



Research Paper

Technology-Based Banking Products and Economic Growth of Nigeria: An ARDL Approach

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Abstract

The study examined the effect of technology-based payment system on economic growth in Nigerian. In order to achieve this broad objective, the study specifically adopted Automated Teller Machine (ATM), Point of Sale (POS), web banking and mobile phone payment systems as proxies for technology-based payment system and these served as the independent variables while real gross domestic product was adopted as proxy for economic growth and dependent variable. The Co-integration technique using Autoregressive Distributed Lag (ARDL) model was employed to analyze the quarterly data sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin for the period 2009-2018. From empirical findings, it was revealed that ATM had positive and significant effect on economic growth in Nigeria in both the short run and long run periods. Point of Sale (POS) technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run but had a positive and insignificant effect on economic growth in Nigeria in the long run. Web technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run while it exhibited a negative and significant effect on economic growth in Nigeria in the long run. Mobile phone technology-based payment system had negative and significant effect on economic growth in the short run while it exhibited a positive and significant effect on economic growth in Nigeria in the long run. In conclusion, the study argued that technology-based payment system in Nigeria had significant effect on Nigeria's economic growth. The study recommended amongst others that commercial banks in Nigeria and the government should further educate the populace on how to make use of the technology-based banking products, especially ATM and POS since their usage had positive effect on Nigeria's economy. This could be through seminars and workshops as well as through the mass media.

Keywords: Banking, Economic Growth, Financial Intermediation, Payment System

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I. Introduction

Banks all over the world provide a wide range of services summed into financial intermediation to suit the needs of their customers, be they individuals, corporate or government customers. Bencivenga and Smith (1991), posited that the basic activities of banks are acceptance of deposits and lending to a large number of agents, holding of liquid reserves against unpredictable withdrawal demands of customers, issuing liabilities that are more liquid than their primary assets and eliminating or reducing the need for self financing of investments. In developing countries of the world, Nigeria inclusive, majority of the people are poor, capital for investment is in short supply and means of transport are underdeveloped likewise basic infrastructures. The banks through their intermediation role and other services as earlier enumerated aim at overcoming these obstacles and thus promote economic growth of the nation.

Financial intermediation by the banks mainly involve channeling funds from the surplus units to the deficit units of the economy, thus transforming bank deposits into credits or loans. The role of credit on economic growth has been recognized as credits are obtained by various economic agents to enable them meet operating expenses (Bencivenga and Smith, 1991). Thus, a relationship exists between financial development and the growth of an economy. The banking sub-sector of the financial sector is very important as it links the surplus and deficit units in an economy. One basic and fundamental goal of every economy according to

Ogbeide-Osaretin and Ishiwu (2016) is the increase in economic growth. The banking sub-sector has stood out in the financial sector as a prime mover, because in most developing countries of the world, the sector is virtually the only financial means of attracting private savings in a large scale to enhance economic growth (Afolabi, 1988).

The environment in which banks and other financial institutions operate is very dynamic. Techniques and concepts used or applied few years ago have all changed or gone through a lot of transformations. Indeed, change which is said to be constant is a major function of today's banking environment (Nwaeze, 2016). There has been a tremendous change in the regulatory framework for the banking industry over the years. Legislative measures to control the activities of the commercial banks started in 1952 with the passing of the Banking Ordinance of 1952, which was later replaced with Banking Amendment Act, 1958. These changes in the legislative framework continued both in nomenclature and contents (Ujah, 2010). The Banking Act 1969 replaced the Banking Amendment Act 1958 and this continued to change and eventually came to a climax when the Central Bank of Nigeria Act No. 24 of 1991 and the Banks and Other Financial Institutions Act No. 25 of 1991 came into being. These Acts have equally undergone some amendments since then. The banking industry has experienced various reforms aimed at strengthening the banks. These reforms include amongst others, the universal banking scheme 2000, banking consolidation scheme which raised the capital base of the banks from ₦2 billion to ₦25 billion (2005), conversion of community banks to microfinance banks (2001) etc.

Another area of reform is the advancement of technology in the banks, which is the main focus of this study. In the area of information and communication technology (ICT), the banking industry has witnessed tremendous transformations as the existing mega banks are technologically advanced and are becoming more advanced on daily basis. Electronic-based systems (computers) have now replaced manual work. These electronic based systems, otherwise known as telematics systems, represent information system which receive data as input and subsequently produce output (Nwaeze, 2016).

These systems depend on electronic signals communicated through satellite or microwave links. They work to enhance the efficiency and productivity of banks through automation (real time and on-line processes). Examples include internet banking, Automatic Teller Machines (ATM), Point of Sales (POS), mobile banking, etc.

The Central Bank of Nigeria's (CBN's) electronic banking initiative simply refers to an arrangement where the volume of cash used in transactions is being reduced to minimal and electronic payment or electronic commerce system of business transaction are encouraged in the country. In its effort to reposition the nation's economy, and make it relevant to the global financial environment, the Central Bank of Nigeria (CBN) has continued the reform of the financial sector using electronic payment and electronic commerce (e-payments and e-commerce). In general, these reforms are aimed at strengthening the banks to engage in their roles effectively and efficiently and even across international boundaries. A second financial system plays the intermediation role of mobilizing savings and extending credits to the economic units as financial development has been established to have a direct link to economic growth in developed countries (Olohunlana and Dauda, 2019).

