Digital Financial Services and Economic Growth of Nigeria: 2006 - 2021

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ABSTRACT: *This study investigated digital financial services and economic growth of Nigeria from 2006 to 2021. The study specific objectives include investigation of the relationship between automated teller machine services and real gross domestic product; evaluation of the relationship between point of sales services and real gross domestic product; determination of the relationship between mobile banking services and real gross domestic product; and investigation of the relationship between web banking services and real gross domestic product from 2006 to 2021 in Nigeria. The study anchored on technology acceptance model (TAM) advanced by Davis (1989) and purposive sampling technique was adopted for the collection of quarterly secondary data from the Central Bank of Nigeria. The quarterly data collected were analysed using univariate, bivariate and multivariate analyses. The findings from the VECM indicated that automated teller machine services positively and insignificantly influence real gross domestic product in Nigeria; point of sales services positively and significantly influence on real gross domestic product in Nigeria; mobile banking services positively and insignificantly influences real gross domestic product in Nigeria; and web banking services positively and significantly influence on real gross domestic product in Nigeria. On the basis of the findings, the study concluded that digital financial services influence the economic growth of Nigeria. Hence, the study recommended amongst others that appropriate policies aimed at promoting and enhancing the availability and penetration of digital financial services should be implemented and made effective as this will increase real gross domestic product of the country.*

KEYWORDS: ATM, POS, web banking, economic growth, Nigeria

INTRODUCTION

The growing attractiveness of transactions and payment services through digital platforms has exposed the incredible prospective to increase financial services through financial technology.

According to Iwedi et al (2023), the use of digital financial services in contemporary intermediation process have improved the lives of people by minimizing the need to carry cash or spend time traveling over long distance to get to the nearest point of banking services. Research has considered digital financial services as a major catalyst for economic growth. Digital financial services play a critical factor in economic growth. According to Tchamyou et al (2019), digital financial services minimize income inequalities by formalizing the financial sector, and the literature has argued that digital financial services accelerate economic growth. Anane and Nie (2022) noted that digital financial services stimulate world economic growth through software, infrastructure, and hardware that permits fast data transfer between individuals, companies, devices, networks, and systems (Roessler, 2018).

Digital financial services are those services utilized by customers through digital technology. Abbasi and Weigand (2017) noted that digital financial services improve the provision of financial services provided by conventional financial institutions through cutting-edge and advanced technologies such as mobile money, mobile banking, internet banking and digital payment platforms. According to Pazarbasioglu et al. (2020), digital financial services are the financial services that are dependent on digital technologies for delivery and use by customers. Digital financial services in developing countries enables individuals with limited access to financial services to access these services using their mobile phones at their convenience and without physically going to the physical bank. Asian Development Bank (2016) defined digital financial services not only enable money transfers but also enables safe storage of money electronically (mobile money), payment services, savings and opportunity to a wider access of other financial services such as insurance and credit facilities. Digital financial services enable the deposit money banks customers to access simple financial services through digital payment arrangements, mobile phones, and electronic money structures (Anane & Nie, 2022). According to Pazarbasioglu et al. (2020), countries with more technologically cutting-edge financial systems exhibit faster economic growth and more substantial decreasein inequality and poverty gaps. Digital financial services decreases transaction costs by accelerating transaction speed, security, and transparency and enables more tailor-made financial services to the advantage of the poor (Pazarbasioglu et al., 2020). Hasan et al. (2020) noted that the fast growth of digital financial services and substantial technological developments are motivating many nations to increase their digital finance system, which assists in the reduction of poverty and may serve as a means to mitigate social exclusion.

