

Deposit Money Banks Disruptive Innovations And Financial Inclusions In Nigeria

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Abstract

This study examined the impact of deposit money banks' disruptive innovation on financial inclusion in Nigeria. The broad objective of this study is to ascertain the impact of banking innovations on financial inclusion in Nigeria. The analysis spans from 2011 to 2023, utilizing quarterly time series data sourced from the World Bank database. The variables examined include the number of Deposit Money Bank branches (a proxy for financial inclusion), the number of Automated Teller Machines (a proxy for banking innovations), institutional quality, income level, financial depth, access to electricity, and an interaction term between the number of ATMs and institutional quality. The Autoregressive Distributed Lag Model was the method of estimation employed in the study. The findings indicate that banking innovations and Financial Inclusion do not have a significant long-run linear relationship, and that the number of Automated teller machines (ATMs), which serves as a proxy for banking innovations, has a positive and significant impact on financial inclusion. This study also found a significant impact of the interaction between banking innovations and government institutions on Financial Inclusion in Nigeria. Consequently, the study recommends that government institutions foster public-private partnerships, such as the Shared Agent Network Expansion Facility (SANEF), to promote banking innovations. Additionally, the government, through the Central Bank of Nigeria (CBN), should implement policies to enhance the deployment and functionality of ATMs nationwide and promote financial literacy programmes

Keywords: Money; Deposit; Financial inclusion; Innovation

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I. Introduction

The banking industry has undergone a significant transformation driven by technological innovations. These innovations, largely driven by technological advancements, have reshaped the way financial services are delivered, thus enhancing access to finance for underserved populations. In Nigeria, one of the key challenges hindering economic growth is the limited access to formal financial services, particularly in rural and underdeveloped urban areas.

Financial inclusion is a growing concern in Nigeria. The banking system in Nigeria is less inclusive than those in more developed African countries such as South Africa. In fact, the importance of financial inclusion in Nigeria is determined by its connection to three major debates currently ongoing in the country that concern poverty reduction, the need to reduce the level of inflation, and control the shadow banking sector.

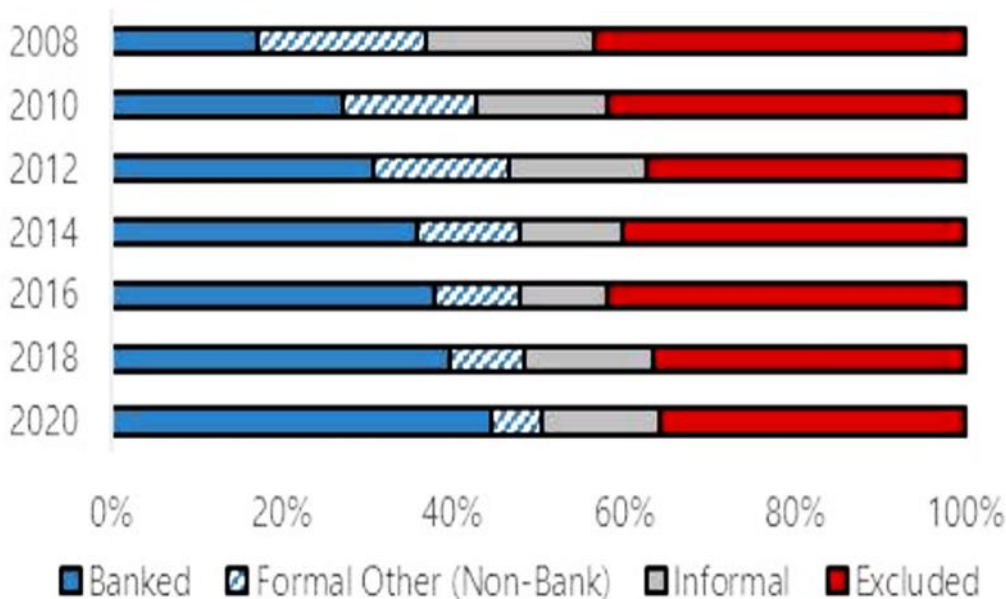
In Nigeria, being financially included can lead to economic benefits as individuals with access to formal financial services can invest in education and entrepreneurial activities, which can contribute to reducing poverty and also allows them to increase their income (Ozili, 2020a; Bruhn & Love, 2014; Demirgüç-Kunt et al., 2015; Ozili, 2020a, 2020b). It entails the availability and accessibility of financial products and services for all individuals, especially those in lower-income brackets and geographically remote regions.

