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DEPOSIT MONEY BANKS' COMPUTERIZATION AND FINANCIAL INCLUSION IN NIGERIA

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ABSTRACT: *This study examined deposit money banks' computerization and financial inclusion in Nigeria covering the period 2013Q1 to 2019Q4. Data for the study were extracted from the Central Bank of Nigeria (CBN). The investigation employed the Ex Post Facto design given that it is targeted at analyzing the impact of some independent variables on a specified dependent variable. The Vector Error Correction Model (VECM) was used to estimate the structural parameters of the model. The major findings of the study were that point on sales contributes positively and significantly to financial inclusion in Nigeria (β = 0.004101, t* = 5.76845), automated teller machines contributes positively and significantly to financial inclusion in Nigeria (β = 0.000405, t* = 2.49681), web Pay contributes negatively and significantly to financial inclusion in Nigeria (β = -0.006088, t* = -5.27666), mobile Pay (MOP) contributes negatively and significantly to financial inclusion in Nigeria (β = -0.001506, t* = -5.79714) and financial deepening contributes negatively and insignificantly to financial inclusion in Nigeria (β = -0.028889, t* = -0.32843). It is therefore the recommendation of the study that the monetary authorities should develop more reliable technological checks to eradicate the possibility of fraud taking over the technological payment channels and the Central Bank of Nigeria should intensify its campaign for the acceptance of web pay by the bankable population since it has been identified as one of the major drivers of financial inclusion.*

Keywords: Deposit Money, Bank Computerization, Financial Inclusion, CBN, Mobile Pay, Nigeria

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INTRODUCTION

The functioning financial system is the beating heart of any country's economy. The banking industry is the primary lubricant of the financial system and the economy. Ramesha (2014) asserts that effective payment systems boost the economy significantly. Technology has virtually taken over business activities in the 21st century, and the banking sector that plays a major role in the economic development of a nation is not an exemption of the innovation orchestrated by this phenomenon. Banking practices about three decades ago in Nigeria were so crude that customers could spend a whole day in the banking hall just to make deposit or withdrawal, and even sometimes had to return to the same bank the following day for the same transaction because of a long queue. Banking operations as at that time were so designed in form of "arm-chair brick and mortal" approaches that those customers could not make transactions in another branch of the same bank on the same street. Banking services during the conventional banking era in Nigeria were very poor because they were manually carried out owing to lack of technological innovation (Oluwatolani *et al.*, 2011; Okoye *et al.*, 2019). This kind of scenario was a sure guarantee for financial exclusion and hence, a compromise to economic growth objectives of the Central Bank of Nigeria (CBN).

In order to improve the level of financial inclusion in Nigeria, the Central Bank of Nigeria which is the apex regulator in the financial sector introduced the cashless policy. The policy was intended to drive the development and modernization of the payment system in Nigeria on one hand, reduce the cost of banking services on the other hand, and thirdly to drive financial inclusion by providing more efficient transaction options and greater reach. Thus, the adoption of the cashless policy has led to a remarkable increase in the level of technology (electronic banking) acceptance by deposit money banks in Nigeria and this is evidenced by the increase in the number of automated teller machines, point-of-sales facilities, internet banking, and mobile banking, among others. Nigeria is the most populous black nation in the world with a population of over 200 million people, yet about 43 percent of its bankable adult population are financially excluded despite the adoption of technology by the deposit money banks (IMF, 2019).

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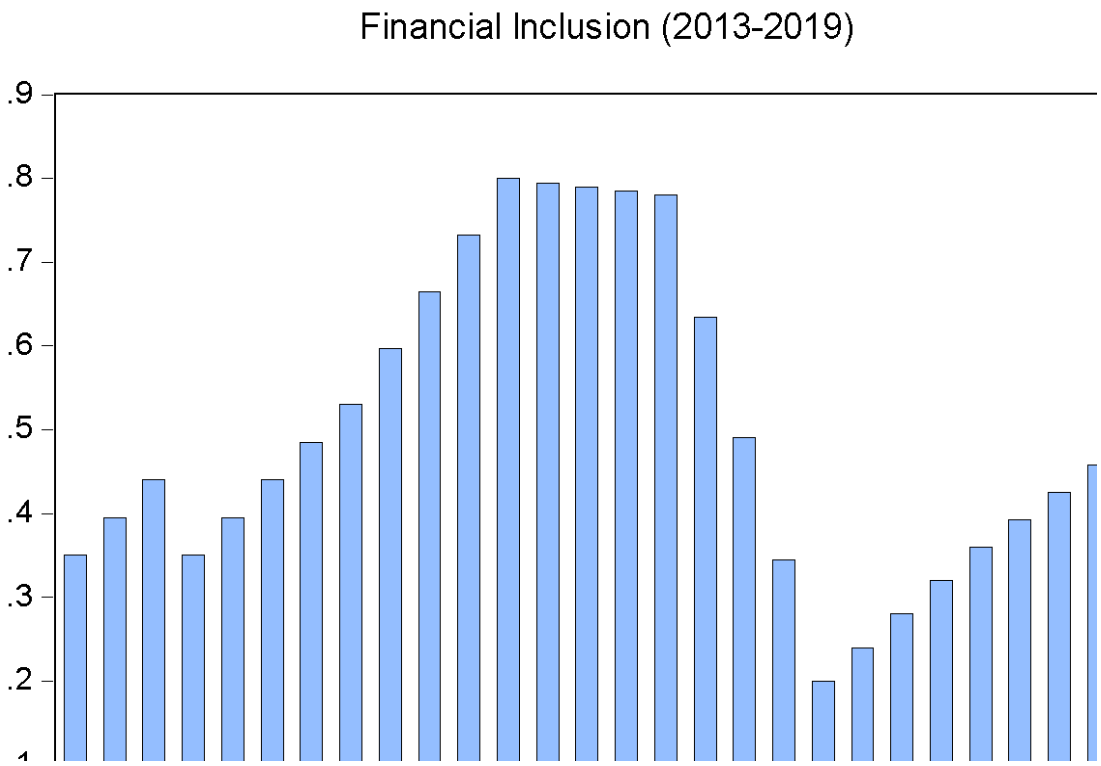