Economic Growth is a concept used to explain the constant and gradual improvement of the volume of production or output of a given country (Ramos & Olwenyi, 2021). According to Soyer et al (2020), economic growth is an annual increase of material production expressed in value, the rate

of growth of GDP or national income. Appah (2022) suggested that economic growth is a sustained increase in per capita national output or net national product over an extended period. It implies that the rate of increase in total output must be higher than the rate of population growth thereby resulting to improvement or increased in standard of living of the citizens. According to Anane and Nie (2022), digital financial services stimulate world economic growth in developed and developing nations. Olubukola, et al (2023) studied digital financial services and the Nigerian economy from 2009 to 2017. The findings indicated that volume of mobile banking, volume of point of sales, and volume of automated teller machine positively and significantly affects gross domestic product. Additionally, volume of web transactions negatively affects the gross domestic product. Nyasimi (2016) study of mobile money transfer services on economic growth in Kenya indicated that a positive relationship between the number of customers who use mobile money and GDP growth. Wong et al (2020) investigated cashless payment in five European Union (EU) countries from 2000-2012. The findings indicated that there is short run causality running from cheque payment to telegraphic transfer and card payment, as well as causality running telegraphic transfer to card payment. Sreenu (2020) investigated cashless payment on economic development in India from 2010 to 2018. The results disclosed that there is a high acceptance of cashless system policy and as such there was a positive impact on economic growth. Tee and Ong (2016) examined cashless payment and economic growth in Austria, Belgium, France, Germany, and Portugal, from 2000 to 2012. The study established a short run causality running from cheque payment to telegraphic transfer and card payment, as well as causality running telegraphic transfer to card payment. In the long run, there is significant effect of adopting cashless payment on the economy of the five EU countries. The serious question confronting researchers concerning how to achieve an all-inclusive financial system remains unanswered. In this context, the study seeks to investigate the impact of digital financial services on economic growth of Nigeria. The specific objectives are to:

1. investigate the relationship between automated teller machine services and real gross domestic product;
2. evaluate the relationship between point of sales services and real gross domestic product:
3. determine the relationship between mobile banking services and real gross domestic product:
4. investigate the relationship between web banking services and real gross domestic product: and

The study was guided by the following research questions:
1. What is the relationship between automated teller machine services and real gross domestic product?

2. What is the relationship between point of sales services and real gross domestic product?
3. What is the relationship between mobile banking services and real gross domestic product?
4. What is the relationship between web banking services and real gross domestic product? and

The following null hypotheses were tested in this study:

H0₁: Automated teller machine have no positive and significant influence on real gross domestic product.

H0₂: Point of sales have no positive and significant influence on real gross domestic product.

H0₃: Mobile banking have no positive and significant influence on real gross domestic product.

H0₄: Web banking have no positive and significant influence on real gross domestic product.

REVIEW OF RELATED LITERATURE

Concept of Digital Financial Services

Digital financial services are those services utilized by customers through digital technology. Abbasi and Weigand (2017) noted that digital financial services improve the provision of financial services provided by conventional financial institutions through cutting-edge and advanced technologies such as mobile money, mobile banking, internet banking and digital payment platforms. According to Pazarbasioglu et al., (2020), digital financial services are the financial services that are dependent on digital technologies for delivery and use by customers. Digital financial services in developing countries enables individuals with limited access to financial services to access these services using their mobile phones at their convenience and without physically going to the physical bank. Asian Development Bank (2016) defined digital financial services not only enable money transfers but also enables safe storage of money electronically (mobile money), payment services, savings and opportunity to a wider access of other financial services such as insurance and credit facilities. Digital financial services enable the deposit money banks customers to access simple financial services through digital payment arrangements, mobile phones, and electronic money structures (Anane & Nie, 2022). According to Pazarbasioglu et al. (2020), countries with more technologically cutting-edge financial systems exhibit faster economic growth and more substantial decreasein inequality and poverty gaps. Digital financial services decreases transaction costs by accelerating transaction speed, security, and transparency and enables more tailor-made financial services to the advantage of the poor (Pazarbasioglu et al., 2020). Hasan et al. (2020) noted that the fast growth of digital financial services and substantial

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technological developments are motivating many nations to increase their digital finance system, which assists in the reduction of poverty and may serve as a means to mitigate social exclusion. Asian Development Bank (2016) noted that the leading objective of digital financial services is not to make known the concept of financial management to the people but rather to provide access to affordable, reliable financial services and ways of managing their finances. The implementation of digital financial services varies from country to country depending on the level of technology and infrastructure available.