There are concerns about the level of financial inclusion and accessibility to financial services, among those who do not have the access to and knowledge of technology, as well as those who live in rural areas with limited access to bank branches and ATMs in Nigeria. It is pertinent to note that the Nigerian banking sector has witnessed a surge in innovative financial products and services aimed at addressing these challenges. Mobile banking, Agent banking, Digital payment systems, and other fintech-driven solutions are redesigning how financial services are provided and consumed. These innovations are not only making banking more accessible but also improving the efficiency of financial services and fostering trust in the formal financial sector.

These innovations have the potential to reshape how financial services are delivered and accessed, especially in a country like Nigeria, where a large portion of the population remains unbanked or underbanked.

The percentage of the population that were banked, non-banked, and excluded from accessing banking services is demonstrate as shown in figure 1.

Figure 1: The percentage of the population that were banked, non-banked, and excluded



Source: World Bank Group (2021)

Any nation's growth and development would accelerate if a wide range of its citizens had access to financial services. This is because more individuals will be able to participate in economic activities, which will facilitate business, create jobs, develop skills, transfer knowledge and technology, and create a competitive market that fosters innovation. Despite the concerted efforts by the government and financial institutions to increase financial inclusion, a significant gap remains in the access and usage of financial services, particularly in rural and underserved urban areas.

The central challenge is whether banking innovations such as; mobile banking, digital wallets, agency banking, and biometric systems can effectively bridge this gap. While these innovations promise to make banking services more accessible, affordable, and user-friendly, there is an insufficient understanding of their actual impact on financial inclusion in Nigeria. Factors such as digital literacy, infrastructure limitations, security concerns, and trust in digital banking systems continue to hinder widespread adoption, particularly among low-income earners and those in rural areas. Based on the above discussion, this paper addressed the following research questions.

- (i) What is the impact of banking innovations on financial inclusion in Nigeria?
- (ii) What is the nature of the relationship between banking innovation and financial inclusion in Nigeria?
- (iii) What is the impact of the interaction of institutional quality and banking innovation on financial inclusion in Nigeria?

This study is significant for its potential to provide valuable insights into how innovative banking solutions can address financial exclusion in a country where large proportion of the population are still unbanked or underbanked. This will assist policymakers, financial institutions, and other stakeholders in formulating strategies to enhance financial access, improve economic opportunities, and reduce poverty. This paper employed annual time series data from 2011 to 2023.

The dependent variable in this study is the number of Commercial Bank branches, serving as a proxy for Financial inclusion. The independent variables are Banking Innovations proxied by the number of Automated Teller machines, Institutional quality proxied by government effectiveness, GDP per capital income, financial depth, and infrastructural development proxied by access to electricity. The data for these variables were sourced from the World Bank database.

II. Review Of Related Literature

There are many theories related to this paper that were review. The technology acceptance model helps in explaining how people come to embrace and use technology. This theory was propounded by Fred Davis in the late 1980s, The perceived ease of use and the perceived usefulness shape users' attitudes toward the technology. Other theories reviewed are the financial literacy theory which sees education as the best channel to

achieve financial inclusion, and diffusion of innovation theory which explains how idea or product gathers momentum and diffuses (or spreads) within a certain population.

The studies related to the nexus between bank innovations and financial inclusion were also reviewed. Ene et al. (2019) studied the influence of electronic banking on financial inclusion in Nigeria. The study utilized the total number of automated teller machines and point-of-sale devices in Nigeria as proxies for electronic banking and the proportion of banked adult population to total bankable adult population in Nigeria as proxy for financial inclusion. The study employed multiple regression analysis and found that that automated teller machines do not considerably affect financial inclusion but point-of-sale devices greatly impact financial inclusion in Nigeria.

Marshal (2023) investigated the effect of the digital banking paradigm on financial inclusion in Nigeria from 2009 to 2021. The paper agreed with Ene et al. (2019) that the digital banking paradigm affects Nigeria's financial inclusion.

