclusion index have adopted either PCA or individual approaches (Dahiya & Kumar, 2020; Chuka et al., 2022; Ahamed & Mallick, 2019; Anarfo et al., 2019; Elsherif, 2019; Huang & Zhang, 2019; Nguyen, 2020; Park & Mercado, 2018; Sethi & Sethy, 2019). These methods are not without merits and demerits, which account for the lack of consensus among scholars and the divergency in results.

2.1 FinTech, Financial Inclusion and Economic Growth Nexus

The significance of high-tech (Solow, 1956) and labour and productivity (Domar, 1946) in reducing growth disparities globally is emphasised in the exogenous growth model. Modern economic development is largely influenced by the exogenous growth assumption of high-tech innovation and new organizational and managerial structures for the production and transformation of a static to dynamic economy. Contemporary high-tech innovation has evolved from the creation of new products to providing solutions to unending economic glitches (Kotsemir and Abroskin 2013).

3. Econometric Model

Quarterly data from 2009Q1–2019Q4 were collated from the CBN and World Bank Development Index. In this study, FinTech is proxied by transaction values on each retail digital platform and is projected to boost economic growth. These are considered the most potent proxies for FinTech (Adil et al. 2020). GDP per capita proxy economic growth is expressed in US dollars and natural logarithms. Financial inclusion is proxied by the unbundled dimensions of (availability, penetration, and usage). Availability (number of bank branches). Sarma (2016) noted that transaction points are fundamental to financial inclusion, and should be easily available and convenient for users. Penetration (bank depositors per 1,000 adults). An all-inclusive financial system entails deep penetration (Nguyen, 2020). Usage (credit to private sector % of GDP). An all-inclusive financial system ensures the full utilisation of financial services (Nguyen, 2020; Sarma, 2016). Control variables: The financial deepening index (domestic credit to the private sector and M3 (% of GDP)) and communication index (Internet access (% of the population) and mobile cellular subscriptions (per 100 people)) were adopted for their influence on financial inclusion and the economy.

3.1 Estimation Strategy

The variables are time series (t), and testing of the stationary properties is vital. The NG-Perron unit root was used to address the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)-associated weaknesses in determining the stationary properties of the series (Folarin & Asongu, 2019). The Pesaran et al. (2001) autoregressive distributed lag (ARDL) bounds model was used to assess the long-run nexus in the variables, as specified in (2). The model integrates variables of diverse orders of integration, and is considered the most suitable.

Endogeneity is used to eliminate hitches associated with serial correlation and variables (Rahman & Kashem, 2017). The linear form of the model is expressed as follows:

Economic Growth		Retail Digital Products	Financial Inclusion	Financial Deepening	Control Variables	(1)
↕		↕	↕	↕	↕	
GDP	$= f$	FINTECH	BB, CP, BD	DC, M_3	IP, MC	

The ARDL Model is Expressed as:

$$GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_i GDP_{t-i} + \sum_{i=0}^{k1} \delta_i ATM_{t-i} + \sum_{i=0}^{k2} \lambda_i POS_{t-i} + \sum_{i=0}^{k3} \Upsilon_i WBP_{t-i} + \sum_{i=0}^{k4} \phi_i MOB_{t-i} + \sum_{i=0}^{k5} \pi_i BB_{t-i} + \sum_{i=0}^{k6} \theta_i CP_{t-i} + \sum_{i=0}^{k7} \upsilon_i BD_{t-i} + \sum_{i=0}^{k8} \psi_i DC_{t-i} + \sum_{i=0}^{k9} \omega_i M3_{t-i} + \sum_{i=0}^{k10} \tau_i IP_{t-i} + \sum_{i=0}^{k11} \chi_i MC_{t-i} + \varepsilon_t \quad (2)$$