The banking industry of the 21st century operates in a complete and competitive environment characterized by large volume of transactions which are usually handled manually or conventionally in the banking hall. Till date, many people still prefer cash-based transactions to the use of technology-based channels despite the problem of inefficiency and low productivity associated with it. Therefore, the basic problem of this study is the continuous adoption of cash transactions in the banks with its attendant consequences of time wastage, low output, insecurity issues as well as inefficiency of operations.

Banks customers want to associate with banks that will offer them services that will meet their particular needs (personalized banking) and support their business goals. For instance, bank customers want to pay for their tickets online and subscribe to initial public offerings by transferring the money directly from their accounts or pay for various goods and services by electronic transfers of credit to the seller's account (Nwaeze, Uruakpa, Ibekwe and Nwamkpa, 2022). They want to be able to check their balances online, find out if their cheques are cleared, transfer funds amongst accounts and even want to download transaction records into their own personal computers from the comfort of their homes or offices. It is only advancement in technology that can assist banks achieve all these by improving service delivery as well as bank productivity.

Based on the above scenario, this study is aimed at examining the effect of these technology-based banking products/services on the growth of the Nigerian economy for the period 1990-2018. Specifically, it examines the effect of Automated Teller Machine (ATM), Point of Sales (POS), WEB and mobile Banking technology-based payment systems on the economic growth of Nigeria for the period studied.

Questions such as to what extent has the ATM, POS, WEB and Mobile banking technology-based payment systems impacted on the growth of the Nigerian economy have been raised in this study.

II. Review of Literature

Conceptual Review

The following concepts as it relates technology-based banking products and services are discussed below:

Automated Teller Machines (ATM)

The Automated Teller Machine (ATM) represents the most visible form of electronic fund transfer (EFT) in retail banking technology in Nigeria. The ATM service enables bank customers to withdraw money up to a certain limit from their accounts via the ATM. Some ATMs, could be used to deposit money too by bank customers. It is fast and convenient as customers do not have to go to the bank before having access to their money. Money could be withdrawn from machines situated in hotels, parks, schools, hospitals, market and other public places. The ATM came into Nigeria in the 1990s and has assisted banks in cash dispensing, cash deposits, account enquiries, fund transfers as well as payment of utility bills e.g. recharging of cell phones as well as cable television subscriptions etc. Rose (1999) as cited in Babatunde and Salawudeen (2017), described ATM as a combination of a computer terminals, database systems and cash vaults in one unit, permitting customers to enter the bank's book keeping system with a plastic card containing a pin or by punching a special code number terminal linked to the bank's computerized record 24 hours a day. It offers a great deal of banking services to clients.

WEB (Internet) Payment System

Banks all over the world are increasingly using internet facilities in effecting payments. With a personal computer (PC) connected to the bank via the internet, the product empowers bank customers to transact banking business when, where and how they wish with little or no interaction with the bank physically. The personal computers in the customers' homes and offices enables them to access their accounts, print statement of accounts and transfer funds from one account to another, in addition to effecting various forms of payments. All these are done from the comfort of customers' homes and offices. It is important to note that the security of financial transactions may not be guaranteed just like in all electronic payment systems. However, it affords a lot of convenience to the customers and also a high level of cost efficiency.

Mobile Banking

This advancement in technology is recent in banking service and developed as a result of the introduction of the General System of Mobile (GSM) Telecommunication (Ujah, Nwaeze and Adegboye, 2015). It offers customers the freedom of banking with their mobile phones, using SMS messaging facility with optimal confidentiality and security. Mobile banking enables customers to enquire about their account balances and mini-statements, fund transfers between customer accounts, effect stop payment orders (countermands) and also effect payment of utility bills among other services. The product keeps a customer in touch with his financial affairs with the bank all the time and anywhere.

Point of Sales (P.O.S.)

Points of Sales (POS), a critical piece of a point of purchase, refers to the place where a customer executes the payment for goods and services and where sales taxes may become payable. It can be in a physical store, where POS terminals and systems are used to process card payments or a virtual sales point such as computer or mobile electronic device.

Electronic POS software systems streamline retail operations by automating the transaction process and tracking important sales data. POS system is increasingly interactive particularly, in the hospitality industry and allows customers to place orders and reservations and pay bills electronically.

