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Automated Teller Machine (Atm) Penetration and Financial Inclusiveness in Nigeria: A Tripod Banking System Approach

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Abstract: The work 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 are 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. Hence, we conclude that ATM demographic penetration is instrumental to the enhancement of financial inclusiveness in Nigeria. It was recommended for Banks to increase more of their branches (geographical coverage). Lastly, ATM Agents are to be trustworthy as it will increase confidence and acceptability for ATM Demographic distribution for optimum ATM potentiality and contributions to GDP.

Keywords: Tripod; Deposit Money Banks (DMBs); Financial Inclusiveness; Geographic ATM Penetration; Demographic ATM Penetration; Total Number of ATM;

1. Introduction

Over the years, the banking business has changed dramatically around the world. Historically, banks have been at the forefront of using technology to better their products and services (Memba & Njeru, 2018). The banking business in the twenty-first century operates in a complicated and competitive environment marked by these shifting conditions and a volatile economic climate.

Changes in the way financial services are supplied to customers have been visible as a result of the impact. While banks' basic activities have remained essentially constant over the last few decades, the industry's structure has transformed dramatically, Backjena, Mala, and Vasanthi (2016). There has been a considerable expansion in the number of alternative channels for the delivery of financial services during the last decade. Traditional delivery techniques have given way to new delivery technologies such as Internet banking, mobile banking, and a variety of ATM products (Ndlovu & Ndlovu, 2017). Banks are collaborating with hardware, software, and telecommunications businesses to provide new ways for customers to check account balances, transfer payments, pay bills, and purchase goods and services without having to use physical cash, checks, or leave their homes (CBN, 2019).

Banks have used ATM penetration as a powerful strategic variable to outpace any sort of competition, making it an excellent way for banks to boost their performance while maintaining their efficacy in the market Memba and Njeru (2018). The banking industry is highly competitive, and players are beginning to see the benefits of adopting new approaches to providing banking services to low-income and rural customers (FSD, 2011, 2012).

The study of ATM penetration and financial inclusiveness was chosen because, as noted by the Central Bank of Nigeria (CBN), (2013), banks are now facing high operational costs, management inefficiencies, and liquidity difficulties which have led to a wave of mergers, acquisitions, and bank failures recently signaling a need for action (CBN, 2016). The research analyzed yielded varied results when it came to the relationship between ATM adoption and financial inclusiveness, with some concluding a positive association, others a negative relationship, and some concluding no relationship. Second, the banking industry in Nigeria is knowledge-intensive because it deals with financial services in support of the country's investment and currency in circulation, but no empirical study in the area of finance, specifically how ATM penetration adoption is managed to improve financial inclusion. Again, there are few statistics and literature available locally on the levels of ATM acceptance and efficacy in the banking business. In addition, this research will employ hierarchical regression analysis equations to look at the moderating effects of bank size on the relationship between ATM use and DMBs' financial inclusiveness. As a result of the existing knowledge gaps, a study on the relationship between ATM penetration adoption and financial inclusion in Nigeria is required.

2. Empirical Review of Related Literature and Theoretical Framework

Automated Teller Machine (ATM) Penetration

ATM is an electronic banking terminal that enables consumers to conduct simple transactions without the assistance of a teller or branch personnel. In the usage of ATMs, anyone with a credit

or debit card can get cash. ATMs are convenient because they allow customers to do self-service operations like cash withdrawals, bill payments, and account transfers. However, most ATMs are disabled from cash deposits in Nigeria. Cash withdrawal fees are frequently charged by some mischievous DMBs irrespective of where the account is domiciled.