The optimal lag was automatically determined using Schwarz information criteria (SIC). The ARDL bound test is expressed as follows in equation (3):

$$\Delta InGDP_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta InGDP_{t-i} + \sum_{i=0}^{k1} \delta_i \Delta InATM_{t-i} + \sum_{i=0}^{k2} \lambda_i \Delta InPOS_{t-i} + \sum_{i=0}^{k3} \Upsilon_i \Delta InWBP_{t-i} + \sum_{i=0}^{k4} \phi_i \Delta InMOB_{t-i} + \sum_{i=0}^{k5} \pi_i \Delta InBB_{t-i} + \sum_{i=0}^{k6} \theta_i \Delta InCP_{t-i} + \sum_{i=0}^{k7} \upsilon_i \Delta InBD_{t-i} + \sum_{i=0}^{k8} \psi_i \Delta InDC_{t-i} + \sum_{i=0}^{k9} \omega_i \Delta InM3_{t-i} + \sum_{i=0}^{k10} \tau_i \Delta InIP_{t-i} + \sum_{i=0}^{k11} \chi_i \Delta InMC_{t-i} + \lambda_1 InGDP_{t-1} + \lambda_2 InATM_{t-1} + \lambda_3 InPOS_{t-1} + \lambda_4 InWBP_{t-1} + \lambda_5 InMOB_{t-1} + \lambda_6 InBB_{t-1} + \lambda_7 InCP_{t-1} + \lambda_8 InBD_{t-1} + \lambda_9 InDC_{t-1} + \lambda_{10} InM3_{t-1} + \lambda_{11} InIP_{t-1} + \lambda_{12} InMC_{t-1} + \varepsilon_t \quad (3)$$

where Δ is the difference operator and l*n* is the natural log of the variables.

The F-statistic value of the bound test was estimated to assess the presence of a long-run nexus, and the estimated F-statistic value was compared with the upper and lower bound critical values.

Decision rule: The F-statistics are (>) the upper critical value (cointegration). F-statistics are (<) upper and lower critical values (no cointegration); F-statistics fall between upper and lower critical values (inconclusive).

From (3), the short-run dynamics are captured by λi; for i = 1, 2,3,4,5. . .6, and the long-run dynamics are captured by βi; γi; δi; ρi; τi; υi; θi; ωi; ϕi; χi and σi for i = 1, 2, 3, 4, 5. . . ., p.

The error correction (ECT) model (Equation (3)) is expressed as

$$\Delta InGDP_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta InGDP_{t-i} + \sum_{i=0}^{p} \delta_i \Delta InATM_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta InPOS_{t-i} + \sum_{i=0}^{p} \Upsilon_i \Delta InWBP_{t-i} + \sum_{i=0}^{p} \phi_i \Delta InMOB_{t-i} + \sum_{i=0}^{p} \pi_i \Delta InBB_{t-i} + \sum_{i=0}^{p} \theta_i \Delta InCP_{t-i} + \sum_{i=0}^{p} \upsilon_i \Delta InBD_{t-i} + \sum_{i=0}^{p} \psi_i \Delta InDC_{t-i} + \sum_{i=0}^{p} \omega_i \Delta InM3_{t-i} + \sum_{i=0}^{p} \tau_i \Delta InIP_{t-i} + \sum_{i=0}^{p} \chi_i \Delta InMC_{t-i} + \infty ECT_{t-1} + \varepsilon_t \quad (4)$$

ECT captures the variables long-run nexus coefficient, ∞, and the speed of convergence to long-run equilibrium from short-run divergence due to shocks in the system. ∞, is negative and significant after an external shock. The diagnostic tests of the ECM result, were conducted.

4. Empirical Estimation

The descriptive statistics are reported in Table 1. The average value of MOB transactions was ₦900.376, approximately three times the average value of ATMs and POS and four times the average of WBP, suggesting that mobile money is the fastest, easiest, and most convenient retail digital platform to access financial services and products within the review period. This signals a gradual shift from ATMs to more convenient and accessible digital retail platforms. WBP is the least patronised retail platform in Nigeria. The average number of deposit accounts is 823.463 (penetration) and credit to the private sector is 18.759 (usage). This indicates that FinTech positively influences inclusive growth and is evident in its usage and access to financial services.