Theoretical Review

The following theories as they relate to the subject of study are reviewed below:

Innovation Diffusion Theory (IDT)

According to Ratcliff, Van-Zandt and McKoon (1999), the Innovation Diffusion Theory proposed by Rogger (1983) argues that diffusion refers to the process by which an innovation is converted through certain conduits over time among the participants in a social system. The theory tries to explain that individuals aim to embrace a technology as a methodology to perform or carry out a traditional activity or action. In IDT, mechanical development is imparted through specific channels, after some time and among individuals from a social framework. The stages through which a mechanical advancement passes include: information (presentation to its presence and comprehension of its capacities), influence (the shaping of a good state of mind to it), choice (duty to its selection), execution (putting it utilized) and affirmation (support taking into account positive results from it). This theory basically is concerned with the mode in which a new technological idea,

innovative thought, technique, procedure or another use of an old one migrate from creation to utilization. Meso, Chechi, Sevcik, Loch and Strarib (2006) argued that not every innovation is adopted, even if they are good. It takes a while for an innovation to be adopted. This study is hinged on the Innovative diffusion theory.

Endogenous Growth Model

The view of the Keynesian/financial repressions which argued against government restrictions on the banking system such as interest rate ceiling, high reserve requirements, and direct credit programmes that hinder financial development and thus reduce output growth. This situation was strongly supported by Goldsmith (1969) and Schumpeter (1911) who stressed on the role of banks in promoting economic growth. They argued that the development of the banks will facilitate technological innovations as financial intermediaries and thus, help in assembling or mobilizing huge savings from the surplus units and also make funds available for the deficit sector with investment opportunities and also attract foreign capital or investments. Thus, the endogenous model supports financial intermediary development and emphasizes the impact of bank development through technological advancement on economic growth. This will promote investment and growth by ensuring that resources are put to the most productive uses.

Empirical Review

Below are some empirical reviews of works related to the topic of study:

Petkovski and Rjosevski (2014) studied an empirical analysis of the question, if banking sector development promotes economic growth using 16 countries in Central and South Eastern Europe. The study employed the Generalized Methods of Moments (GMM) dynamic panel analysis method. Empirical results showed that credit to the private sector and interest margin (IM) used as measure of bank development negatively affected economic growth, whereas RQM was positively related to economic growth.

Hassan, Mukhtar, Ullah, Shafique and Rehman (2012) in their study to demonstrate the technological improvement in payment systems using European Union Member States for the period 1995-2009, made use of retail payments data. Findings of the study revealed that technological improvements in payment systems have been found productive not only in terms of bank operating costs, but also in terms of increase in revenue. The study further revealed that migration to efficient electronic retail payment systems had a positive effect on GDP, consumption and trade and that this relationship is strongest for card payments.

In a study by Rafiu and Salamu (2007) on the benefit and influence of e-business on banking activities and satisfaction of customers, they made use of cross tabulation and chi-square method of data analysis. The result of the study revealed that there was a linear and significant relationship between high-level automation of banking services and improvement in service delivery.

Obademi and Adegboyega (2014) studied the relationship between banking development and economic growth and the direction of causality in Nigeria with emphasis on the financial repression hypothesis over the period 1970-2010. The Ordinary Least Squares (OLS) method of regression analysis and the Pairwise Granger Causality test were employed in this study. Empirical results revealed that banks have significant and positive impacts on growth in Nigeria under all the regulatory regimes the deregulatory period. However, the study concluded that although banking development showed a positive impact on growth, it cannot be said to be the propelling force for economic growth in Nigeria.

Aregbeyem (2011) examined the impact of the re-engineering of operational processes on First Bank of Nigeria PLC for the period 1986 – 2008. The study made use of paired data samples as well as both descriptive and inferential analytical methods in its data analysis. Study findings revealed that the re-engineering project significantly improved performance (profitability) of the bank for the period studied.

Ogbeide-Osaretin and Ishiuwu (2015) studied an empirical investigation into the impact of electronic banking on Nigerian economic growth for the period 2009 -2014. Economic growth (RGDP) was regressed on some measures of e-banking (Automated Teller Machine, Mobile Banking, Web banking and Point of Sale Terminal) for the period using quarterly data. The Pairwise Granger Causality test was also adopted to determine the direction of causality. The results of the study showed that e-banking had significant impact on economic growth. While the Automated Teller Machine (ATM) and Mobile Banking (MB) had positive impact on economic growth, Point of Sales (POS) and Mobile Banking (MB) showed negative impacts on economic growth for the period studied. The result further showed that there is a long-run relationship between e-banking and economic growth and that e-banking Granger causes economic growth in Nigeria.

Omodele and Onyeiwu (2019) critically examined the impact of electronic banking service on customer satisfaction and specifically probed into the various dimensions of electronic banking service quality. A descriptive survey research design was adopted in the study. The sample size was 93 respondents while the main research instrument was the questionnaire. Data collected were analyzed using descriptive statistics, followed by Pearson Correlation and Regression analysis to test the hypotheses. Findings of the study revealed

that there was a significant relationship between customer satisfaction and the various electronic banking service quality dimensions. Electronic banking had significant impact on customer satisfaction.