Emergence and Development of ATM Transactions in Nigeria

The previous Mechanical Cash Dispenser placed by the National Cash Registers (NCR) in 1989 for the defunct Societe Generale Bank of Nigeria (SGBN) can be traced back to the historical development of SGBN ATM in Nigeria. The SGBN ATM was known as "Cash Point 24.". Two years after SGBN's ATM, First Bank of Nigeria (FBN) Plc launched their own. named "First Cash." While the SGBN ATM was a drive-up machine, the First Bank ATM was a through-the-wall machine (Jegede, 2018). They were, nevertheless, considered a highbrow amenity at the time, created for individuals seeking special care. Today, the story is different, as ATM financial engineering is already generally used and accepted. The widespread acceptance of ATM financial engineering is attributed to the 2004 bank reforms and the country's earlier establishment of the Inter switch network in 2003. In cementing the reform program, money deposit banks installed ATMs in their premises and different critical areas to develop a cashless economy and ensure the efficiency of banks. Consequently, Olatokun and Igbinedion (2009), referenced in Backjena and Gundimeda (2018), observed that bank transactions increased by 93 percent between January 2005 and March 2006, owing to aggressive roll-out initiatives by banks, powered by Inter-switch Network.

As a result, transactions volume increased from N1.6 million in 2006 to over N500 million in 2009, and the total number of ATMs increased dramatically from 500 in 2006 to over 8,000 in 2009. The number of ATMs was also 10,221 at the end of June 2012, with the value of ATM transactions increasing by 34.3 percent to N937.39 billion from N698.19 billion. From the initial N937.39 billion in June 2012, this sum had risen to N1.3 trillion by the end of the year. CBN recently announced that the number of financial transactions carried out through ATMs was N1.7 trillion in June 2014, up from N1.3 trillion in 2012. The number of ATMs increased from 10,727 in 2012 to 15,000 in June 2014. Rapid ATM transactions in Nigeria are, however, not linked to DMBs' heavy attention on the promotion of ATM awareness through several ATM promotional schemes. Banks have even gone so far as to penalize their clients for not using ATM cards by debiting their account for withdrawing less than a particular amount across the counter, (Memba and Njeru, 2018). Consequently, CBN's Bankers Committee recommended the immediate abolition of the N100 penalty for clients who used a different bank's ATM from November 6, 2012.

In a recent development, the CBN reintroduced ATM charges on September 1, 2014, and banks now charge consumers N65 for using remote-on-us ATMs after the third withdrawal within a month. Withdrawals performed from ATMs other than the bank where the account is domiciled are known as remote-on-us ATM withdrawals (Kumari, 2017). According to CBN N65

reintroduction was necessary since bank customers now use ATMs indiscriminately resulting in to decrease in profits and increased overhead costs. As a result, the reintroduction of the fee will assist to reduce bank costs

Financial Inclusiveness

Financial inclusiveness, according to the World Bank (2020), is defined as the provision of long-term, low-cost financial services to low-income people. Kumari (2017) Financial inclusion's ability to encourage economic growth through investments in education and simple access to entrepreneurial capital is one of its most important features. Individuals are also given the ability to invest in their health and well-being, as well as efficiently handle shocks, (World Bank Group 2014). In other words, financial inclusiveness refers to the provision of financial services to commercial and retail clients who are now unable to access them at a reasonable cost and with ease. The financial sector, which includes banks and other financial institutions such as post offices, insurance companies, brokers, and investment funds, is responsible for providing financial services. Financial sector improvement lowers information and transaction costs, which help to mobilize savings, boost economic growth, reduce poverty, disburse credit, facilitate payments, and manage risk, etc. At the same time, some concerns have been raised that the wealthy and politically powerful might benefit more from banking sector improvements (Kumari (2017). However, as the economy grows from a slow to a fast-growing one, more people participated and entered the formal financial system and benefited from a variety of services that helped to ensure a stable distribution of income across people (Mala &Vasanthi, 2016).

