



EMERGING FINANCIAL TECHNOLOGICAL INNOVATION AND ECONOMIC GROWTH IN NIGERIA

Dr. Okoye Victor¹

¹Chief Lecturer, Department of Banking and Finance, School of Financial Studies, Federal Polytechnic Oko, Anambra State, Nigeria

Nwisienyi, Kenechukwu J.²

²Lecturer II, Department of Banking and Finance, School of Financial Studies, Federal Polytechnic Oko, Anambra State, Nigeria

Obi, Onyeka A³

³Lecturer II, Department of Banking and Finance, School of Financial Studies, Federal Polytechnic Oko, Anambra State, Nigeria

ABSTRACT

The financial technological innovations has taken a dynamic prevalence in the Nigerian financial sector. The sector has been established to be the most ICT driven sector in the country. Little or no study has been identified to have linked or established the relationship between financial innovation and economic growth in Nigeria. This study seeks to add to knowledge by estimating the relationship between financial technological innovations and Nigerian economic growth using quarterly time series data for the period 2009 - 2019. The study used the Autoregressive Distributed Lag (ARDL) approach to identify the long-run and short-run dynamics between selected variables. The estimation of both the long-run and short-run models is based on the ARDL error correction methodology. The results show that mobile phone transfers are positively related to economic growth in the long-run and at lag 0 in the short run. The sum of ATM and POS transfers are negatively related to economic growth in the long-run but positive at lag 1 in the short-run. In other words, the study established positive relationship (though not strong) between economic growth and some aspects of financial technological innovation. The study recommends, amongst others, that policies aimed at promoting and enhancing the availability and penetration of financial technological innovations should be implemented and made effective as this will also boost financial inclusion. Further research is also called on considering the paucity of data for this study.

KEYWORDS: *Financial Innovation, Economic growth, Technological Innovation, Long-run relationship, Short-run relationship, Creative Destruction.*

INTRODUCTION

The Nigerian financial sector is, no doubt, the most technologically driven sector in the country. Over the years, the sector has witnessed tremendous changes owing to ever dynamic financial technological innovations. Generally, Nigerian banks are adopting new solutions to improve and simplify operations which foster a move away from physical channels and towards digital/mobile delivery (PWC Nigeria, 2017). According to Onuoha, Peregrino and Isiavwe (2019), these financial technological innovations can boost aggregate expenditure and by extension improve GDP levels. This it does by providing access to a diverse range of financial product and services for individuals and businesses. The use of e-banking channels has led to improvements in financial inclusion (Onuoha, Peregrino & Isiavwe, 2019).

Motsatsi (2016), stated that financial technology promotes efficiency and productivity within the banking sector. It also encourages competition among financial institutions in terms of providing financial services to the public such as capital for investment, and offer low lending rates in order to prop-up household consumption and investment, which as a result influence increased growth of the economy.

Following Manyika, Lund, Singer, White and Berry (2016) digital financial services can add 1.6 billion unbanked people to the formal economy. As a result, this would create 95 million jobs and increase the GDP of developing countries by \$3.7 trillion.

Financial technological innovations has been established to improve banks performance and service delivery in the financial sector. Empirical and theoretical studies like Paripunyapat and Kraiwanit (2018) and Kiilu (2018) gives credence to the aforementioned. Azizah and Choirin (2018) and Motsatsi (2016) established a relationship between financial innovations and economic growth in their respective countries. Financial innovation has transformed and restructured banking services globally, and its impact on economies is becoming increasingly noteworthy (Bara and Mudzingiri, 2016).

Research studies on financial technological innovation in developing countries has mainly been on a micro level with particular reference to its impact on financial inclusion. Interestingly, there has not been any research study relating financial innovation to Nigerian economic growth. The thrust of this study is to bridge this knowledge gap by estimating the relationship

between financial technological innovation and economic growth in Nigeria.

THEORETICAL FRAMEWORK

Financial technology would ultimately mean technological innovation that seeks to improve and automate the delivery and use of financial services. According to Motsatsi (2016), financial technological innovation has a positive impact on financial development which is used to improve the performance of the financial sector and subsequently the growth of the whole economy.

Generally speaking, the level of technology is an important determinant of economic growth (Economic Discussion, n.d). Following Schumpeter (1934), it is observed that innovation or technological progress is the only determinant of economic progress and so, once the technology becomes constant, the process of growth stops.