Oginni, El-Maude, Mohammed and Michael (2013) studied electronic payment system and economic growth: a review of transition to cashless economy in Nigeria for the period 2005-2012. Data was analyzed using Ordinary Least Squares (OLS) and TSLS methods for the period under study. The result indicated a significant and positive relationship between e-payment system and economic growth in terms of real GDP per capita and trade per capita. Only ATM was found to positively contribute to economic growth while other e-payment channels contributed negatively. Thus, the study recommended that the current cashless policy should be tailored towards effective e-payment system and other factors which bear much relevance on successful transition to cashless economy should be prioritized.

Babatunde and Salawudeen (2017) examined the impact of electronic banking in Nigerian banking industry and financial institutions, using both the primary and secondary data to elicit information from forty respondents. The primary data were obtained through the use of questionnaires while secondary data were obtained from the publications of the Central Bank of Nigeria (CBN) Electronic Banking Guidelines, Annual reports of the Central Bank of Nigeria and Access Bank PLC. The paper employed both descriptive and inferential statistics to analyse the data. In addition, simple frequency counts, percentages and the chi-square were used in the data analysis. Findings showed that 62% of the respondents agree with the opinion that electronic banking system has made banking transactions easier, 32.3% of them strongly agreed while 5.7% were undecided. Thus, the paper concluded that the adoption of electronic banking has enhanced the bank's efficiency, making it more productive and effective.

III. Methodology

Research Design

The *ex-post facto* design was adopted in this study in the area of obtaining, analyzing and interpretation of data used in this work. According to Amaechi and Amara (2015), the *ex-post facto* design is normally used to foist a link between the dependent and independent variables, while relying on already existing data (secondary). This type of research design is appropriate and preferred in a cause-effect relationship where data already exists which could not be easily manipulated by the research at the point of the research work. Osuala (2010) posited that the beauty of using the *ex-post facto* design is that the researcher relies on already existing data, devoid of the manipulation of the researcher.

Nature and Source of Data

The data used in this study is mainly secondary (time series). The source of the data is the Central Bank of Nigeria (CBN) 2018 Statistical Bulletin. Using data over the period 2009 – 2018 and in line with the model adopted in the study, real gross domestic product proxy for economic growth was regressed on a variety of technology-based banking products and services such as Automated Teller Machine, Mobile Banking, Web Banking and Point of Sales.

Method of Data Analysis

In order to avoid the issue of spurious result from the use of non-stationary data set, the study made use of pre-testing method involving the Augmented Dickey-Fuller unit root test, which tested the stationarity of the variables. The result revealed a mixed order of integration, hence the adoption of the Auto-Regressive Distributed Lag (ARDL) bounds test to test the long-run relationship (co-integration) among the variables and also the empirical analysis of the data.

Model Specification

Ogbeide-Osaretin and Ishiwu (2015) specified a model which captured an empirical investigation into the impact of electronic banking on Nigerian economic growth.

$$\text{Growth} = \alpha_0 + \beta_1 (\text{E-banking}) + \epsilon_i \dots \dots \dots \text{eqn 1}$$

$$\text{RGDP} = f(\text{WB, MB, POS, ATM}) \dots \dots \dots \text{eqn 2}$$

Where:

RGDP = Real Gross Domestic Product

WB = Value of Web Banking

MB = Value of Mobile Banking

POS = Value of Point of Sales Terminal

ATM = Value of Automated Teller Machine

This model was adopted to suit the objectives of this present study. Thus, we have:

$$\text{RGDP} = f(\text{ATM, POS, WB, MB}) \dots \dots \dots \text{eqn 3}$$

Where:

ATM = Automated Teller Machine Technology-based Payment System.

POS = Point of Sales Technology-based Payment System

WB = Web Banking Technology-based Payment System

MB = Mobile Banking Technology-based Payment System

When transformed to its econometric model, it becomes:

$$RGDP = \beta_0 + \beta_1 ATM + \beta_2 POS + \beta_3 WB + \beta_4 MB + \mu \dots \dots \dots \text{eqn 4}$$

Where:

β_0 = Constant (Intercept) term

$\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficient parameters of the explanatory variables

μ = Scholastic or error term

To bring the variables to the same base, the equation is transformed as below:

$$\text{LnRGDP} = \beta_0 + \beta_1 \text{LnATM} + \beta_2 \text{LnPOS} + \beta_3 \text{LnWB} + \beta_4 \text{LnMB} + \mu \dots \dots \text{Eqn 5}$$

By a priori expectation, $\beta_0 > 0$, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$.

Research Variables

Both the dependent and independent variables were made use of in this work. The dependent variable in this study is real gross domestic product. It depicts the value of all outputs produced in a country valued at the cost of the factor services that went into production. The major explanatory variables in this study include: automated teller machine, point of sales, web banking and mobile banking technology-based banking products/services.

IV. Data Presentation, Results and Discussion

Data Presentation

The data below is used in the analysis of this study.