Automated Teller Machine (ATM): This is a computerized telecommunications device that provides the customers of a financial institution with access to financial transactions in a public space without the need for a human clerk or bank teller. It is a computer controlled device that dispenses and provides other services to customers who identify them with a personal identification number (PIN). The benefits of ATM to a bank are: a useful channel to attract and retain more customers, increases cash in your customers hands, provide convenient service for customers, reduces the amount of bad cheques, saves lots of hidden costs etc (Appah & Inini, 2019). The study conducted by Ramos and Olweny (2021) revealed that automated teller machine positively and significantly influences economic growth in Kenya. Olubukola et al (2023) study in Nigeria suggested that volume of automated teller machine transactions positively impact on economic growth of Nigerian economy.

Point of Sales (POS): This is a retail shop, a checkout counter in a shop, or the location where a transaction occurs. It refers to the hardware and software used for checkouts – the equivalent of a cash register (Appah & Tebepah; 2017). POS machines are electronic devices deployed at retail outlets to facilitate the exchange of value between a cardholder and a merchant. POS machines are used to perform a variety of basic banking and financial transactions like payment for purchases, balance enquiries, mini-statement printing, cashback etc (Appah & Inini, 2019). It eliminates the numerous issues related to regular cash transactions. The benefits of POS services to the bank include: increased income from transaction fees and float, increased market share of the customers' payment market, enhances customer and merchant loyalty, competitive advantage from offering a superior and secure payment service, provision of banking services to customers beyond banking hours and provides a simple, more efficient and convenient payment system. mobile banking. The study conducted by Ramos and Olweny (2021) revealed that POS positively and significantly influences economic growth in Kenya. Olubukola et al (2023) study in Nigeria suggested that volume of POS transactions positively impact on economic growth of Nigerian economy.

Mobile Banking: These are services delivered by banks or other financial institutions that permits customers to use a mobile device such as smart-phones or other cellular devices to access banking

services and execute financial transactions (Appah & Tebepah; 2017). According to Appah and Inini (2019), mobile banking refers to the provision of banking and financial services with the help of mobile telecommunication devices. It is a system that allows customers of a financial institution to conduct a number of financial transactions through a mobile device such a mobile phone. It is a term used for performing balance checks, account transactions, payments, etc. via a mobile device such as the mobile phone. Mobile banking products provides basic banking services to customers from their mobile phone. It is an SMS driven platform which facilitates access to banking services using cell phones. Siyanbola (2013) stated that mobile banking is popular and exciting to the customers given the low infrastructure requirements and a rapidly increasing mobile phone penetration in Nigeria. The services available on the mobile banking product include: mini-statements and checking of account history, alerts on account activity or passing of set thresholds, monitoring of term deposits, access to loan statements, pension plan management, domestic and international funds transfer etc (Anyalenkeya, 2010). The study conducted by Ramos and Olweny (2021) revealed that mobile banking positively and significantly influences economic growth in Kenya. Olubukola et al (2023) study in Nigeria suggested that volume of mobile banking transactions positively impact on economic growth of Nigerian economy. Additionally, Patnam and Yao (2020) disclosed the effect of mobile money on economic growth in India. The findings submit that businesses adopting mobile payments enhance their sales after six-months of use, compared to others.

Web Banking: This is an online platform through which customers of the bank can access their account and accomplish financial transactions using the internet. Customers can view account, transfer funds between sister accounts, invest in a tenor deposit, confirm cheque issued and transfer funds in favour of third party (Appah & Inini, 2019). It uses the electronic card infrastructure for executing payment instructions and final settlement of goods and services over the internet between the trader and the customer. The study conducted by Ramos and Olweny (2021) revealed that web banking (Electronic fund transfer) positively and significantly influences economic growth in Kenya. Olubukola et al (2023) study in Nigeria suggested that volume of web banking transactions negatively impact on economic growth of Nigerian economy. Mawejje and Lakuma (2019) investigated mobile money and economic growth of Uganda. The findings revealed that mobile money moderate positively on monetary aggregates, consumer price index, private-sector credit, and aggregate economic activity.