With the emergence of new technology-driven applications and processes, new digital applications that facilitate easier payments, alternative processing networks and increased use of electronic devices to transfer money, the banking and payment sub-sectors has experienced a high level of disruption (PWC Nigeria, 2017). This gives credence to Schumpeter's creative destruction theory of 1942. The creative destruction or what is known as the disruptive force applies to the fact that the introduction of new products displaces the old ones. It results in the obsolescence or failure of these old products. Research has shown that a shift from cash payments/traditional methods of banking to digital payments/financial technology will enhance financial inclusion, improve efficiency (increasing speed of payments and reducing cost), increase transparency and security of payments and have a long-term positive effect on bank performance (Demirguc-kunt, Klapper & Singer, 2017; Scott, Reenen & Zachariadis, 2017).

FINANCIAL TECHNOLOGY IN NIGERIAN BANKS

The Nigerian banks have, over the years, evolved into a whole new and revolutionized sector, courtesy of technological innovations. The use of technological innovations in the financial industry came into play as a result of the intense competition witnessed in the industry due to globalization (Emmanuel and Adebayo, 2011). We can safely say that these innovations heralded the "New Generation Banks". Today's business environment is very dynamic and undergoes rapid changes due to technological innovation, increased awareness and increased demands from customers. The banking industry of the twentieth century operates in a complex

and competitive environment characterized by these changing conditions and a highly volatile economic climate, and these technological innovations (ICT) are at the centre of this global change curve (Agboola, 2006). So in order to survive, banks and indeed other financial institutions have integrated these technologies into their operational processes.

The financial system in Nigeria has made huge investments in these technologies and has pioneered the use of a number of innovative ICT-driven business solutions (CBN, 2007). According to CBN (2007), these technological resources, have among other things, enhanced operations and productivity, developed products and services and achieved competitive advantage for the financial institutions.

Of recent, the financial institutions in Nigeria can boast of countless technological applications integrated in their operations. Agboola (2001) looks at it in 3 different dimensions; Automated Clearing Services, Automated Payment Systems and the Automated Delivery Channels.

- **Automated Clearing System (ACS):**

This is the clearing system of the entire financial industry for both electronic instruments (ACH) and derivatives/images paper-based instruments (cheques). Before now, the clearing system was manually operated and instruments took several days to clear. However, with the automation of the clearing system, this whole process takes less than 48hrs in its entirety. Sub services that are available under the ACS are;

- i. Automated Bulk Clearing Service
- ii. Central Mandate Management System
- iii. E-Dividend Payment
- iv. Automated Clearing House
- v. Fund sweeping Service
- vi. Nigeria Inter-Bank Settlement System (NIBSS) Intra-Day Exposure System
- vii. Settlement Services

- **Automated Payment Systems:**

This is a payment system where transfer of funds between parties is executed via electronic devices and/or networks. Payments/transfers are made using electronic platforms without any paper money changing hands or intervention from any bank staff. This can alternatively be called electronic funds transfer (EFT). It covers both credit transfers (salary or payroll payments) and debit transfers (rents, utility bill payments) which could be intra-bank or inter-bank transfers or transfers involving multiple

financial institutions (in most cases). What this means is that one can make transfers/payments (debit or credit) anytime, anywhere, anyhow without necessarily visiting any bank. Electronic devices or terminals used in initiating transfers are;

- i. Internet Banking
- ii. Automated Teller Machine (ATM)
- iii. Point-of-Sales Service (POS)
- iv. Debit/Credit Cards
- v. Unstructured Supplementary Service Data (USSD) Mobile Banking
- vi. Society for Worldwide Interbank Financial Telecommunications (SWIFT) Code/Network
- vii. Instant Payment
- viii. Phone Banking
- ix. Real-Time Gross Settlement (RTGS)
- x. National Electronic Funds Transfer (NEFT)

- **Automated Delivery Channels:**

Also known as Alternative Delivery Channels (ADC) or Alternative Banking Channels (ABC), they are those channels that expand the reach of banking/financial services beyond the traditional bank branch/banking hall. They are the channels or methods for providing banking services directly to the customers other than the conventional bank branch. These channels would include;

- i. The Internet or Web (for Online/Internet Banking and Email Banking)
- ii. Automated Teller Machines (ATM)
- iii. Point-of-Sales Service (POS)
- iv. Telephone (for Call Centers and Digital Interactive Voice Response (DIVR))
- v. Smartphones (for Mobile Banking)

EMPIRICAL REVIEW

Dauda and Akingbadu (2011) used the Pearson Correlation Co-efficient to examine customers' and employee's responses to technology innovation, and their effects on the performance of the Nigerian banks. The study revealed that technological innovation influenced banks employee's performance, customer's satisfaction and improvement in banks profitability.