The average value of ₦22.507 for M3 (financial deepening) indicates a positive impact on economic growth, with an average value of ₦2370.09 bn and ₦12.805 billion for domestic credit for the reviewed period. The average value of 75.543 for mobile cellular subscriptions shows the importance of mobile technology for inclusive growth, as evidenced by the average value of 22.497% for individuals using the internet for information. The Ng-Perron unit root test results in Table 2 show stationarity across diverse orders. Thus, we satisfy and provide creditability to our ARDL-bound model.

Table 1: Descriptive Statistics

	Mean	Median	Max	Min	Std. Dev.	Skew	Kurt	Jarque-Bera
ATM	3581.10	3679.87	6512.60	399.71	2237.27	0.024	1.616	3.513
POS	798.277	312.071	3204.75	11.03	1049.10	1.294	3.272	12.421
MOB	900.376	346.467	5080.96	1.27	1460.20	2.140	6.484	55.865
WBP	171.302	84.15	675.916	25.05	202.920	1.645	4.217	22.563
BB	5.2890	4.9802	6.564	4.283	0.8463	0.270	1.502	5.489
BD	823.463	667.464	1458.40	464.479	312.838	0.688	2.288	5.198
CP	18.759	18.667	22.754	15.067	1.723	0.244	4.128	3.2744
DC	12.805	12.491	19.625	10.246	2.437	1.684	5.561	35.8176
M3	22.507	22.898	24.895	19.820	1.394	-0.567	2.726	2.948
GDP	2370.09	2204.18	3200.95	1883.88	400.603	0.734	2.330	5.643
IP	22.497	22.75	35.5	9.3	8.508	0.018	1.743	3.156
MC	75.534	77.467	98.032	47.586	14.981	-0.403	2.101	3.159

Source: Author (2023)

Table 2 Ng-Perron Unit Root Test

	Mza	**MZt**	**MSB**	**MPT**	**Decision**	**Lag**
ATM	-17.30**	-2.92**	0.18**	0.59**	I (1)	2
POS	-33.00***	-4.06***	0.12***	0.74***	I (1)	1
WBP	-9.97**	-2.21**	0.22**	2.54**	I (0)	0
MOB	-18.86***	-2.68***	0.14***	2.63***	I (1)	0
BD	-18.95***	-3.06***	0.16***	1.34***	I (1)	0
BB	-8.70**	-2.08**	0.24**	2.84**	I (1)	3
CP	-24.93***	-8.24***	0.03***	3.05**	I (0)	2
M3	-19.26***	-3.10***	0.16***	1.28***	I (1)	1
DC	-25.82***	-21.70***	0.029***	0.42***	I (1)	0
IP	-8.81**	-2.09**	0.24**	2.82**	I (0)	2
MC	-10.68**	-2.25**	0.21**	2.54**	I (1)	2
GDP	-69.67***	-5.90***	0.08***	0.35***	I (0)	3

Note: *, **, *** signify the level of significance; 10%, 5%, and 1% respectively.
Source: Author (2023)

The results of the ARDL cointegrating bound test and other diagnostic tests are presented in Table 3. The results specify that the various retail digital FinTech platforms ATM, POS, MOB, and WBP cointegrate with their determinants. The degree of the effect was assessed, and the results are presented in Table 6.