Table 4.1: Nominal Data on RGDP, ATM, POS, WEB and Mobile Payment Systems (2009 – 2018) (₦'billion)

YEAR	RGDP	ATM	POS	WEB	MOBILE
2009Q1	12,464.03	137.72	3.51	4.38	0.06
2009Q2	12,464.03	145.57	2.75	5.19	0.11
2009Q3	12,464.03	126.12	2.48	52.27	0.52
2009Q4	12,464.03	139.19	2.29	22.31	0.58
2010Q1	12,583.48	62.59	2.77	3.37	0.87
2010Q2	12,934.53	80.72	2.67	4.26	1.37
2010Q3	14,304.44	114.90	2.80	9.94	1.84
2010Q4	14,789.82	141.50	4.48	7.48	2.57
2011Q1	13,450.72	333.51	6.28	24.13	3.32
2011Q2	13,757.73	364.67	6.45	22.01	3.72
2011Q3	14,819.62	387.48	8.64	6.36	5.01
2011Q4	15,482.97	476.08	9.65	7.11	6.93
2012Q1	13,915.51	454.79	1.87	6.38	1.08
2012Q2	14,323.05	483.25	8.74	6.93	4.93
2012Q3	15,645.43	499.71	14.75	7.53	7.26
2012Q4	16,045.90	546.91	22.66	10.72	18.24
2013Q1	14,535.42	611.26	26.28	11.37	22.88
2013Q2	15,096.76	675.09	30.94	9.36	28.92
2013Q3	16,454.37	729.23	43.15	12.30	33.92
2013Q4	17,132.16	813.36	60.64	14.29	57.08
2014Q1	15,438.68	784.05	67.47	16.60	66.36
2014Q2	16,084.62	852.36	70.25	14.13	74.16
2014Q3	17,479.13	1,027.92	78.00	18.94	86.48

2014Q4	18,150.36	1,015.55	96.35	24.37	119.47
2015Q1	16,050.60	937.96	96.31	22.76	91.22
2015Q2	16,463.34	962.43	104.57	17.05	100.44
2015Q3	17,976.23	1,011.48	112.42	22.39	109.31
2015Q4	18,533.75	1,058.38	135.20	29.38	141.00
2016Q1	15,943.71	1,069.99	144.76	31.69	135.24
2016Q2	16,218.54	1,134.50	163.71	26.28	168.28
2016Q3	17,555.44	1,246.80	189.95	30.76	223.06
2016Q4	18,213.54	1,536.85	260.58	43.63	230.31
2017Q1	15,797.97	1,502.06	285.98	46.57	260.59
2017Q2	16,334.72	1,544.23	324.13	37.09	295.24
2017Q3	17,760.23	1,558.76	364.55	45.58	239.36
2017Q4	18,598.07	1,832.55	435.15	55.35	306.82
2018Q1	16,106.73	1,568.95	474.73	60.74	329.12
2018Q2	16,580.51	1,603.17	543.63	53.26	410.57
2018Q3	18,081.34	1,591.01	650.41	69.07	498.08
2018Q4	19,041.44	1,716.96	714.35	221.53	592.94

Source: CBN Statistical Bulletin (2018)

Table 4.2: Unit Root Test Result

Variable	ADF t-statistic		0.05 critical value		Order of Integration
	Level	1 st Difference	Level	1 st Difference	
LOGRGDP	-1.049595	-4.410054	-3.552973	-3.544284	I(1)
LOGATM	-1.719560	-5.943685	-3.529758	-3.533083	I(1)
LOGPOS	-4.005003	-	-3.529758	-	I(0)
LOGWEB	-3.692948	-	-3.529758	-	I(0)
LOGMOBILE	-3.378165	-8.159938	-3.529758	-3.533083	I(1)

Source: Author's computation (2021) from E-views 9.0 software package

From the unit root test results in table 4.2 above, it is evident that POS and WEB were stationary as their ADF values -4.005003 and -3.692948 were greater than the critical values -3.529758 in absolute terms. Therefore, POS and WEB are said to be integrated of order zero (i.e. I(0)). On the other hand, RGDP, ATM and MOBILE were not stationary at level given that their ADF values were less than the 5 percent critical values. ADF values for RGDP, ATM and MOBILE -1.049595, -1.719560 and -3.378165 (in absolute terms) were less than the critical values -3.552973, -3.529758 and -3.529758, respectively. Based on this there was a need to difference them one more time to see whether they would become stationary. At first difference, RGDP, ATM and MOBILE became stationary as their ADF values (in absolute terms) became greater than the critical values. Thus, RGDP, ATM and MOBILE were said to be integrated of order 1 (i.e. I(1)). Evidently, there are combinations of I(0) and I(1). Thus, the researcher employed cointegration technique using autoregressive distributed lag model (ARDL) as analytical technique.

Table 4.3: Bounds Test Result

Test Statistic	Value	K
F-statistic	9.141454	4
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author's computation (2021) from E-views 9.0 software package

The researcher carried out the bound testing aimed at determining whether the ARDL model contains a level (or long run) relationship among the variables. From the result in table 4.3 above, it is evident that the F-statistic (9.141454) exceeded the upper bounds at 10%, 5%, 2.5% and 1%. Thus, the null hypothesis of no long

run relationship is rejected and the alternative hypothesis that there exists long run equilibrium relationship among the variables is accepted. The researcher concluded that a long run relationship existed among the variables in the study.