Source: *World Development Indicators (Worldbank)*

The rate of financial inclusion in Nigeria has not been fluctuating. This is reflected in the chart above where it is shown that the rate of financial inclusion in Nigeria has been cascading. This is despite the introduction of financial inclusive technologies in Nigeria.

A historial analysis reveals that between 2013 till date, the Central Bank of Nigeria (CBN) has introduced a series of technological strategies to facilitate financial inclusion in Nigeria. The prominent tech-strategies are POS, ATM, web pay and Mobile Pay.

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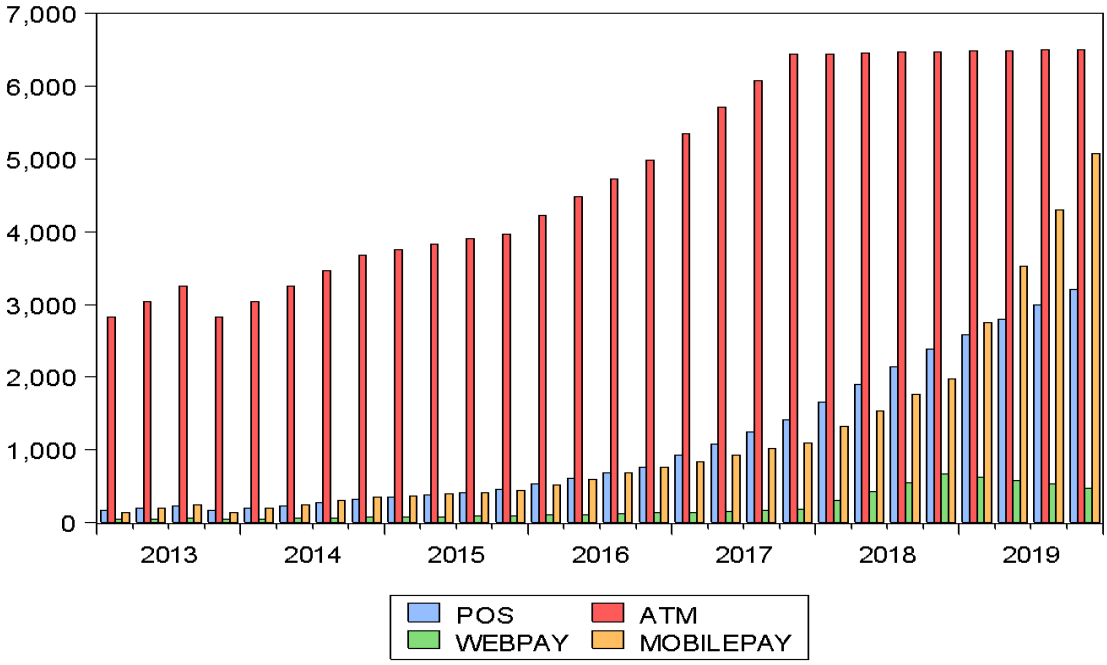

Source: *Central bank of Nigeria (CBN) Statistical Bulletin*

The graph above shows that the four major technological channels have been in action since 2013 with ATM leading the chart. However, studies on this have ignored mobile pay and web pay as channels of technological advancement in financial inclusion actualization. The aim of this study is to identify collective and individual contributions and the impact of the specified bank technological advancements on financial inclusion in Nigeria. There is currently uncertainty regarding their impact on financial inclusion in Nigeria. This is what the current study is committed to resolve.

LITERATURE REVIEW

Conceptual Framework

Digital financial inclusion involves the deployment of the cost-saving digital means to reach currently financially excluded and underserved populations with a range of formal financial services suited to their needs that are responsibly delivered at a cost affordable to customers and sustainable for providers. The linkage between financial technology and financial in the context of Nigeria is demonstrated in the schematic framework below:

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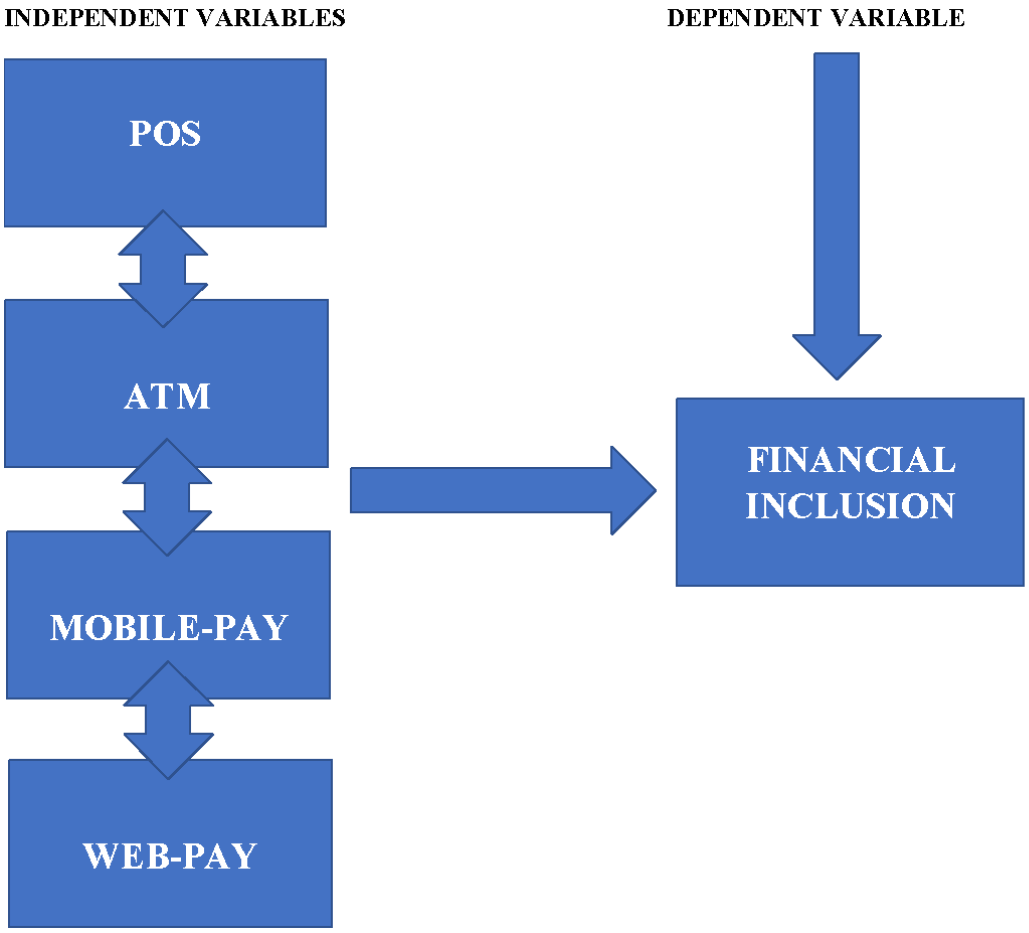

Source: *Researcher's Initiative, 2022.*

The Concept of Financial Inclusion

Ene (2019) outlined financial inclusion as the delivering of basic banking services at an affordable cost to all sections of the society, especially the vast disadvantaged and low-income groups who tend to be excluded from the formal banking system. Financial inclusion requires that attention is given to human and institutional issues, such as quality of access, affordability of products, provider sustainability, and outreach to the most excluded populations.

Financial Technology (FinTech)

The concept of Financial Technology has been defined in many ways by researchers. Daniel (2005) defines the concept as the delivery of information and services by banks to customers via different delivery platforms that can be used on different electronic devices such as personal computers, mobile phones or digital televisions with browsers or desktop software. As good as this definition appears, it does not take into cognizance other platforms for financial technology such as automated teller machines, internet banking and point-of-sales which are the focus of this study.

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Mobile Apps

These are applications that have been developed by the banks to encourage online transactions. With these apps, consumers are expected to do most of their transactions online, meaning that they do not have to visit banks. It is anticipated that wherever customers live within the country, they should be able to access the mobile app and carry out transactions. Acceptance of technology in this area is just starting to grow. This form of innovation to improve financial inclusion appeals more to millennials, Generation X and Generation Y, as these demographics are those that are more interested in using technology. This often excludes older consumers who still prefer physical cash instead of relying on an app to transfer money they cannot see. The number of people that have a smart phone to download and use this app is lower than was initially anticipated, which is not ideal for the adoption of this technology. In addition, the memory size of the available smart phones also presents limitations regarding the number of applications that can be downloaded and used by customers. Limited access to the internet in Nigeria presents a huge challenge to consumers relying on their bank's mobile app for financial transactions. Consumers may be interested in using the app but discouraged because they often do not regularly have enough internet access for the usage of the app to be feasible.

Unstructured Supplementary Services Data (USSD)

With a growing number of Global System for Mobile Communications (GSM) users in Nigeria, USSD has become an alternative means of enabling financial transactions and financial inclusion. USSD, sometimes referred to as 'Quick Codes' or 'Feature codes', is a GSM service that allows high-speed interactive communication between subscribers and applications (in this case, banks) across a GSM Network (Dabas & Dabas, 2009). The banks have different codes that allow consumers to carry out financial transactions on their mobile phones. Some examples of these codes are First Bank *894#, First City Monument Bank (FCMB) *389*214# and Guaranty Trust Bank (GTB) *737#.

Mobile Banking Technology

Mobile banking technology is used by individuals and small business owners that have been accredited by financial service providers in Nigeria to carry out transactions on behalf of the banks and other financial service providers using FinTech. This is also described as agency banking, which is a dispersed and more mobile nature of ensuring deepened financial inclusion for the unbanked (Akinpelu, 2018). Agency banking is known by different names in different countries, such as correspondent banks, non-bank correspondents and non-bank agents.

Third-Party Payment Apps

These are apps provided by FinTech companies that have been approved by the Central Bank of Nigeria and licensed as Mobile Money operators to provide financial services. The apps are a hybrid of mobile apps from banks, using USSD for transactions and services from Mobile Money agents. These apps allow consumers to send money to anyone in Nigeria with a phone number or email address. Interswitch, founded in 2002 by Mitchell Elegbe, is considered the unicorn of this sector as Visa acquired a minority equity stake in the firm (Bright, 2019). Interswitch pioneered the infrastructure to digitalize Nigeria's then predominantly paper-ledger and cash-based economy. Other players include Palmpay, oPay, Paystack and Paga.

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Theoretical Literature

The functional theories associated with the area under study were reviewed in this section.