Ugwuanyi and Okore (2022) explored the influence of financial technology on financial inclusion in Nigeria. The study employed the survey research design. Primary data were gathered by a field survey using of questionnaire. Findings from the study revealed that Financial Technology eases accessibility to financial services, such as deposit, withdrawal, account opening, savings, borrowing and bill payment. Joy et al. (2023) evaluated the influence of digital banking on financial inclusion in Nigeria in order to assess the influence of agency banking, online banking, and Unstructured Supplementary Service Data (USSD) facility on financial inclusion. The results of the paper showed that POS and USSD banking had considerable influence on financial inclusion without significant relationship between web banking and financial inclusion.

Uzor and Mukhtar (2023) studied the efficacy of digital finance on financial inclusion from 2004 to 2020 using Autoregressive distributed lag (ARDL). The results indicated that Deposit Money Banks branches and internet connectivity are the main drivers of financial inclusion in Nigeria. The paper further found that deposit money banks branches, internet access, and exchange rates significantly affect financial inclusion in the long run. Other papers that studied the impacts of financial inclusion and banking innovation on economic growth were Saranu, et al 2024, Olajide, 2023), and West, 2015).

Bayero (2014) did research to assess the effects of the Cashless Economy Policy on Financial Inclusion in Nigeria. The regression and other studies demonstrated that knowledge, customer value proposition, and infrastructure had a substantial influence on Financial inclusion, and that Business Models of financial service providers did not have a significant link with Financial Inclusion. Soyemi et al. (2020) did research in Nigeria on financial inclusion as a strategy of attaining sustainable development using fully modified least square. The paper found that eliminating bank branches and spending more on personal healthcare drains resources that could have been employed for savings, raising the rate of financial inclusion in the nation.

Nazir et al. (2020) studied the influence of financial innovation on economic development in India, China, and Pakistan from 1970 to 2016 using the Autoregressive Distributed Lag Model and Error Correction Model (ECM). The research revealed that the different indices of financial innovation had a major influence on economic development across the three nations investigated. The paper also found that financial innovation greatly influences economic growth. Researchers in support of this include Qamruzzaman, et al. 2020,

Choudhury (2015) underlined the importance of Financial Inclusion in the north-eastern rural region of Bangladesh. The poor meet modest hazards in their life with cash in hand and household savings. For intermediate risks, they depend on borrowings from moneylenders or friends. For serious threats like flood or drought they depend on government aid and donor money. Financial Inclusion is considered an important external intervention that can stabilize rural families and assist in decreasing risk. However, he pointed out that Financial Inclusion is not complete in the north east rural region and agent and mobile banking have to be developed to elevate people's lives.

Adalessossi and Kaya (2015), investigated the degree of financial inclusion in 41 African nations, and concluded that 27 countries had a poor level of financial inclusion. Discriminant model analysis was done using number of individuals with outstanding mortgage, using a formal account and account from a formal financial institution. From the empirical literature reviewed, it was observed that most of the research carried out in this area of study have focused on the nexus of banking innovations and financial inclusion in Nigeria. No study has actually considered the role of government institutions or institutional quality in examining this relationship in Nigeria

The Model

This study is based on the technology acceptance model, which is used to explain why people adopt or reject new technologies, such as banking innovations. Pre-estimation tests of unit root and co-integration test were carried out. In this paper, the ADF test was specified as:

Generally, ADF equation can be written as:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^p \delta \Delta y_{t-i} + \epsilon_t \dots \dots \dots 1$$

where:

$\Delta y_t = y_t - y_{t-1}$ = the first difference of the series.

y_{t-1} = the lagged value of the series.

α = a constant (drift term)

β = the coefficient on the time trend t (if included)

γ = the coefficient of interest that tests for the presence of a unit root

$\sum_{i=1}^p \delta \Delta y_{t-i}$ = the lagged differences of the dependent variable to account for autocorrelation (where p is the number of lags).

ϵ_t = the error term (white noise)

The unit root null hypothesis is given as:

Ho: The series has a unit root (i.e., it is non-stationary), $\gamma = 0$

H₁: The series is stationary, $\gamma < 0$

If the test statistic is less than critical value (or p-value is greater than 0.05), we fail to reject the null hypothesis, indicating that the series is non-stationary.