Table 4.4: ARDL Long run Estimates

Dependent Variable: LOGRGDP

Variable	Coefficient	Std. Error	t-statistic	Prob.
LOGATM	0.067469	0.029258	2.306010	0.0358*
LOGPOS	0.025424	0.031869	0.797742	0.4375
LOGWEB	-0.076760	0.021884	-2.585489	0.0032*
LOGMOBILE	0.054570	0.021106	2.585489	0.0207*
C	4.381385	0.083892	52.226375	0.0000

Source: Author's computation (2021) from E-views 9.0 software package

*indicates significance at 5 percent level

The result showed that in the long run, automated teller machine (ATM) had a positive relationship with economic growth in Nigeria. 1 percent increase in ATM usage increased real gross domestic product in Nigeria by 0.07 percent. The probability value of ATM (0.0358) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that ATM had significant effect on economic growth in Nigeria in the long run.

The result showed that Point of Sale (POS) had a positive relationship with economic growth in Nigeria in the long run. 1 percent increase in POS usage increased real gross domestic product in Nigeria by 0.03 percent. However, the probability value of POS (0.4375) was greater than the test significant level (i.e. $p > 0.05$). Thus, the study concluded that POS had insignificant effect on economic growth in Nigeria in the long run.

The result showed that web (WEB) transaction had a negative relationship with economic growth in the long run. 1 percent increase in WEB usage decreased real gross domestic product in Nigeria by 0.08 percent. The probability value of WEB (0.0032) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that WEB had significant effect on economic growth in Nigeria in the long run.

Finally, the result showed that mobile transactions (MOBILE) had a positive relationship with economic growth in Nigeria. 1 percent increase in MOBILE usage increased real gross domestic product in Nigeria by 0.05 percent. The probability value of MOBILE (0.0207) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that MOBILE had significant effect on economic growth in Nigeria in the long run.

Table 4.5: ARDL Short Run Estimates

Dependent Variable: D(LOGRGDP)

Variable	Coefficient	Std. Error	t-statistic	Prob.
D(LOGATM)	0.079220	0.027291	2.902843	0.0109*
D(LOGPOS(-3))	0.061156	0.022758	2.687174	0.0169*
D(LOGWEB(-1))	0.029616	0.013785	2.14397	0.0484*
D(LOGMOBILE(-3))	-0.070433	0.021010	-3.352310	0.0044*
CointEq(-1)	-0.974168	0.237269	-4.105756	0.0002*

Source: Author's computation (2021) using E-views 9.0 software package

The result showed that automated teller machine (ATM) had a positive relationship with economic growth in Nigeria in the short run. 1 percent increase in ATM usage increased real gross domestic product in Nigeria by 0.08 percent. The probability value of ATM (0.0109) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that ATM had significant effect on economic growth in Nigeria in the short run.

The result showed that Point of Sale (POS) had a positive relationship with economic growth in Nigeria in the short run. 1 percent increase in lagged three-year POS usage increased real gross domestic product in Nigeria by 0.06 percent. The probability value of POS (0.0169) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that POS had significant effect on economic growth in Nigeria in the short run.

The result showed that web (WEB) transaction had a positive relationship with economic growth in the short run. 1 percent increase in lagged one-year WEB usage increased real gross domestic product in Nigeria by 0.03 percent. The probability value of WEB (0.0484) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that WEB had significant effect on economic growth in Nigeria in the short run.

Finally, the result showed that mobile transactions (MOBILE) had a negative relationship with economic growth in Nigeria in the short run. 1 percent increase in MOBILE usage decreased real gross domestic product in Nigeria by 0.07 percent. The probability value of MOBILE (0.0044) was less than the test significant level (i.e. $p < 0.05$). Thus, the study concluded that MOBILE had significant effect on economic growth in Nigeria in the short run.

The result showed that technology-based payment indicators converged to long run cointegrating equilibrium at a high speed of 97 percent. The implication of this is that any disequilibrium in ATM, POS, web and mobile phone technology-based instruments would converge to long run cointegrating equilibrium position at a reasonable fast rate.

Discussion of Findings

The study showed that ATM had positive and significant effect on economic growth in Nigeria in the short run and long run. This relationship is in line with economic expectation because the adoption of ATM increased the speed at which transactions are executed thereby increasing the spate of business activities as well as enhancing economic growth. This finding corroborates Babatunde and Salawudeen (2017) which argued that ATM had increased customers' satisfaction in Nigeria. Perhaps, this result is attributed to the huge acceptability of ATM platform by Nigerians which has reduced the overcrowding of banking halls as obtained before. With less people having the need to enter the banking halls, it has made other banking services such as clearing of cheques much easier and less cumbersome thereby increasing the satisfaction of banks' customers in Nigeria. With increased customers' satisfaction comes increased productivity thereby increasing economic growth in Nigeria.