Table 3: ARDL Bound Cointegration Test Results

Models		F-Stat	Normality	BG LM test (1)	BPG heteroskedasticity test	ARCH test (1)
ATM	*F*(InATM,BD,BB, CP, M3, DC, IP MC	10.08	0.54	0.79	0.064	0.182
POS	*F*(InPOS,BD,BB, CP, M3, DC, IP, MC	11.65	0.95	0.07	0.06	0.63
MOB	*F*(InPOS,BD,BB, CP, M3, DC, IP, MC	6.74	0.08	0.639	0.83	0.70
WBP	*F*(InPOS,BD,BB, CP, M3, DC, IP, MC	9.95	0.32	0.60	0.90	0.48

Notes: The F-statistics upper (lower) bounds critical value at 1% and 5% are 3.77(2.62) and 3.15(2.11) respectively. The values for the normality test, Breusch–Godfrey serial correlation LM test (BG LM test), Breusch–Pagan–Godfrey (BPG) heteroskedasticity test, and ARCH test are the P-values of the F-stat. ** and *** significant level at 5% and 1% respectively.

Source: Author (2023)

Table 6: The ARDL results

Dependent Variable = GDP per capita				
Independent Variables	ATM	POS	WBP	MOB
Panel A				
Log(ATM)	-0.21 (3.77)**			
Log(POS)		0.62(7.72)***		
Log(WBP)			0.33(3.69)***	
Log(MOB)				0.59(4.42)***
BD	-0.065 (-3.158)*	0.34(8.06)**	0.117(2.27)**	0.69(5.50)***
BB	0.375(4.874)**	0.35(4.84)**	0.132(1.54)	0.015(4.219)***
CP	0.061(2.675)	0.09(2.82)**	0.62(5.08)****	0.40(3.053)**
M3	0.025(1.513)	-0.09(-2.25)	0.086(4.46)***	0.069(3.450)***
DC	0.063(5.325)**	-0.09(-4.91)**	0.016(4.82)***	-0.039(-2.74)
IP	0.049(0.3520)*	0.16(3.34)	0.46(3.38)***	0.024(1.14)
MC	0.013(3.096)***	0.039(0.768)	0.019(3.90)***	0.014(2.55)
C	2.75(3.384)	6.48(11.93)	5.81(6.66)	5.70(8.78)
Panel B: Error Correction Model				
CointEq(-1)*	-0.756 (-11.543)**	-0.662 (-8.339)**	-0.923 (-6.481)**	-0.539 (-5.921)**
R^2	0.970	0.989	0.972	0.973
Adjusted R^2	0.957	0.980	0.950	0.953
F-Stat (Prob)	76.429 (0.000)	122.019 (0.000)	43.940 (0.000)	49.436 (0.000)
Note(s): *, **, *** significance levels at 10%, 5% and 1%, respectively.				

Source: Author (2023)

Individual indicators of financial inclusion were used to estimate their respective effects on growth and provide benefits for policy implications. The retail digital platforms ATM, POS, WBP, and MOB, along with the financial inclusion index, had a significant long-run influence on economic growth in Nigeria. A unit increase in the value of POS, WBP, and MOB transactions increases access to convenient, affordable, and flexible financial services by 62%, 33%, and 59%, respectively, in the long run. Retail digital channels are vital to the financial ecosystem. The negative nexus with ATMs can be attributed to the closure of most ATM galleries in bank branches and outside the branches owing to high maintenance costs and insecurity around the ATM galleries, among others.

This is evident in the long waiting time to use ATMs, and the growing number of bank customers further suggests that the current 22,500 ATMs in bank branches are insufficient to enhance inclusive growth. The availability index (bank branches) across the models shows a positive and significant influence on financial inclusion and economic growth at 37%, 35%, 13%, and 0.015% in the long run, respectively.

The availability of transaction points increases economic activities. Individually, a unit increase in bank branches per 100,000 adults increases economic activity and financial inclusion by 0.37%. This impact could be attributed to the banked population's increased access to financial services and products through FinTech retail digital platforms. Thus, collaborating the exogenous growth model argument on the significance of technology and the results of Udo et, al (2023); Udo, et, al (2019a); Van and Linh (2019), Inoue et, al (2016), and Thomas et al. (2017) on the positive influence of commercial bank branches.