The ARDL bounds co-integration test was employed for this purpose, in this study.

The model used in this study was the Autoregressive Distributed Lag (ARDL) model because of its flexibility and its ability to handle varying order of integration among the variables used.

The functional form of the model was specified as:

$$NCBB = f(NATM, GE, NAT.*INSTO, LI, FD, ACE) \dots \dots \dots 2$$

Equation 2 was transformed into statistical form as shown in equation 3.

$$NCBB_t = \beta_0 + \beta_1 NATM_t + \beta_2 INSTQ_t + \beta_3 NATMINSTQ_t + \beta_3 \log LI_t + \beta_4 FD_t + \beta_5 \log ACE_t \dots \dots 3.$$

Equations 2 and 3 is difficult to be applied in social sciences because of uncertainty surrounding unpredictable human behavior. The Econometric form of the model was specified as shown in equation 4 by introducing an error term in the model.

$$NCBB_t = \beta_0 + \beta_1 NATM_t + \beta_2 INSTQ_t + \beta_3 NATMINSTQ_t + \beta_3 \log LI_t + \beta_4 FD_t + \beta_5 \log ACE_t + U_t \dots \dots \dots 4$$

Where,

NCBB= Number of commercial Bank Branches

NATM= Number of automated teller machine

INSTQ= Institutional quality

NATMINSTQ= The interaction of Number of Automated Teller Machine and institutional quality

LI= Level of income

FD= Financial depth

ACE= Access to electricity

U_t = The error term

t = the time series property of the respective variables.

β_0 = Intercept term or constant parameter.

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5,$ and β_6 = The Regression parameters and slopes of the respective explanatory variables.

In this paper the Autoregressive and Distributed Lag (ARDL) estimator was employed, hence, the ARDL model was specified as:

$$\begin{aligned} \Delta \log NCBB_t &= \alpha_0 + \sum_{i=1}^n \beta_1 \Delta \log NCBB_{t-i} + \sum_{i=1}^n \beta_2 \Delta \log NATM_{t-i} + \sum_{i=1}^n \beta_3 \Delta \log INSTQ_{t-i} \\ &+ \sum_{i=1}^n \beta_4 \Delta \log NATMINSTQ_{t-i} + \sum_{i=1}^n \beta_5 \Delta \log LI_{t-i} + \sum_{i=1}^n \beta_6 \Delta \log FD_{t-i} + \sum_{i=1}^n \beta_7 \Delta \log ACE_{t-i} \\ &+ \gamma_1 NATM_{t-1} + \gamma_2 INSTQ_{t-1} + \gamma_3 NATMINSTQ_{t-1} + \gamma_4 LI + \gamma_5 FD_{t-1} + \gamma_6 ACE + \epsilon_t \end{aligned}$$

Where: all the variables remain as defined

Δ is the first difference operator, and α_0 is the drift component.

Different post estimation tests carried out include normality, autocorrelation, heteroscedasticity and the Ramsey Reset tests. Time series data used were sourced from the World Bank development indicators (WDI) 2024.

III. Results

Descriptive statistics were computed using Eview software version 13 in order to trace the distribution of the data used in the model. The result of the descriptive statistics is shown in Table 1

Table 1: Descriptive Statistics Result

Variables	NCBB	NATM	INSTQ	NATMINSTQ	LI	FD	ACE
Mean	5.064545	15.33	-0.570731	-8.908177	358147.8	0.342549	55.60646
Median	4.78	16.19	-0.448515	-6.044285	355548.1	0.283154	55.4
Maximum	6.41	17.19	1.094255	17.73788	379251.6	0.536851	59.5
Minimum	4.28	11.49	-2.387359	-40.41799	339852.3	0.253987	52.5
Std. Dev.	0.717727	1.980946	1.002306	16.66385	12481.3	0.099802	2.149991
Skewness	0.546904	-1.053977	0.171915	-0.021154	0.417046	0.987367	0.548962
Kurtosis	1.869364	2.421099	2.55221	2.572955	2.189011	2.326924	2.500077
Jarque-Bera	4.537044	8.760753	0.584347	0.337622	2.481257	7.979783	2.668159
Probability	0.103465	0.012521	0.746639	0.844669	0.289202	0.018502	0.263401
Sum	222.84	674.52	-25.11216	-391.9598	15758501	15.07217	2446.684
Sum Sq. Dev.	22.15069	168.7384	43.19852	11940.41	6.70E+09	0.428298	198.7659
Observations	44	44	44	44	44	44	44