Motsatsi (2016), in employing a quarterly time-series data for period 2006 – 2014, used the Autoregressive Distributed Lag (ARDL) model to estimate the role of financial sector development on economic growth.

Using the Autoregressive Distributed Lag (ARDL) model, Bara and Mudzingiri, (2016) finds that financial innovation has a relationship to

economic growth that varies depending on the variable used to measure financial innovation. A long-run, growth-driven financial innovation is confirmed, with causality running from economic growth to financial innovation.

Hasan, Renzi and Schmiedel (2013) estimated the relationship between retail payment (technological innovation) and the real economy using Generalized Methods of Moments (GMM) covering the period between 1995 and 2009 for 27 EU countries. The study concluded that there is a positive relationship economic growth and technological innovation.

Carbo, Paso and Rodriguez (2007) estimated the impacts of financial innovation on economic growth covering the period between 1986 and 2001 in 17 different regions in Spain using the Generalized Methods of Moments (GMM). They used three different measures of economic development (GDP, Gross Fixed Capital Formation and Gross Savings) which were estimated simultaneously with respect to business innovation (mutual funds and loan commitments) and technological innovation (ATMs, debit and credit cards) as a measure of technological innovation. Their results showed that financial

innovation has a positive influence on economic growth.

DATA AND METHODOLOGY

Data

The study employed a quarterly time series data spanning from 2009Q1 – 2019Q1 to estimate the relationship between financial technological innovations and economic growth in Nigeria. The study used GDP (2010 constant basic prices) as a measure of economic growth, financial technological innovation variables (the sum of ATM and POS transfer transactions, internet/web pay transactions and mobile phone transfer transactions) and inflation rate as one of the determinants of economic growth. The choice of these variables were informed from Motsatsi (2016) and Mwinzi (2013). All the data used were secondary data and were sourced from the 2019 Quarterly Statistical Bulletin of the Central Bank of Nigeria.

Methodology

In estimating the relationship between financial technological innovations and economic growth in Nigeria, considerations were made with respect to the properties of time series. The model used for the study is specified in log form as;

$$lngdp = \beta_0 + \beta_1 lnap + \beta_2 lnmt + \beta_3 lnit + \beta_4 lnir + \varepsilon_t \tag{1}$$

- Where gdp = GDP @ 2010 constant basic prices
- ap = Sum of ATM and POS transactions
- mt = Mobile phone transfer transactions
- it = Internet transfer transactions
- ir = Inflation rate
- ln = Log
- β_0 = Additional factor affecting lngdp
- $\beta_1 - \beta_4$ = Coefficients of ap, mt, it, and ir
- ε_t = Error term

As is conventional, a unit root test is first to be performed in an econometric analysis (Shrestha and Bhatta, 2018). It is imperative to conduct this test in order to prevent spurious regression results. This test is to determine the stationarity or order of integration of the variables. For this purpose, the Augmented Dicker-

Fuller test will be used to determine whether the variables are integrated of order I(0) or I(1) or both.

The Autoregressive Distributed Lag (ARDL) model approach to co-integration is used to investigate the existence of co-integration relationships among variables. As proposed by Pesaran, Shin and Smith (2001), it is an appropriate method for variables with mixed order of integration; I(0) and I(1). This test approach is preferred based on the fact that both the long run and short run parameters of the model specified can be estimated simultaneously. This study will adopt the ARDL approach to estimate the long run and short run parameters of equation (1) and thus the model specification for this approach is as follows;

$$\begin{aligned} \Delta lngdp_t = & \beta_0 \sum_{t=1}^q \beta_{1t} \Delta lngdp_{t-1} + \sum_{t=1}^q \beta_{2t} \Delta lnap_{t-1} + \sum_{t=1}^q \beta_{3t} \Delta lnmt_{t-1} + \sum_{t=1}^q \beta_{4t} \Delta lnit_{t-1} \\ & + \sum_{t=1}^q \beta_{5t} \Delta lnir_{t-1} + \beta_6 lngdp_{t-1} + \beta_7 lnap_{t-1} + \beta_8 lnmt_{t-1} + \beta_9 lnit_{t-1} \\ & + \beta_{10} lnir_{t-1} + \varepsilon_t \end{aligned} \tag{2}$$

Where Δ = first difference operator, q = optimal lag length and ϵ_t = error term. The left hand side in equation (2) represents GDP while in the right hand side, $\beta_1 - \beta_5$ expressions with summation sign represent the short run dynamics and the $\beta_6 - \beta_{10}$ expressions represent the long run relationship of the model.