Concept of Economic Growth: Economic growth simply refers to as an increase in the value of goods and services produced by a country over a period and can be used to reflect the size of a country. According to Appah (2022), economic growth is a sustained increase in per capita national output or net national product over an extended period. It implies that the rate of increase in total output must be higher than the rate of population growth thereby resulting to improvement or increased in standard of living of the citizens. There are different indicators used for measuring

economic growth but the most accepted is Gross Domestic Product (GDP).GDP is the monetary value of goods and services produced in a nation during a particular period by the residents of that nation irrespective of the nationality of the residents. GDP can be measured at current basic prices (Nominal GDP) or constant basic prices (Real GDP) or current market price. Real GDP has been seen as a good measure of economic growth because it account for the change in the price level of goods and services produced within the nation at particular period. Appah and Zibaghafa (2018) clearly state that Gross Domestic Product is the total volume of production that has taken place in the economy irrespective of the nationality of the people who produced the goods and services. According to the authors, it is the total production that has taken place in Nigeria by Nigerians themselves and foreigners living in Nigeria. The GDP does not include incomes and property earnings of Nigerians abroad. In the same vein, it does not exclude the income of foreigners and foreign property earnings in Nigeria.

Theoretical Review

This study anchored on the technology acceptance model (TAM) advanced by Davis (1989). This is an information system theory that models how users of information technology come to accept and use a new system. Davis (1989) applied the technology acceptance model to explain the main factors responsible for individual target to accept and use new technology. The study discovered that the two main factors inducing individual intention to accept and use new technology are perceived usefulness and ease of use. Ailemen et al (2018), stated that perceived Usefulness is a factor that affects user's acceptance because it is based on how capable the new technology will help improve job performance. The technology must be capable of producing an advantageous result and must also be able to generate a positive performance. Perceived Ease of Use explains how easy it is for users to make use of new technology. It means that the ability to employ the new technology should be effortless (Iwedi et al, 2023). Anane and Nie (2022) noted that connecting digital financial services acceptance requires service providers to measure the likelihood of success for new technology introductions and understand the factors that influence acceptance to develop proactive interventions targeted at populations of users who may be less likely to adopt and use new systems. Yavuz (2021) studied the factors affecting mobile augmented reality (MAR) adoption in Turkey, noted that security and privacy are the two most significant factors influencing MAR application use. Technology adoption may be hampered by a lack of information or awareness, self-efficacy, and high transaction costs (Shaikh & Karjaluoto, 2015). The technology acceptance model (TAM) has been established over the years showing its proficiency in the digital financial sector. Lai (2016) stated that the improvement of payment systems rest largely on a struggle between rapid technological change and natural barriers to new product or service acceptance. It has significantly supported the adoption of digital technology which has seen a remarkable increase with financial

technologies such electronic check clearing networks, ATMs for cash withdrawals and deposits, online banking and cash flow, and mobile payment infrastructure improving economic growth (World Bank, 2017). The emergence of digital payment has enabled customers to embrace E-commerce with the use of internet-based transactions. Which involves online shopping, bookings, e-tickets, use of credit/debit cards, M-wallet, cryptography, among others (Madan, 2016). These digital financial services assist distant payments and are often designed explicitly to ease payment transfer between distant individuals (Akinyemi & Mushunje, 2020). Therefore, the acceptance of the technologies and the advancements by the government to the private sectors can subsequently improve the uptake and thus improve useability towards convenience transactions (Gbongli & Amedjonekou, 2019).This theory is relevant to the current study because information, communication technology (ICT) adoption helps improve financial services of deposit money banks in Nigeria therefore stimulating economic growth.

Empirical Review

There are several prior empirical investigations on the relationship between digital financial services and economic growth in developed and developing countries. Some of these studies are reviewed below with a view to observe the trends of the findings and the gaps in literature.

Iwedi et al (2023) conducted a study on financial inclusion and financial technology in Nigeria. The study employed ex post facto research design and secondary data were collected from the Central Bank of Nigeria from 2009 to 2019. The independent variable financial technology was measured using point of sale, automated teller machine, web banking technology and mobile banking technology while the dependent variable financial inclusion was measured using deposit ratio. The secondary data obtained were analysed using univariate and multivariate analysis. The vector auto regression estimation result revealed that web banking technology positively and significantly affects financial inclusion while point of sale, automated teller machine and mobile banking technology positively and not significantly affects financial inclusion in Nigeria. The study concluded that an upsurge in the use of financial technology instruments such aspoint of sale, automated teller machine, web banking technology and mobile banking technology will improve the level of financial inclusion in Nigeria.