The study showed that POS had positive and significant relationship with economic growth in Nigeria in the short run but a positive and insignificant relationship with economic growth in Nigeria in the long run. This finding is not consistent with Oginni, El-Maudem, Mohammed and Michael (2013) which argued that POS has a negative relationship with economic growth in Nigeria. Perhaps, this finding might be attributed to wide acceptability of POS terminals as alternative payment methods. With such acceptability, the ease of doing business increases thereby increasing economic growth in Nigeria in the short run. In the long run, the insignificant effect of POS on economic growth might be attributed to the excessive charges imposed on bank customers in the course of using POS for transactions. This excessive charge waters-down the influence POS would have had on economic activities and overall economic growth in Nigeria.

The study revealed that there was a negative and significant relationship between internet payment system and economic growth (proxied by gross domestic product) in Nigeria in the long run. This relationship is not in conformity with economic expectation because as more persons adopt the use of internet banking, the faster the time it takes to complete financial transactions and ultimately the higher the level of economic growth. In the short run, the study revealed that internet payment system had positive and significant effect on economic growth in Nigeria. Perhaps, the negative relationship between internet banking and economic growth in the long run as evidenced in this study might be attributed to the fraudulent practices associated with web transactions which have over the years made Nigerians very wary of accepting internet banking channel as a credible technology-based payment method. Such development has led many foreigners to become apprehensive to deal with Nigerians and this has reduced the level of businesses in Nigeria thereby adversely affecting Nigeria's economic growth.

Finally, the study revealed that there was a positive and significant relationship between mobile phone payment system and economic growth (proxied by gross domestic product) in Nigeria in the long run. This relationship is in conformity with economic expectation because as more persons adopt the use of mobile phone banking, the faster the time it takes to complete financial transactions thereby leading to increase in economic growth. In the short run, the study revealed that mobile phone payment system had negative and significant effect on economic growth in Nigeria. Perhaps, the negative relationship between mobile phone banking and economic growth in the long run as evidenced in this study might also be attributed to the fraudulent practices associated with mobile phone transactions which has brought fear to many bank customers with most of them resorting to queue in the banking halls rather than using mobile phone technology-based banking system. This adversely affects business activities thereby reducing economic growth in Nigeria.

Summary of Findings

Major findings of the study are summarized below:

1. ATM technology-based payment system had positive and significant effect on economic growth in Nigeria in both the short run and long run.
2. POS technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run but had a positive and insignificant effect on economic growth in Nigeria in the long run.
3. Web technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run while it exhibited a negative and significant effect on economic growth in Nigeria in the long run.

4. Mobile banking technology-based payment system had negative and significant effect on economic growth in the short run while it exhibited a positive and significant effect on economic growth in Nigeria in the long run.

Conclusion

The study examined the effect of technology-based payment system on economic growth in Nigerian. In order to achieve this broad objective, the study specifically adopted Automated Teller Machine (ATM), Point of Sale (POS), web banking and mobile phone payment systems as proxies for technology-based payment system and these served as the independent variables while real gross domestic product was adopted as proxy for economic growth and dependent variable. Cointegration technique using Autoregressive Distributed Lag (ARDL) model was employed to analyze the quarterly data sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin. From empirical findings, it was revealed that ATM had positive and significant effect on economic growth in Nigeria in both the short run and long run periods. Point of Sale (POS) technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run but had a positive and insignificant effect on economic growth in Nigeria in the long run. Web technology-based payment system had positive and significant effect on economic growth in Nigeria in the short run while it exhibited a negative and significant effect on economic growth in Nigeria in the long run. Mobile phone technology-based payment system had negative and significant effect on economic growth in the short run while it exhibited a positive and significant effect on economic growth in Nigeria in the long run. In conclusion, the study argued that technology-based payment system in Nigeria had significant effect on Nigeria's economic growth.

Recommendations

The following recommendations are made in the study:

1. Commercial banks in Nigeria and government should further educate the populace on how to make use of the ATM and POS since their usage had positive effect on Nigeria's economy. This could be through seminars and workshops as well as through the mass media.
2. Central Bank of Nigeria (CBN) should closely work with the commercial banks to monitor and track web and mobile phone technology-based payment systems so as to forestall fraudulent financial transactions involving web and mobile phone transactions. This would restore confidence of Nigerians and non-Nigerians in making transactions using the internet and mobile phones thereby increasing the growth of Nigerian economy.
3. Bank infrastructures such as constant power needs be provided as well as effective information communication technologies to drive the technology-based banking products of banks.