Source: Author's computation using EView 13

The variable level of income had the highest average value (mean) of 358147.8 across the time period. The probability value of the JB statistics shows that the variables such as number of automated teller machine and financial depth were not normally distributed, because the probability value of their respective Jarque-Bera statistics were less than 5%. Other variables such as number of commercial bank branches, institutional quality, the interaction of number of automated teller machine and institutional quality, level of income, access to electricity were normally distributed because their probability value of the Jarque-Bera statistics for each of the variables were greater than 5%. The numbers of observation were 44

The Augmented-Dickey unit root test was employed and its results were shown in Table 2.

Table 2: Augmented Dickey-Fuller Unit Root Test Result

Variables	ADF stat at level	5% Critical Value	ADF Stat at first difference	5% Critical Value	P-Value	Order of integration
NCBB	-1.893420	-3.518090	-6.975055	-3.520787	0.0000	I(1)
NATM	-1.147556	-3.518090	-6.739240	3.520787	0.0000	I(1)
INSTQ	-1.801626	-3.518090	-6.279629	-3.520787	0.0000	I(1)
NATMINSTQ	-1.777628	-3.518090	-6.265928	-3.520787	0.0000	I(1)
LI	-1.074442	-2.931404	-6.326877	-2.933158	0.0000	I(1)
FD	-1.980383	-2.931404	-7.073213	-2.933158	0.0000	I(1)
ACE	-2.295171	-2.931404	-6.341977	-2.933158	0.0000	I(1)

Source: Author's Computation using Eview 13

The results of the unit root test showed that all the variables were integrated of order one, I(1). This called for cointegration test to be carried out to determine the presence of long run relationship. The ARDL bounds test was employed and the results were shown in Table 5.

Table 4.3 ARDL Bounds Test Result

Test Statistic	Value	K
F-statistic	1.203380	6
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
5%	2.45	3.61

Source: Author's Computation using Eview 13

From the Table 3, the F-statistics was lower than the lower bound at 5% critical value but less than the upper bound at 5% critical value. The result showed absence of a long run relationship amongst the variables as the value of the F-statistics is less than both the lower bound and upper bound, at 5% significance level.

The result of the Autoregressive Distributed model was presented in Table 5, below:

**Table 5: ARDL Short Run Result
Dependent Variable: NCCB**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NATM)	0.360284	0.030214	11.924274	0.0000
D(INSTQ)	-1.012576	0.428144	-2.365036	0.0249

D(NATMINSTQ)	0.063164	0.025734	2.454527	0.0203
D(LLI)	2.437219	0.954407	2.553648	0.0162
D(FD)	13.024928	0.724371	17.981012	0.0000
D(LACE)	0.107644	0.354594	0.303571	0.7636
C	-4.358213	5.984989	-0.728191	0.4723

Source: Author's computation using Eview 13

From table 5, the constant term (C) is -4.358, suggesting a baseline level for the number of bank branches when all independent variables are held constant, the Number of Commercial Bank Branches will decrease by 4 units. The coefficient for the number of ATMs (NATM) was 0.360 and statistically significant (p=0.0000). This indicates a positive short-run impact on the number of bank branches, which is consistent with a priori expectations. The result implies that given a unit increase in the number of automated teller machines, the number of commercial bank branches will increase by 36%.

The coefficient for institutional quality (INSTQ) was -1.013 and was statistically significant (p=0.0249). This negative impact contradicts our a priori expectation and warrants further discussion. The result, therefore, implies that, given a unit increase in the value of the Institutional Quality, the Number of Commercial Bank Branches will decrease by 1 unit.