2.2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model, propounded by Davis in 1989, posits that there are two factors that determine whether a computer system will be accepted by its potential users: (1) perceived usefulness, and (2) perceived ease of use. The key feature of this model is its emphasis on the perceptions of the potential user, that is, while the creator of a given technology product may believe the product is useful and user-friendly, it will not be accepted by its potential users unless the users share those beliefs. The theory is an adaptation of the Reasoned Action Theory specifically tailored for modeling user acceptance of information systems. The goal of the theory is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. Thus, this study believes that the acceptance of contemporary banking technology by customers is fundamental to the performance of these banks as well as the realization of financial inclusion.

Empirical Review

Previous and related studies conducted on the subject were reviewed in this section of the study. David, Tyagher, Jacob and Tordue (2022) investigated the impact of agency banking on financial inclusion and economic activity in Benue State, focusing on First Bank Ltd's agency banking activities. The study was based on agency theory and it employed a survey design. The study analyzed both primary and secondary data with descriptive statistical tools and structural equation models. According to the study's findings, First Bank Ltd's agency banking activities have significantly increased financial inclusion and economic activity in Benue State. However, challenges such as cash shortages, security issues, network failures, and a lack of financial literacy were impeding the smooth operation of agency banking in the state. On the basis of these findings, the study recommended among others that other banks operating in the State should be encouraged to venture into agency banking in the State so as to have a wider coverage of agency banking in the State. Also, government should provide security and partner with the private sector to provide national carrier communication network system to overcome the network failure challenge. Finally, banks should intensify efforts to educate the masses about the validity and potency of agency banking.

Ehiedu (2021) examined ATM penetration and financial inclusiveness in Nigeria (1990–2019). The cardinal focus here was on a long- and short-run relationship. The explanatory variables were ATM Penetration proxied by Geographic ATM Penetration, Demographic ATM Penetration, and Total Numbers of ATMs about GDP. The explained variable is financial inclusion as measured by the financial inclusion index. The above ATM Penetration proxies formed the Tripod Banking System Approach. The econometric Views (E-Views) Version 9.0 was used to run the regression result. All tests proved the model as fit for prediction. Accordingly, the result showed that ATM Penetration enhances the level of financial inclusiveness in Nigeria. However, in terms of individual variables, the level of ATM Penetration within the economy is still weak though ATM Demographic Penetration seems strong.

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Udak (2020) empirically investigated the effect of digital currency development (digital finance) on financial inclusion in Nigeria for the period. Nigeria undertook her digital currency development to rip the benefits of financial inclusion, safer remittances and exchange rate regularization among others. The researcher developed high-frequency quarterly data for the analysis from 2006:1 to 2020:4 in a weighted stepwise forward regression. Findings suggest that: (1) a unit rise in the usage of automated teller machines by citizens spontaneously raised financial inclusion in a quarter in Nigeria by 0.012 units and were statistically significant; (2) a percentage rise in the use of point of sales transaction by citizens in the country also raised financial inclusion in Nigeria by approximately 1%; (3) a percentage increase by mobile payment users in Nigeria spontaneously increased financial inclusion by at least 0.4%.

Babatunde and Raymond (2019) investigated the relationship between internet usage, financial inclusion and economic growth in Nigeria for the period 1999 to 2016. Using the time series data for the period, the study utilizes Engle Granger Cointegration Test and the Fully Modified Ordinary Least Squares (FMOLS) approach for analysis. The results showed that internet usage and broad money have positive and significant effect on financial inclusion. Also, internet usage has positive and significant effect on economic growth in Nigeria. However, the effect of financial inclusion on economic growth is negative, minimal and insignificant. Furthermore, the effect of the interacted coefficient of internet usage and financial inclusion on economic growth is positive, minimal and insignificant. Hence, the positive effect of internet usage on economic growth in Nigeria is not transmitted through the mechanism of financial inclusion. They recommended that government should strengthen and improve on the positive gains of internet usage on the economy. Also, the monetary authority should take measures to encourage the drive for more savings to improve financial inclusion and ensure that investment by government is channeled into more productive areas to improve the economy.

METHODOLOGY

Research Design

The investigation employed the *Ex Post Facto* design given that the study is anchored on the utilization of secondary data. This study makes use of econometric procedure in estimating deposit money banks' technological advancement and financial inclusion in Nigeria. In researches that involve times series and secondary data, the appropriate methodology is the linear regression with the application of Ordinary Least Squares (OLS) technique. The primary justification for adopting the linear regression is based on the fact that it possesses the optimal properties of linearity, unbiasedness, linearity and minimum variance (Koutsoyiannis, 2003).

Unit Root Test

In order to avoid spurious regression estimates, a time series data should be examined for stationarity or order of integration. Time series data is accepted to be stationary if "it exhibits mean reversion in that it fluctuates around a constant long-run mean, has a finite variance that is time invariant and has a theoretical correlogram that diminishes as the lag length increases" (Asteriou, 2006).

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There are many tests trying to find the order of integration of series and among them Dickey-Fuller, Augmented Dickey-Fuller and Phillips and Perron tests are the most widely used ones in testing the presence of unit roots. Dickey-Fuller (DF) test is based on the following model:

$$\Psi_t = \lambda \Psi_{t-1} + \varepsilon_t$$

The model can also be expressed as:

$$\Delta\psi_t = \varpi\psi_{t-1} + \varepsilon_t$$

where $\varpi = (\lambda - 1)$. This model is called pure random walk model. Null hypotheses are $H_0 : \lambda = 1$ for model (3.4.1) and $H_0 : \varpi = 0$ for model (3.4.2). The corresponding alternative hypotheses are $H_a : \lambda < 1$ and $H_a : \varpi < 1$ respectively. If DF test statistic (t-statistic of lagged dependent variable) is less than the critical value, we reject the null hypothesis and conclude that the series is stationary (there is no unit root). Model (3.4.2) can be extended by including a constant term and/or the trend.