The ARDL Bound test for co-integration is based on the Wald-test (F-statistic). Two critical values are given

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0 \quad (\text{there is no co-integration}) \quad (3)$$

$$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0 \quad (\text{there is cointegration}) \quad (4)$$

The test criteria will be to accept H_0 if F-statistic < $I(0)$ and reject H_0 if F-statistic > $I(1)$. However, if the F-statistic falls between $I(0)$ and $I(1)$, then the test is deemed inconclusive meaning that the relationship between the variables cannot be ascertained.

The Error Correction Model (ECM) will be used to test for the speed of adjustment and how the variables

by Pesaran et al (2001) for co-integration test; the lower bound $I(0)$ and the upper bound $I(1)$. The null hypothesis of no co-integration and the alternative hypothesis of co-integration amongst variables are denoted as follows;

in the data-set converge towards equilibrium in the long run. This model was introduced by Engle and Granger (1987). So once co-integration is established, the ARDL long run model can be estimated as follows;

$$lngdp_t = \beta_0 + \beta_1 lngdp_{t-1} + \beta_2 lnnp_{t-1} + \beta_3 lnmt_{t-1} + \beta_4 lnit_{t-1} + \beta_5 lnir_{t-1} + \epsilon_t \quad (5)$$

The error correction version of the ARDL model relating to the variables is as follows;

$$\begin{aligned} \Delta lngdp_t = & \beta_0 \sum_{t=1}^q \beta_{1t} \Delta lngdp_{t-1} + \sum_{t=1}^q \beta_{2t} \Delta lnnp_{t-1} + \sum_{t=1}^q \beta_{3t} \Delta lnmt_{t-1} + \sum_{t=1}^q \beta_{4t} \Delta lnit_{t-1} \\ & + \sum_{t=1}^q \beta_{5t} \Delta lnir_{t-1} + \lambda EC_{t-1} + \epsilon_t \end{aligned} \quad (6)$$

Where λ = the speed of adjustment and EC_{t-1} is the error correction term which is derived from the residuals obtained from equation (5).

To check for structural stability of the model, this study will adopt the Cumulative Sum of Recursive Residuals (CUSUM) and the Square of Cumulative Sum of Recursive Residuals (CUSUMSQ) test for structural stability of the model. In addition, there will also be a check for serial correlation, normal distribution and problems of heteroscedasticity.

ANALYSIS AND RESULTS

The analysis in this study was run with Eviews 10 software. As required, the variables for this study

were tested for stationarity using the Augmented Dickey-Fuller (ADF) unit root test. The test reveals that at level status, both with trend and without trend, all variables are with unit root. In other words, they are non-stationary. However, at first difference, both with trend and without trend, $lngdp$ is non-stationary while other variables are stationary. Therefore, it is then appropriate to apply the ARDL approach or method of analysis since there is a mixture of stationary and non-stationary variables. The results of the ADF test is summarized in table 1 below;

TABLE 1: UNIT ROOT TEST (AUGMENTED DICKEY-FULLER TEST)

Variable	Intercept				Trend and Intercept			
	Level		1 st Difference		Level		1 st Difference	
	t-stat	5% critical value	t-stat	5% critical value	t-stat	5% critical value	t-stat	5% critical value
Ln _{ap}	-1.037	-2.937	-5.979	-2.939	-1.770	-3.527	-5.940	-3.530
Ln _{mt}	-2.908	-2.937	-6.359	-2.939	-2.114	-3.527	-7.309	-3.530
Ln _{ir}	-2.141	-2.939	-4.062	-2.939	-2.136	-3.530	-3.994	-3.530
Ln _{gdp}	-2.039	-2.951	-2.893	-2.946	-1.839	-3.549	-2.556	-3.540
Ln _{it}	0.498	-2.941	-9.258	-2.941	-3.877	-3.527	-9.906	-3.533

*Null Hypothesis: There is Unit Root
 **Criteria: Accept Null hypothesis if t-stat < Critical value

Source: Author's compilation from Eviews 10 computations

Equation (2) was applied for the ARDL Co-integration test. The ARDL model of 4,4,4,1,2 was automatically selected using the Akaike Information Criterion. The calculated Wald F-statistic = 43.25 and is greater than

the lower and upper bound critical values of all the significance levels (1%, 5% and 10%) as is evidenced in the table 2 below.