Theoretical Underpinning

Jensen and Meckling were proponents of Agency theory (1976). The idea presents interactions between a company's owners and her managers, who act as agents under the law. When ownership and control are separated, the cardinal question in agency theory is whether appropriate market mechanisms exist to require managers to act in ways that maximize firm's Bimba (2015) In agency theory, a Principal (P) assigns authority to his Agent (A) to transact and take decisions on his or her behalf to maximize the principal's utility preferences. In MDBs, agency challenges come from three sources: a) partial ownership of DMB by a group of persons who are both owners and managers, thus, behave differently from the utility-maximizing owners alone; b) presence of public sponsored deposit insurance program not differently pricing insurance coverage in reflecting risk vulnerability of each bank, thereby creating moralistic jeopardy which makes management and stockholders to follow high-risk investments in a bid to transferring depositors' wealth to shareholders; and, c) existence of knowledge imbalance, in which owners and managers do not share the same content, (Henderson and Pearson, 2010).

Empirical Review

Memba and Njeru (2018) determined the relationship between ATM banking and the financial deepening of DMBs in Kenya. The study covered all DMBs operating in Kenya in the last 10 years. It was discovered that the adoption of financial innovations and the financial deepening of DMBs in Kenya had a statistically significant association. The link between financial innovations adoption and financial deepening was also influenced by the size of the bank as a moderating variable.

Jegede (2018) investigated the effect of ATMs on the performance of Nigerian Banks. The Chi-square technique was used to examine the data statistically, which was done online using the Software Package for Social Science (SPSS version 20.0). The result indicates the deployment of ATMs improving bank performance.

Backjena and Gundimeda (2018) investigated the impact of self-help group linkage programs in achieving financial inclusiveness across sixteen states in India. Using descriptive statistics, it found that despite the recent expansion of the formal banking network, fundamental financial services remain out of reach for broad segments of the population. The self-help group bank connection concept has the potential to provide an alternate mechanism for extending financial services to substantial segments of the population who are currently unbanked.

Kumari (2017) investigated the Reserve Bank of India's assessment on the role of mobile banking as a tool for financial inclusiveness in India revealed a negative association between five banks, which account for 92 percent of aggressive mobile banking transactions, and 63 banks, which account for 8% of those who are not. Between 2010 and 2015, mobile banking was found to be a failure as a tool for financial inclusiveness in India.

Ndlovu and Ndlovu (2017) examined mobile banking as the future to rural financial inclusiveness in Zimbabwe Using primary data and descriptive statistics, researchers discovered that mobile banking can alleviate poverty by engaging previously excluded rural areas into mainstream economic activities.

Anand and Saxena (2017) researched technology-based initiatives by India commercial banks towards financial inclusion using descriptive statistics. The findings revealed that, despite considerable gains in financial sustainability, profitability, and competitiveness, banks have been unable to bring a large segment of the population, particularly the underserved, into the fold of basic banking services.

Sigh, Mittal, Garg, Goenka, Goud, and Ram, (2016) researched on financial inclusiveness in India: selected issues – using descriptive statistics. The finding reviewed that India is lagging in With nearly half of households still unbanked and 90% of villages lacking bank branches, the process of delivering financial services to the masses is underway. It was also revealed that people in these unbanked communities do not completely understand why they need a bank account in the first place, or why formal-sector loans are more useful than informal-sector loans.

Siddik, Sun, Yanjuan, and Kabiraj, (2016) worked on mobile banking as a tool of financial inclusiveness in Bangladesh using primary data and regression analysis. The findings revealed that perceived financial cost, perceived risk, and subjective norm were the most influential elements in

people's decision to use mobile banking. Finally, it was found that it was important for Bangladeshi mobile banking service providers and policymakers to develop mobile banking services in such a way that access and usage may be enhanced, resulting in a beneficial impact. Mala and Vasanthi (2016) concluded that the banking industry has played a significant role in financial inclusiveness and that financial inclusion is playing a catalytic role for the economic and social growth of India society, using descriptive statistics and secondary data.