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APPENDIX

YEAR	RGDP	ATM	POS	WEB	MOBILE	LOGRGDP	LOGATM	LOGPOS	LOGWEB	LOGMOBILE
2009Q1	12,464.03	137.72	3.51	4.38	0.06	4.095658	2.138997	0.545307	0.641474	-1.2218487
2009Q2	12,464.03	145.57	2.75	5.19	0.11	4.095658	2.163072	0.439333	0.715167	-0.9586073
2009Q3	12,464.03	126.12	2.48	52.27	0.52	4.095658	2.100784	0.394452	1.718253	-0.2839967
2009Q4	12,464.03	139.19	2.29	22.31	0.58	4.095658	2.143608	0.359835	1.3485	-0.236572
2010Q1	12,583.48	62.59	2.77	3.37	0.87	4.099801	1.796505	0.44248	0.52763	-0.0604807
2010Q2	12,934.53	80.72	2.67	4.26	1.37	4.111751	1.906981	0.426511	0.62941	0.13672057
2010Q3	14,304.44	114.90	2.80	9.94	1.84	4.155471	2.06032	0.447158	0.997386	0.26481782
2010Q4	14,789.82	141.50	4.48	7.48	2.57	4.169963	2.150756	0.651278	0.873902	0.40993312
2011Q1	13,450.72	333.51	6.28	24.13	3.32	4.128745	2.523109	0.79796	1.382557	0.52113808
2011Q2	13,757.73	364.67	6.45	22.01	3.72	4.138547	2.5619	0.80956	1.34262	0.57054294
2011Q3	14,819.62	387.48	8.64	6.36	5.01	4.170837	2.588249	0.936514	0.803457	0.69983773
2011Q4	15,482.97	476.08	9.65	7.11	6.93	4.189854	2.67768	0.984527	0.85187	0.84073323
2012Q1	13,915.51	454.79	1.87	6.38	1.08	4.143499	2.65781	0.270764	0.804867	0.03404486
2012Q2	14,323.05	483.25	8.74	6.93	4.93	4.156035	2.684168	0.941418	0.840928	0.69255514
2012Q3	15,645.43	499.71	14.75	7.53	7.26	4.194388	2.69872	1.168771	0.87706	0.8609563
2012Q4	16,045.90	546.91	22.66	10.72	18.24	4.205364	2.737917	1.355175	1.030153	1.2610432
2013Q1	14,535.42	611.26	26.28	11.37	22.88	4.162428	2.786225	1.419707	1.05571	1.35942894
2013Q2	15,096.76	675.09	30.94	9.36	28.92	4.178884	2.82936	1.490541	0.971234	1.46113294
2013Q3	16,454.37	729.23	43.15	12.30	33.92	4.216281	2.862864	1.634939	1.089977	1.53051103
2013Q4	17,132.16	813.36	60.64	14.29	57.08	4.233812	2.910284	1.782788	1.154927	1.7564734
2014Q1	15,438.68	784.05	67.47	16.60	66.36	4.18861	2.894346	1.829097	1.220239	1.82190586
2014Q2	16,084.62	852.36	70.25	14.13	74.16	4.206411	2.930621	1.846659	1.15024	1.87015249
2014Q3	17,479.13	1,027.92	78.00	18.94	86.48	4.24252	3.011961	1.892103	1.277286	1.93690035
2014Q4	18,150.36	1,015.55	96.35	24.37	119.47	4.258885	3.006699	1.983854	1.386848	2.07727108
2015Q1	16,050.60	937.96	96.31	22.76	91.22	4.205491	2.972184	1.983671	1.357172	1.96009007
2015Q2	16,463.34	962.43	104.57	17.05	100.44	4.216518	2.983369	2.019407	1.231724	2.0019067
2015Q3	17,976.23	1,011.48	112.42	22.39	109.31	4.254699	3.004957	2.050844	1.350054	2.03865989
2015Q4	18,533.75	1,058.38	135.20	29.38	141.00	4.267963	3.024642	2.130977	1.468052	2.14921911
2016Q1	15,943.71	1,069.99	144.76	31.69	135.24	4.20259	3.02938	2.160649	1.500952	2.13111221
2016Q2	16,218.54	1,134.50	163.71	26.28	168.28	4.210012	3.054803	2.214081	1.419558	2.22604449
2016Q3	17,555.44	1,246.80	189.95	30.76	223.06	4.244412	3.095796	2.278632	1.488037	2.34841671
2016Q4	18,213.54	1,536.85	260.58	43.63	230.31	4.260394	3.186631	2.415936	1.639771	2.36231884
2017Q1	15,797.97	1,502.06	285.98	46.57	260.59	4.198601	3.176686	2.456332	1.668144	2.41595669
2017Q2	16,334.72	1,544.23	324.13	37.09	295.24	4.213112	3.188712	2.510721	1.56929	2.4701695
2017Q3	17,760.23	1,558.76	364.55	45.58	239.36	4.249449	3.192778	2.561757	1.658752	2.3790444
2017Q4	18,598.07	1,832.55	435.15	55.35	306.82	4.269468	3.263056	2.638643	1.743135	2.48688003
2018Q1	16,106.73	1,568.95	474.73	60.74	329.12	4.207008	3.195609	2.676448	1.783492	2.51734868
2018Q2	16,580.51	1,603.17	543.63	53.26	410.57	4.219598	3.204979	2.7353	1.726365	2.61338292
2018Q3	18,081.34	1,591.01	650.41	69.07	498.08	4.257231	3.201674	2.813185	1.839299	2.6973006
2018Q4	19,041.44	1,716.96	714.35	221.53	592.94	4.2797	3.234759	2.853908	2.345436	2.77300906