TABLE 2: ARDL BOUNDS TEST

F-Bounds Test		H0: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	43.24887	10%	2.45	3.52
K	4	5%	2.86	4.01
		1%	3.74	5.06

Source: Author's computation using Eviews 10

Based on this, the null hypothesis of no co-integration is rejected implying that a long run co-integration relationship exist among the variables. The long run

level equation coefficients for the variables is stated as follows;

$$CointEq = lngdp - (-0.0848lnap + 0.0633lnmt - 0.0095lnit - 0.0477lnir) \tag{7}$$

As shown in table 3 below, lnmt and lnir are statistically significant at 1% and 5% level of

significance respectively in the long run while ln_{ap} and ln_{it} are not statistically significant.

TABLE 3: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAP	-0.084787	0.055196	-1.536099	0.1429
LNMT	0.063320	0.015038	4.210641	0.0006
LNIT	-0.009504	0.008171	-1.163235	0.2608
LNIR	-0.047711	0.016557	-2.881682	0.0104

Source: Author's computation using Eviews 10

The coefficient for lnmt is positive and statistically significant at 0.063. This suggests a positive relationship between mobile phone transfers and

economic growth and implies that a 1% increase in mobile phone transfers brings about a 6.3% increase in economic growth. Lnir is negatively and statistically

significant at -0.048. This suggests a negative relationship between inflation rate and economic growth and it implies that 1% increase in the inflation rate brings about a 4.8% decrease in economic growth.

The short run (error correction model) representation of the model is shown in table 4 below;

TABLE 4: Short Run (Error Correction Model) Representation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-0.260994	0.164846	-1.583259	0.1318
D(LNGDP(-2))	-0.576451	0.110416	-5.220694	0.0001
D(LNGDP(-3))	-0.684038	0.103675	-6.597882	0.0000
D(LNAP)	-0.010497	0.045095	-0.232772	0.8187
D(LNAP(-1))	0.098463	0.024285	4.054525	0.0008
D(LNAP(-2))	0.019283	0.029055	0.663662	0.5158
D(LNAP(-3))	-0.089006	0.018217	-4.885820	0.0001
D(LNMT)	0.013074	0.006817	1.917769	0.0721
D(LNMT(-1))	-0.007021	0.009480	-0.740569	0.4691
D(LNMT(-2))	-0.021946	0.010093	-2.174353	0.0441
D(LNMT(-3))	-0.016672	0.008794	-1.895805	0.0751
D(LNIT)	-0.020594	0.009968	-2.065953	0.0544
D(LNIR)	-0.059080	0.039958	-1.478535	0.1576
D(LNIR(-1))	-0.088412	0.042393	-2.085517	0.0524
CointEq(-1)	-0.823127	0.193634	-4.250943	0.0005

Source: Author's computation using Eviews 10

The results show that lag 1 and lag 3 of ln_{ap} are statistically significant at 1% level of significance in the short run. Their coefficients are 0.0984 and -0.089 respectively.

ln_{mt} at 0, 2 and 3 lags are statistically significant at 10%, 5% and 10% levels of significance respectively in the short run. They contribute about 1.3% [D(ln_{mt}) = 0.0131], -2.19% [D(ln_{mt}(-2)) = -0.0219] and -1.67% [D(ln_{mt}(-3)) = -0.0167] respectively to the economy.

ln_{it} at 0 lag is statistically significant at 10% level of significance with a negative coefficient of -0.021.

The first lag of ln_{ir} is statistically significant at 10% level of significance with a negative coefficient of -0.088.

The error correction term (ECT) represented by CointEq(-1) in the table measures the speed at which prior deviations from the equilibrium are corrected in the current period. The ECT is as expected, significantly negative at 1% level of significance with estimated coefficient of -0.823 (CointEq(-1) = -0.82313). This indicates that 82.3% of the disequilibrium due to the previous quarter's shocks is adjusted back to the long-run equilibrium in the current quarter.

The diagnostic/fitness and stability tests deployed for this model are summarized in the ensuing table and figure.