The coefficient of the Interaction of number of automated teller machines and institutional quality was 0.063164. This satisfies the economic expectation of this paper. The result then implies that given a unit increase in the Interaction of number of automated teller machine and institutional quality, number of commercial bank branches will increase by 6%.

The result further showed that the level of income had positive impact on the Number of Commercial Bank Branches with coefficient of 2.437219. This also satisfies the a priori expectation and implies that a unit increase in the level of income increased the number of commercial bank branches by 2 units. Financial depth and access to electricity had positive effect on financial inclusion with coefficients of 13.02493 and 0.107644 respectively.

From table 5, access to electricity (ACE) had p-value of 0.7636 which shows that it was not statistically significant. This indicates no discernible impact on financial inclusion. The probability value of the institutional quality, the interaction of number of automated teller machine and institutional quality, level of income and financial depth were individually less than 0.05, implying that they are significantly impacting on financial inclusion.

The probability value of the f-statistic was less than 0.05, implying that all the explanatory variables employed in this paper have a joint significant impact on financial inclusion.

The result of the post estimation tests showed that the error term in the regression result was not normally distributed as the p-value was less than 0.05 critical value. The result is as shown in Table 6

Table 6: Normality Test Result

Jarque-Bera statistic	41.03368
Probability value	0.000000

Source: Researcher's computation using Eview 13

The result of the Breuch-Godfrey LM Serial Correlation Test Result was presented in Table 7

Table 7: Breuch-Godfrey LM Serial Correlation Test Result

Obs*R-squared	2.011449
Prob. Chi-Square (1)	0.3658

Source: Researcher's computation using Eview 12

The result showed that the probability value of the chi-square statistics was not less than 0.05, implying that there is no presence of autocorrelation in the regression result.

The Breuch-Pagan-Godfrey Statistics, which follow the chi-square statistics was employed and the result was presented in Table 8.

Table 8: Breuch-Pagan-Godfrey Test Result

Obs*R-squared	30.80670
Prob. Chi-Square (5)	0.0036

Source: Researcher's Computation using Eview 12

The results indicated that the probability value of the chi-square statistic was less than 0.05, indicating that the error term of the regression result was not homoscedastic. This is a serious problem in statistical analysis, but was corrected by the Newey-West HAC

The correlation matrix was used for testing the presence of multicollinearity and the result is a contained in figure 9.

Table 9 Correlation Matrix

Variable	NCBB	NATM	INSTQ	NATMINSTQ	LI	FD	ACE
NCBB	1						
NATM	-0.83334	1					
INSTQ	0.350571	-0.08188	1				
NATMINSTQ	0.415885	-0.16156	0.996148	1			
LI	0.222726	0.182659	0.649069	0.617702435	1		
FD	0.942917	-0.96649	0.173422	0.250700032	-0.02833	1	
ACE	-0.36734	0.284976	-0.377	-0.380615032	-0.40155	-0.32609	1

Source: Researcher’s computation using Eview 13

It can be observed that the coefficient of the correlation matrix of institutional quality and number of automated teller machine, and number of automated teller machine and institutional quality were the only pairs of the explanatory variables employed in this study that are correlated. This is because both of the correlation matrix coefficients of the pairs of variables mentioned earlier are up to 0.80 and above.

IV. Conclusion

This study set out to ascertain the impact of banking innovations on Financial inclusion in Nigeria. The specific objectives of the study was primarily to ascertain if banking innovation and financial inclusion have a long term linear relationship in Nigeria, to examine the impact of Banking Innovations on Financial inclusion in Nigeria, and to investigate the role of the interaction of government institutions and banking innovations on Financial inclusion in Nigeria. The study employed annual time series data which ranges from the period of 2011-2021 and was converted into quarterly data from World Development indicator. The findings of the study as we have discussed earlier suggested that there is a significant impact of banking innovation on Financial inclusion in Nigeria, and also the interaction of banking innovation and government institutions have a significant impact on Financial inclusion.

This paper recommends that government institutions should continue to promote public-private partnerships, such as the Shared Agent Network Expansion Facility (SANEF), to foster the development and implementation of banking innovations in Nigeria. This should be encouraged by improving the regulatory framework for banking innovations by the CBN and Nigeria Deposit Insurance Complan (NDIC).

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