The penetration (deposit account) dimension index of financial inclusion from various FinTech platforms showed a positive (0.34%, 0.11%, and 0.69%) and substantial impact on economic growth. Penetration begins with operating a formal account with a bank or mobile money service provider to increase economic and financial activities. The reintroduction of the 2012 financial inclusion policy strategy significantly simplified banking penetration.

The negative nexus with ATMs can also be attributed to high ATM card charges and the rigorous process of renewing or collecting new ATM cards, which decreases economic activity by 0.065%. In addition, the results indicate that the demographic and behavioural pattern of most Nigerians at the base of the pyramid" (BoP) indicates cash preference due to a lack of trust in retail digital payment systems and high financial and technology illiteracy (Koker & Jentzsch, 2013; Udo et al., 2023). The usage index across the models shows a positive influence on economic agents' access to credit facilities for economic activities. Sharma (2016) and Inoue (2016). Udo et al. (2019a) and Hamori (2016) corroborate our findings.

The Schumpeterian growth model acknowledges the multiplicative influence of loanable funds on economic activities. The non-significant bank credit-economic growth nexus suggests that the unstable business climate in Nigeria accounts for 65.9% of MSME credit repayment defaults and the futile utilisation of bank credit for the intended purpose. The general verdicts of this study support the exogenous growth model and emphasise the significance of technological advancement (FinTech) (Solow, 1956), labour productivity (Domar, 1946), new organisational structures, production processes, and management styles in transforming a static financial and economic climate into a dynamic one. As such, the integration of FinTech into the operational and business activities of the classical financial system has not only created new products, but has also provided solutions and eliminated barriers to financial and economic growth (Kotsemir and Abroskin 2013). The study's findings also lend credence to endogenous growth theory through financial deepening to encourage growth (Udo et al. 2019a; Udo et al. 2023; Ibrahim et. al., 2018; Sharma, 2016).

The financial deepening index (M3 money supply and domestic credit) positively and significantly influences economic growth. Thus, a unit increase in financial sector efficiency surges economic growth by 0.025%, 0.086%, and 0.069% through money supply for mobilisation and 0.063% and 0.016% for allocation for investment purposes in Nigeria. Empirically, the results of these studies collaborate with the findings of Peru (2018), Udo et, al (2019b); Tchamyou, Erreyger, and Cassimon (2019); Gabor and Brooks (2017); Dorfleitner and Roble (2018); Eton, et, al (2018); Na Song and Appiah-Otoo (2022) in China. From the results reported in Panel B of Table 6, ECTs were correctly signed across the models. The speed of convergence to the long-run equilibrium ranges from -0.539 to -0.756, denoting short-run divergence.

5. Conclusion and Policy Implications

Studies on the Fintech–economic growth nexus is evolving and open because of the expanding and dynamic nature of technology and the global economy. Financial inclusion is crucial to achieving inclusive economic and financial growth in Nigeria. Nigeria is considered the epicentre of digital retail platforms for financial inclusion. These studies have established that mobile devices are rapidly becoming the preferred channel of payment. The reintroduction of the 2012 financial inclusion strategy in Nigeria motivated this study to adopt the ARDL cointegration technique to examine the long-run nexus between the three constructs of FinTech, financial inclusion, and economic growth. Individual financial inclusion indicators are adopted to provide more informed policy implications. The results revealed a long-run nexus, whereas the usage indicator had a non-significant effect.

This indicates that financial infrastructure development is beneficial but its usage is poor. This study recommends that policies should not only focus on addressing the usage but also on their availability, penetration, and efficiency which are key to encouraging and inculcating saving habits among the base of the pyramid. There is a dire need to toughen regulatory outlines to safeguard new entrants into mainstream financial or mobile financial systems from predatory practices and usurious moneylenders in financial services. The formulation of cost-efficient and purpose-driven fintech solutions to provide citizen-centric funding must be considered by policymakers, as more countries strive to establish legislation that takes into account country-specificities.

COMPETING INTERESTS

The author has no competing interests to declare.

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