The researcher discovered that internet and telephone banking is proving to be difficult channels to use in fostering financial inclusiveness for the period under review using time series data and multiple regression analysis. ATMs, on the other hand, are the most widely used method for promoting financial inclusiveness in South Africa. Surprisingly, branch banking has not had the same success. Electronic banking criticisms explain why the financially disadvantaged are hesitant to adopt it.

Research Methodology

This paper adopts the ex-post facto research design because the study seeks to establish ATM penetration and financial inclusiveness by analyzing past events and data of already existing circumstances. Accordingly, our study population is confined to ATM penetration concerning financial inclusiveness in Nigeria. Data were sourced from CBN and World Bank Data Bank (2019). Consequently, the aggregate ATM penetration, (bank branches, ATM and loans penetrations) and financial inclusiveness (Number of internet users) measures were obtained for this study. On basis of the above, a multivariate regression model was employed and the functional relationship was expressed as:

$$FINX = \beta_0 + \beta_1 GAP + \beta_2 DAP + \beta_3 TAP + \mu \quad \text{---------- 1}$$

Where:

β_0	=	Intercept
$\beta_1 - \beta_3$	=	Coefficient of the independent variables.
μ	=	Error term or stochastic term
FINX	=	Financial Inclusion Index as a measure of Financial Inclusiveness
GAP	=	Geographic ATM Penetration as a measure of ATM Penetration
DAP	=	Demographic ATM Penetration as a measure of ATM Penetration
TAP	=	Total numbers of ATMs about GDP as a measure of ATM Penetration

A multivariate regression statistical tool was adopted and the analysis was done in phases: descriptive results(mean, standard deviation, correlation matrix, skewness /kurtosis tests for normality of data), and econometric tests (lag order selection criteria, Johansen co-integration, and multivariate regression results). Based on the review of related literature and model specification, the following conceptual model was given:

4. Results and Discussions

This section presents the pre-estimation results involving mean, standard deviation, minimum and maximum values, correlation matrix, and normality test results; the results are presented as follows:

Table 1: Descriptive Statistics Results

Variable	OBS	Mean	Std. Dev.	Min.	Max.
GAP	30	3.0831	1.1425	1.2990	4.62
DAP	30	1.6721	0.1079	1.4612	2.02
TAP	30	0.2805	0.4559	0.0000	1
FINX	30	3.4403	0.2500	2.9940	3.76

Source: Author's Compilation Based on Econometric Views Version 9.0. Output (2021)

Presented in Table 1 are the descriptive results of independent variables (Geographic ATM Penetration, Demographic ATM Penetration, total numbers of ATM about GDP) dependent variables (financial inclusion) during the period 1990-2019. The results revealed that none of the variables reported a high standard deviation value suggesting that the model is well fitted and that it is not volatile. The above results are further supported by figure 2:

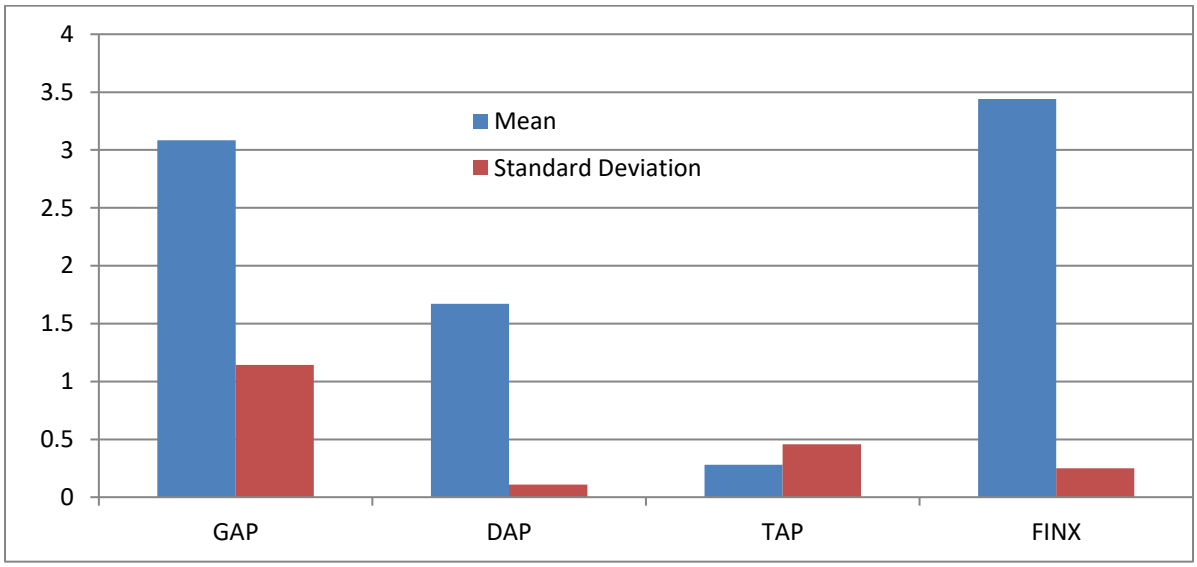

Fig. 1: Movement of Variables

Source: E- Views version 9.0 (2021)

In addition, the mean and low standard deviation values for all the variables are clear indications that the variables are not constant over time and describes that overall, the data for *GAP, DAP, TAP, & FINX* deviate from both sides by 1.1%, .107%, .445%, 2.49%, and .087% respectively and the variations are not too dispersed from each other

Table 2: Tests for Normality of Data

Normality	chi2	df	Prob> chi2	chi2
Jarque-Bera	5.170	4	0.27027	5.170
Skewness	1.644	4	0.43957	1.644
Kurtosis	4.3219	4	0.17150	3.526

Source: Computed by Researcher, 2021

The Jarque-Bera, skewness, and kurtosis tests of normality of the dependent and independent variables are presented in Table 2. From the above, it shows that none of the variables were exactly three (3). Thus, the variables satisfy the normality condition that they are normally distributed.

Table 3: Correlation Matrix

Variable	GAP	DAP	TAP	FINX
GAP	1.0000			
DAP	0.1729	1.0000		
TAP	0.7572	0.0514	1.0000	
FINX	0.9657	0.0498	0.7873	1.0000

Source: Computed by Researcher, 2021

The correlation results revealed that the ATM Penetration proxies, particularly *GAP, DAP, AND TAP* are positively related to the financial inclusion index.

Table 4: Lag Order Selection Criteria

lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-252.755				4546.09*	16.9222	17.1955*	17.7467*
1	-247.682	10.147	4	0.339	6007.11	17.1676	17.5775	18.4043
2	-241.331	12.7	4	0.177	7592.79	17.3332	17.8798	18.9822
3	-232.024	18.615	4	0.029	8422.54	17.314	17.9972	19.3752
4	-215.97	32.107*	4	0.000	6656.85	16.8731*	17.693	19.3466

Source: Computed by Researcher, 2021

Lagrange-multiplier test

lag	chi^2	df	Prob> chi^2
1	16.6804	4	0.05396
2	6.5036	4	0.68865

H0: no autocorrelation at lag order

Source: Computed by Researcher, 2021

Having found that the series is of order I(1) and I (0), the study proceeded to determine the optimal lag using the Akaike information criterion (AIC). From the table, AIC showed that the optimum lag is four. In addition, the Lagrange-multiplier result is an indication that there is no autocorrelation at lag order among the variables of the study.