The corresponding models are called random walk with drift and random walk with drift and time trend:

$$\Delta\psi_t = \alpha_0 + \Omega\psi_{t-1} + \varepsilon_t$$
$$\Delta\Psi_t = \alpha_0 + \beta_2 t + \Omega\Psi_{t-1} + \varepsilon_t$$

where: $\Omega = (\lambda - 1)$. The two models have same testing procedures with the random walk model.

However, Equation (3.4.2) does not consider autocorrelation. Augmented Dickey-Fuller (ADF) test is used to test the existence of unit root when there is autocorrelation in the series and lagged terms of the dependent variable are included in the equation. The following three models represent pure random walk, random walk with drift and random walk with drift and trend used in Augmented Dickey Fuller tests:

$$\Delta\psi_t = \Omega\psi_{t-1} + \sum_{i=1}^{p} \beta_i \Delta\psi_{t-1} + \varepsilon_t$$

$$\Delta\psi_t = \alpha_0 + \Omega\psi_{t-1} + \sum_{i=1}^{p} \beta_i \Delta\psi_{t-i} + \varepsilon_t$$

$$\Delta\psi_t = \alpha_0 + \Omega\Psi + \beta_2 t + \sum_{i=1}^{p} \beta_i \Delta\psi_{t-1} + \varepsilon_t$$

where: $\Omega = (\lambda - 1)$. The null hypothesis is $H_0 : \Omega = 0$ and the alternative hypothesis is $H_a : \Omega < 0$. If ADF test statistic (t-statistic of lagged dependent variable) is less than the critical

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value, we reject the null hypothesis and conclude that the series is stationary (there is no unit root).

Cointegration Test

The co-integration technique allows for the estimation of a long-run equilibrium relationship. Simply put, one can argue that various non-stationarity time series are co-integrated when their linear combinations are stationary. One of the most popular tests for cointegration has been suggested by Engel and Granger (1987). The process is demonstrated thus, given a multiple regression: $y_t = \beta' x_t + \mu_t, t = 1,...,T,$ where $x_t = (x_{1t}, x_{2t},..., x_{kt})'$ is the k-dimensional I(1) regressors. For y_t and x_t to be cointegrated, μ_t must be I(0). Otherwise, it is spurious. Thus, a basic idea is to test whether μ_t is I(0) or I(1).

The Model

The error correction analysis is an econometric analysis carried out if the variables under investigation are seen to be cointegrated. The Error Correction Mechanism (ECM) was used to estimate the speed of adjustment of the short-run dynamics of the variables and timing to long-run convergence. The ECM is given by the equation: $\Delta FI_t = \beta_0 + \Delta\beta_1 POS_t + \Delta\beta_2 ATM_t + \Delta\beta_3 WP_t + \Delta\beta_4 MOP_t + \Delta\beta_5 FD_t + ECM_{t-1} + \mu_t \ldots .3.4$

where Δ = First Difference Operator.

Model Specification

The guiding econometric model for this research is specified thus:

Implicitly, $FI_t = f(POS_t, ATM_t, WP_t, MOP_t, FD,)$ (3.1)

The explicit econometric model is specified thus:

$$FI_t = \beta_0 + \beta_1 POS_t + \beta_2 ATM_t + \beta_3 WP_t + \beta_4 MOP_t + \beta_5 FD_t + \mu_t \quad (3.2)$$

where:

FI = Financial Inclusion (Proxied by Financial Inclusion Index)

POS = Point of Sales Transactions

ATM = Automated Teller Machines Transactions

WP = Web Pay

MOP = Mobile Pay

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FD = Financial Deepening (measured with the ratio of broad money supply to GDP)

t = Time Period

β's = Structural Parameters to be Estimated

μ = Stochastic Error Term

The a priori expectations are given as: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, & $\beta_5 > 0$.

PRESENTATION AND ANALYSIS OF RESULTS

Empirical Results

Time series data are frequently thought to be non-stationary; hence, a unit root test is required to confirm that the data are stationary. The test was used to avoid the issue of erroneous regression. To complement each other, the Augmented Dickey-Fuller (ADF) unit root test was employed to determine the stationarity of the data. The ADF test's decision criteria is that its statistic must be bigger than the Mackinnon Critical Value at the 5% level of significance and in absolute terms. Table 4.1 summarizes the findings of the unit-root test.

Unit-Root Test Result

Table 3: ***Unit Root Test Result***

VARIABLE	ADF STAT.	CRITICAL VAL.	ORDER
FI	-2.384891	-1.954414	I(1)
POS	-4.286343	-3.595026	I(1)
ATM	-2.636355	-1.954414	I(1)
WP	-4.202352	-3.632896	I(1)
MOP	-3.775822	-1.956406	I(1)
FD	-2.288642	-1.954414	I(1)

Source: *Author's Computation Using E-views 10.*

Table 4.1 clearly shows that all the variables are stationary at first difference (I(1)). This means that the variables have unit-root until differenced in the first order.