TABLE 5: Diagnostic and Stability Tests

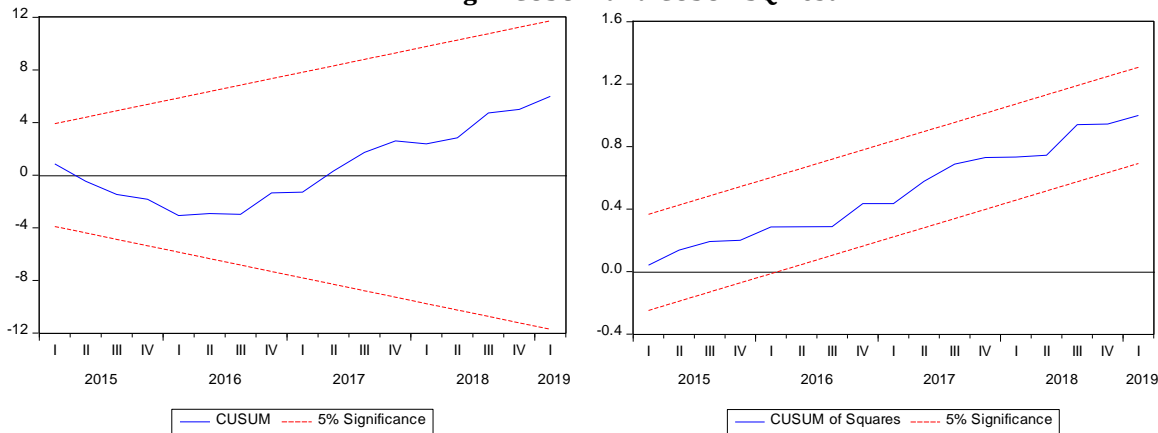
Diagnostic Test	P-value (P)	Sig. (S)	Null Hypothesis (H ₀)	Decision Criteria	Result
Breusch-Godfrey Serial Correlation LM Test	0.4891	0.05	No Serial Correlation	Reject H ₀ if P<S	No Serial Correlation
Breusch-Pagan-Godfrey Heteroskedasticity Test:	0.3117	0.05	No Heteroskedasticity	Reject H ₀ if P<S	No Heteroskedasticity
Jarque-Bera Normality Test	0.466	0.05	Normally distributed	Reject H ₀ if P<S	Normally Distributed.
CUSUM Stability Test					Model is Stable
CUSUMSQ Stability Test					Model is Stable

Source: Author's Compilation from Eviews 10 Computation

The model's residuals are normally distributed as it is also free for serial correlation and heteroskedasticity. The Cumulative Sum of Recursive Residuals (CUSUM) and the Square of Cumulative

Sum of Recursive Residuals (CUSUMSQ) test for structural stability as shown in Fig 1 indicates that the model is stable as the blue CUSUM and CUSUMSQ lines fall within the 5% boundary.

Fig 1: CUSUM and CUSUMSQ Test



Source: Author's computation using Eviews 10

CONCLUSION

This study investigated empirically, the impact of the emerging financial technological innovations on the economic growth in Nigeria. The study adopted a quarterly time series data of 2009Q1 – 2019Q1 with GDP as the dependent variable and the sum of ATM and POS transactions (ap), Internet transfer transactions (it), mobile phone transfer transactions (mt) and inflation rate (ir) as the independent variables. The study established that financial sector development, more particularly technological innovation promotes increased performance of the financial sector through: providing cost effective and efficient payment systems; reduce bank's labor costs which would lead to improvement in productivity and efficiency of financial institutions; increase consumption and trade of goods

and services; and increase funds for investment opportunities.

The ARDL model was used to estimate the long run and short run dynamics between the selected variables. The long run analysis showed that mt and ir were statistically significant. More so, only mt had a positive relationship with economic growth. In the short run analysis, ap, mt, it and ir were statistically significant at specific lags. However, only mt at 0 lag and ap at lag 2 had a positive relationship with economic growth.

The coefficient of the ECT (CointEq(-1)) is as expected at -0.823 and statistically significant as well. The study shows that both in the long run and short run, some aspects of financial technological innovation contribute positively, though not strongly, to economic growth.

RECOMMENDATIONS

Based on the results and conclusion, the study finds it imperative to proffer the following recommendations;

- Policies aimed at promoting and enhancing the availability and penetration of financial technological innovations should be implemented and made effective.
- Education and awareness on the use of these innovations should be encouraged. It will go a long way to encourage financial inclusion.
- Policy makers should adopt effective risk management processes that would help alleviate insecurity and system flaws bedeviling the implementation and/use of these innovations.
- Stakeholders should make continuous review, assessment and repositioning of these technological innovations so as to curb the challenges and setbacks that fraught its implementation.
- Further research on the impact of financial technological innovation on the Nigerian economy is also called on. The variables and the time series used for this study were due to paucity of data.

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