Table 5: Johansen Co-integration Results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.621096	40.20492	40.17493	0.0497
At most 1	0.278807	13.03171	24.27596	0.6189
At most 2	0.128996	3.879952	12.32090	0.7281
At most 3	0.000461	0.012899	4.129906	0.9260

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.621096	27.17322	24.15921	0.0190
At most 1	0.278807	9.151755	17.79730	0.5775
At most 2	0.128996	3.867053	11.22480	0.6497
At most 3	0.000461	0.012899	4.129906	0.9260

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: E- Views version 9.0 (2021)

Using the likelihood ratio, the results showed that there is one (1) co-integrating equation at a 5% significance level; this revealed that cointegration exists. Hence, we proceed immediately to the short-run analysis to know the statistical relationship between the independent and dependent variables under study.

Table 6: Multivariate Results

Dependent Variable: FINX
Method: Least Squares
Date: 06/26/21 Time: 20:09
Sample: 1990 2019
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1308.412	327.8769	-3.990559	0.0005
GAP	11.79316	8.284432	1.423532	0.1665
DAP	116.2554	20.41092	5.695743	0.0000
TAP	-22.99942	12.39990	-1.854807	0.0750
R-squared	0.673048	Mean dependent var		130.4103
Adjusted R-squared	0.635323	S.D. dependent var		180.1103
S.E. of regression	108.7659	Akaike info criterion		12.33984
Sum squared resid	307580.7	Schwarz criterion		12.52667
Log-likelihood	-181.0976	Hannan-Quinn criteria.		12.39961
F-statistic	17.84080	Durbin-Watson stat		0.457251
Prob(F-statistic)	0.000002			

Source: E- Views version 9.0 (2021)

Table 6 showed the multivariate regression of financial inclusion measures (ATM, loans, and bank branches penetrations) and performance measures (total assets and liquidity) of DMBs in Nigeria during the period 1990-2019. The R-Squared is 0.67 indicating that the independent variables jointly explained about 67% of the systematic variations in the financial inclusiveness index respectively. The result further revealed that the wider the geographical coverage of ATM, the higher the level of financial inclusiveness in Nigeria. Put differently, wider coverage of ATM results to reduce the level of financial exclusion in Nigeria. However, it failed the test of statistical significance. This further revealed that the current rate of geographical ATM penetration is not significant enough at the moment to reduce the level of financial exclusion inherent in the country.

Furthermore, Demographic ATM Penetration exerted a positive significant effect on financial inclusiveness in Nigeria. This is because its p-value estimated at 0.0000 is less than 5% while its coefficient value is estimated at 116.2554. This further revealed that the current rate of Demographic ATM penetration is significant enough at the moment to reduce the level of financial exclusiveness inherent in the country.

Furthermore, Demographic ATM Penetration exerted a negative insignificant effect on financial inclusion in Nigeria. This is because its p-value estimated at 0.0750 is greater than 5% while its coefficient value is estimated at -22.99942. This further revealed that the current rate of Demographic ATM penetration is not significant enough at the moment to increase the level of financial inclusion inherent in the country.

Conclusions and Recommendations

The study examined the effect of ATM penetration on the level of financial inclusiveness in Nigeria from 1990 to 2019. The central focus of this study was on the long and short-run relationship. The explanatory variables were ATM Penetration measured by Geographic ATM Penetration, Demographic ATM Penetration, total numbers of ATM about GDP while the explained variable was financial inclusiveness measured by financial inclusion index as obtained from the International Monetary Fund (IMF) and World Bank. The econometric Views (E-Views) Version 9.0 was used to run the regression. All tests proved that the model was fit for prediction. Accordingly, the regression result revealed that the overall ATM penetration enhances the level of financial inclusion in Nigeria. However, in terms of individual variables, the level of ATM penetration in the country is still weak, though ATM Demographic Penetration seems to be strong. Hence, we concluded that ATM Demographic Penetration is instrumental to the enhancement of financial inclusiveness in Nigeria. Hence, we recommend that there is a need for Banks to increase more of their branches (geographical coverage). Lastly, ATM Agents should be trustworthy as it will increase confidence and acceptability for ATM Demographic distribution for optimum ATM potentiality and contributions to GDP.

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