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Optimal Lag Selection

Table 4: ***Optimal Lag Selection***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-669.3913	NA	1.18e+16	54.03130	54.32383	54.11244
1	-406.4861	378.5834*	1.69e+08*	35.87889*	37.92660*	36.44684*
2	-376.5360	28.75215	4.91e+08	36.36288	40.16577	37.41764
3	-335.5022	19.69622	2.84e+09	35.96017	41.51825	37.50175

The VAR order selection criteria displayed in Table 4.2 shows that the optimal lag length for the study is lag one. This is because majority of the criterion (LR, FPE, SC, AIC and HQ) suggested the use of lag one. The importance of selecting an optimal lag length is that it will ensure the estimation of unbiased regression output and the minimization of residual correlation.

Cointegration Analysis (Johansen Methodology)

Table 5: ***Cointegration Test Result***

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.600007	118.9599	95.75366	0.0005
At most 1 *	0.600001	95.13582	69.81889	0.0001
At most 2 *	0.600000	71.31219	47.85613	0.0001
At most 3 *	0.599993	47.48863	29.79707	0.0002
At most 4 *	0.597561	23.66550	15.49471	0.0024
At most 5	4.76E-13	1.24E-11	3.841466	0.9999

Source: *Researcher's Computation Using E-views 10.*

It can be clearly seen from the analysis conducted that the trace statistic indicates 5 cointegration equations at the 0.05 level of significance. This is shown in the trace statistic row of None* (Trace Stat = 118.9599 > 95.75366 Critical Value (0.05), 95.13582 > 69.81889, 71.31219 > 47.85613, 47.48863 > 29.79707, and 23.66550 > 15.49471. It therefore entails that there exists a long-run relationship between financial inclusion (FI), Point of Sales (POS),

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Automated Teller Machines (ATM), Web Pay (WP), Mobile Pay (MOP) and financial deepening at 0.05 level of significance. Given this, we can now run the restricted Vector Autoregression which is the Vector Error Correction Model (VECM).

Vector Error Correction Mechanism (VECM)

Table 6: ***Vector Error Correction Result***

Cointegrating Eq:	CointEq1
FI(-1)	1.000000
POS(-1)	0.004101 (0.00071) [5.76845]
ATM(-1)	0.000405 (0.00016) [2.49681]
WP(-1)	-0.006088 (0.00115) [-5.27666]
MOP(-1)	-0.001506 (0.00026) [-5.79714]
FD(-1)	-0.028889 (0.08796) [-0.32843]
C	0.742858

Error Correction:	D(FI)	D(POS)	D(ATM)	D(WP)	D(MOP)	D(FD)
CointEq1	0.134767 (0.12573) [1.07185]	152.5559 (71.7840) [2.12521]	-233.6387 (348.885) [-0.66967]	171.5387 (84.2326) [2.03649]	82.04728 (271.204) [0.30253]	-0.497473 (0.53680) [-0.92674]
D(FI(-1))	-0.123305 (0.59635) [-0.20676]	-363.1011 (340.472) [-1.06646]	1206.952 (1654.77) [0.72938]	-558.4521 (399.516) [-1.39782]	-327.6791 (1286.32) [-0.25474]	4.099963 (2.54605) [1.61033]

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D(POS(-1))	-0.001991	-0.485083	4.658487	-1.973917	-0.387738	0.009226
	(0.00192)	(1.09514)	(5.32262)	(1.28506)	(4.13751)	(0.00819)
	[-1.03784]	[-0.44294]	[0.87523]	[-1.53605]	[-0.09371]	[1.12659]
D(ATM(-1))	0.000106	0.038327	-0.530455	0.243681	-0.192605	-0.000878
	(0.00025)	(0.14007)	(0.68076)	(0.16436)	(0.52919)	(0.00105)
	[0.43235]	[0.27363]	[-0.77921]	[1.48261]	[-0.36396]	[-0.83802]
D(WP(-1))	0.001412	0.934258	-4.026408	2.055501	0.933594	-0.008000
	(0.00185)	(1.05355)	(5.12049)	(1.23626)	(3.98039)	(0.00788)
	[0.76493]	[0.88677]	[-0.78633]	[1.66268]	[0.23455]	[-1.01544]
D(MOP(-1))	0.000459	0.229173	-1.437734	0.385889	1.027884	-0.002358
	(0.00051)	(0.29070)	(1.41287)	(0.34111)	(1.09828)	(0.00217)
	[0.90122]	[0.78835]	[-1.01760]	[1.13126]	[0.93590]	[-1.08462]
D(FD(-1))	-0.156134	-17.21825	494.2028	-107.9520	-14.78014	1.268197
	(0.10855)	(61.9758)	(301.215)	(72.7235)	(234.148)	(0.46345)
	[-1.43831]	[-0.27782]	[1.64070]	[-1.48442]	[-0.06312]	[2.73640]
C	0.108579	110.8908	-5.643447	101.0364	77.26840	-0.368616
	(0.07502)	(42.8297)	(208.161)	(50.2572)	(161.813)	(0.32028)
	[1.44738]	[2.58911]	[-0.02711]	[2.01039]	[0.47752]	[-1.15092]

Source: *Researcher's Computation Using E-views.*

It can be clearly seen from the VECM output that the numerical coefficient of Point of Sales (POS) yielded a positive numerical coefficient at the magnitude of 0.004101. This entails that there is a positive relationship between POS and financial inclusion in Nigeria. It implies that a one percent (1%) increase in POS services and transactions increases the rate of financial inclusion by 0.004101%. This entails that for the years under analysis, POS promotes and facilitates financial inclusion in Nigeria. This conforms to economic a priori expectation. The computed corresponding t-statistics which yielded 5.76845 > absolute value of 2 entails that POS has a significant impact on financial inclusion in Nigeria.

The numerical coefficient of Automated Teller Machines (ATM) yielded a positive value at the magnitude of 0.000405. This implies that an increase in ATM spread, services, and transactions is expected to yield a corresponding increase in financial inclusion in Nigeria for the period under analysis. It also implies in econometric terms that a one percent (1%) increase in ATM spread is expected to increase financial inclusion by 0.000405%. Hence, ATM and financial inclusion are positively related for the period under analysis. The t-Statistics yielded 2.49681 and this implies that ATM is not only positively related to financial inclusion but also statistically significant. This also conforms to economic a priori expectation.

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The VECM result reveals that the numerical coefficient of web pay (WP) yielded a negative value at -0.006088. This entails that there is an inverse relationship between web pay and financial inclusion. The t-statistics of -5.27666 means that the negative relationship between web pay and financial is significant. This however does not conform to economic a priori expectation.

It can also be seen that mobile pay (MOP) yielded a negative and significant regression coefficient. It yielded a coefficient value of -0.001506 and a t-statistics of -5.79714. This means that mobile pay for the period under investigation does not facilitate financial inclusiveness in Nigerian economy. Since this is also a technological payment system, it was expected that it will contribute positively to financial inclusion in Nigeria. However, the result reveals non-conformity.

Financial deepening (FD) being a control variable yielded a negative but insignificant relationship with financial deepening. It reveals that financial deepening contributes negatively to financial inclusion by -0.028889%, with a corresponding t-statistics value of -0.32843. Financial development theory asserts that an increase in financial deepening is expected to increase economic growth through financial inclusiveness, but this was not applicable to the relationship in this line. Hence, the result does not conform to economic a priori expectation.

The coefficient of determination (R-Squared) yielded 0.562227. This entails that variations in financial inclusion are approximately caused by a 56% change in explanatory variables. This entails that the explanatory power of the independent variables is above average. It further means that over 40% of the effect caused by other macroeconomic variables outside the model affect financial inclusion.

The F-statistic is used to measure the statistical significance of the entire regression plane. From the VECM output, the F-statistic yielded 3.302458. Since this value is greater than absolute value of 3, it entails that the test is statistically significant at the entire regression plane.

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Diagnostic Tests

Block-Wald Causality Test

Table 8: ***Block-Wald Causality Test Results***

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 07/18/22 Time: 22:07
Sample: 2013Q1 2019Q4
Included observations: 26

Dependent variable: D(FI)

Excluded	Chi-sq	df	Prob.
D(POS)	1.077110	1	0.2993
D(ATM)	0.186927	1	0.6655
D(WP)	0.585114	1	0.4443
D(MOP)	0.812191	1	0.3675
D(FD)	2.068745	1	0.1503
All	6.568020	5	0.2548

Source: *Researcher's Computation Using E-views 10.*

From Table 4.6, it can be clearly seen that the Chi-Square probability of POS yielded 0.2993 > 0.05. This entails that POS does not have any causal effect on financial inclusion (FI). The table also reveals that ATM does not have any causal effect on FI because its Chi-Square probability yielded 0.6655 > 0.05. The Chi-Square probability of Web Pay (WP) yielded 0.585114 > 0.05. This entails that WP does not have a causal effect on FI. Mobile Pay (MOP) yielded 0.812191 > 0.05, which entails that MOP does not cause FI and financial deepening (FD) does not cause FI given that its probability value yielded 0.1503 > 0.05. Jointly, POS, ATM, WP, MOP, and FD have no short-run causal effect on financial inclusion (FI). This shows that none of the explanatory variables has causal effect on financial inclusion (FI).

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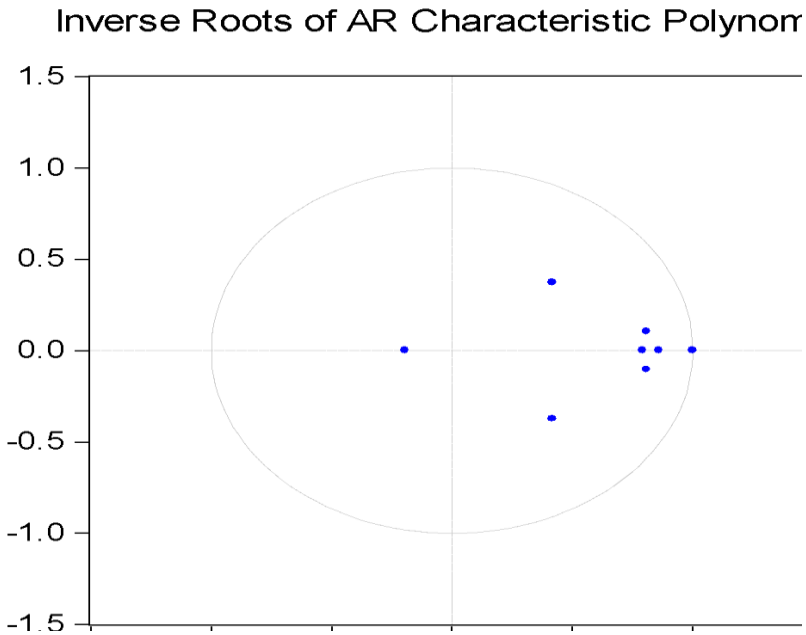
Model Stability (AR Unit-Circle)

Figure 1: ***Model Stability Result***



Source: *Researcher's Computation Using E-views 10.*

The significance of assessing a model's stability cannot be overstated. This is done to ensure the model's dynamic stability. The only requirement for stability is that no inverse root dot be outside the unit circle. According to the inverse roots of the AR characteristic polynomial, the model is stable since no dot is beyond the unit circle's enclave.

Serial Correlation Test

Table 8: ***Serial Correlation Test Result***

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 07/18/22 Time: 22:20
Sample: 2013Q1 2019Q4
Included observations: 26

Lags	LM-Stat	Prob
1	14.13110	0.9996
2	7.209647	0.0000

Probs from chi-square with 36 df.

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In the course of the study, the VEC residual serial correlation LM test was conducted. The serial correlation test was carried out to ascertain the presence of serial correlation in our model. However, it could be recalled that the null hypothesis states that there is no serial correlation. Based on the serial correlation test, it can be clearly seen that probability (prob) yielded 0.0000 < 0.05. This entails the acceptance of the null hypothesis, and we therefore conclude that there is no evidence of serial correlation in our residuals.

Normality Test (Jaque-Berra)

Table 9: ***Normality Test Result***

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 07/18/22 Time: 22:26
Sample: 2013Q1 2019Q4
Included observations: 26

Component	Skewness	Chi-sq	Df	Prob.
1	-0.746002	2.411581	1	0.1204
2	-0.066256	0.019023	1	0.8903
3	-0.957182	3.970191	1	0.0463
4	-2.618835	29.71928	1	0.0000
5	-1.459841	9.234917	1	0.0024
6	1.404764	8.551239	1	0.0035
Joint		53.90624	6	0.0000

Component	Kurtosis	Chi-sq	Df	Prob.
1	4.078159	1.259296	1	0.2618
2	6.105007	10.44449	1	0.0012
3	3.865905	0.812274	1	0.3674
4	12.72265	102.4074	1	0.0000
5	6.027585	9.930127	1	0.0016
6	5.468205	6.599708	1	0.0102
Joint		131.4533	6	0.0000

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Component	Jarque-Bera	Df	Prob.
1	3.670878	2	0.1595
2	10.46351	2	0.0053
3	4.782466	2	0.0915
4	132.1267	2	0.0000
5	19.16504	2	0.0001
6	15.15095	2	0.0005
Joint	185.3595	12	0.0000

The VEC normality test was carried out to ascertain if the residuals are normally distributed. The joint probability value of the Jarque-Bera yielded 0.0000 which is obviously less than 0.05. This compels us to accept the null hypothesis of normal distribution. Hence, we conclude that the residuals are normally distributed.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary of Findings

The essence of this study is to ascertain deposit money banks' computerization advancement and financial inclusion in Nigeria covering the period 2013Q1 to 2019Q4. Data for the study were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin 2020 and the vector error correction mechanism was used to estimate the structural parameters of the model. The major findings of the study were that:

1. Point of Sales (POS) contributes positively and significantly to financial inclusion in Nigeria ($\beta = 0.004101$, $t^* = 5.76845$).
2. Automated Teller Machine (ATM) contributes positively and significantly to financial inclusion in Nigeria ($\beta = 0.000405$, $t^* = 2.49681$).
3. Web Pay (WP) contributes negatively and significantly to financial inclusion in Nigeria ($\beta = -0.006088$, $t^* = -5.27666$).
4. Mobile Pay (MOP) contributes negatively and significantly to financial inclusion in Nigeria ($\beta = -0.001506$, $t^* = -5.79714$).
5. Financial Deepening (FD) contributes negatively and insignificantly to financial inclusion in Nigeria ($\beta = -0.028889$, $t^* = -0.32843$).

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Conclusion of the Study

This research has been able to empirically ascertain deposit money banks' computerization advancement and financial inclusion in Nigeria covering the period 2013Q1 to 2019Q4. The study objectively revealed that out of the four technological payment channels, two (POS and ATM) were seen to be facilitating financial inclusion in Nigeria. The study therefore concludes that POS and ATM are critical elements in Nigeria's financial services reform that began about a decade ago. They have also proven to be key success factor in driving the National Financial Inclusion Strategy (NIFS). The NIFS was launched in October 2012 to reduce the large population of the unbanked. The critical role of POS centers and ATMs are on two key benefits, namely: creating jobs and driving financial inclusion. The other channels are not major drivers of financial inclusion possibly because of the complexity of usage and acceptance.

Recommendations

Based on the findings of the study, the following recommendations are suggested:

1. The results shows that POS plays a key role in driving the financial inclusion strategy in Nigeria. However, the sustainability of the reliability of POS for transactions has been threatened by fraud and banking information compromise. The monetary authorities should develop more reliable technological checks to eradicate the possibility of fraud taking over this payment channel.

2. A deliberate policy that will enhance the performance of Automated Teller Machines (ATM) of banks should be made by the apex regulator of the Nigerian banking system. This policy should among others ensure that Automated Teller Machines installed by banks meet international best standards.

3. Though the result from the analysis shows that ATM has a positive and significant relationship with financial inclusion, the security architecture at ATM units should always be at its best to continue to encourage the use of the facilities at any point in time.

4. Education is key to technology acceptance; therefore, concerted efforts by financial institutions should be geared towards creating awareness and educating the general public about the new normal on the means of accessing the products and benefits of financial institutions.

5. The Central Bank of Nigeria should intensify its campaign for the acceptance of web pay by the bankable population since it has been identified as one of the major drivers of financial inclusion, though it was found to be negatively related to financial inclusion in the study.

6. Since mobile pay has been identified as one of the technological payment channels that has a potential of being a significant driver of financial inclusion, the Central Bank of Nigeria and deposit money banks should make it more accessible to all categories of businesses and bankable adults in the country while improving its operational efficiency. This is because it was found to have a negative and significant impact on financial inclusion in Nigeria.

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7. FinTech companies should work on how to reduce the complexities associated with mobile app technologies to encourage more usage and acceptance, hence increasing financial inclusion.

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