Olubukola, et al (2023) studied digital financial services and the Nigerian economy from 2009 to 2017. The study used ex post facto research design and secondary data were collected from the Central Bank of Nigeria. The study utilized volume of ATM transactions, volume of POS transactions, volume of point of sales transactions and volume of web transactions as the independent variables whereas gross domestic product as the dependent variable. The secondary data were analysed using univariate and multivariate analysis. The ordinary least square results indicated that volume of mobile banking, volume of point of sales, and volume of automated teller machine positively and significantly affects gross domestic product. Additionally, volume of web transactions negatively affects the gross domestic product. The study recommended that

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improvement of financial technology instruments such as ATM transactions, volume of POS transactions, volume of point of sales transactions and volume of web transactions by deposit money banks and Central Bank of Nigeria would enhance the gross domestic product of the country.

Nittayakamolphun and Pholkerd (2022) carried out a study of financial innovation and economic growth in Thailand. The research used quarterly secondary data obtained from 2010 to 2020, from the Bank of Thailand, World Bank and the Office of National Economics and Social Development Council. The study used real gross domestic product per capita (GDPC) as an indicator for economic growth while financial innovation measures used were ratio of bank sector credit for the private sector to GDP(BCP), value of electronic payment and domestic credit in the private sector to GDP, trade openness, inflation, fixed capital formation, government expenditure as macroeconomic indicators. The data collected were analysed using descriptive statistics, unit root test, autoregressive distributive lag, error correction model, diagnostic test and granger causality test. The findings of the study indicated that financial innovation (electronic payment) showed a unidirectional relationship with economic growth in Thailand; that financial innovation (banking sector credit in the private sector) disclosed a unidirectional relationship with economic growth in Thailand. The further noted that financial innovation affects economic growth in Thailand in the long run.

Wang et al (2022) conducted a study of financial innovation, technological innovation and economic growth of 31 provinces and cities in China from 2011 to 2019. The study used secondary data obtained from the Bank of China. The dependent variable economic growth was measured using Per capita gross regional product (PGDP), the independent variables financial innovation and technological innovation were measured using balance of financial institutions loans and research and development expenditure while the control variables were foreign direct investment and population growth rate. The data were analysed using descriptive statistics and fixed effects regression analysis. The results indicated that financial innovation and technological innovation have a positive effect in promoting economic growth, and the influence of financial innovation input in promoting economic growth is larger than that of technological innovation output.

Ramos and Olweny (2021) investigated the effects of digital money on economic growth in Kenya. The study applied descriptive research method and the population consisted of quarterly time series data obtained from the Central Bank of Kenya from 2011 to 2020. The used secondary data collected from the Central Bank of Kenya and analysis consisted of descriptive analysis, diagnostic tests, unit root test, correlation analysis analysis for variance (ANOVA) and regression analysis. The study employed agency banking, mobile banking, card money and internet banking as independent variables while gross domestic product as the dependent variable. The results from the regression analysis indicated a positive and significant association between agency banking, mobile banking, card money and internet banking on gross domestic product in Kenya.

Satia and Okle (2020) analysed empirically financial innovation and economic growth in Cameroon from 1970 to 2018. The study used secondary data obtained from the World Bank and the Central

Bank for Central African States. The economic growth as the dependent variable was measured using gross domestic product per capital growth (GDPPCG) while financial innovation as the independent variable was measured using mobile penetration rate (MB), financial resources made available to household and businesses (DCP), broad money as a percentage to GDP (M2) while control variables consisted of gross capital formation, consumer price index, trade openness, government financial consumption expenditure. The data collected was analysed using unit root test, ARDL bound test. The results indicated that domestic credit to private sector positively and significantly influences economic growth in the long run; broad money positively and insignificantly affects economic growth in the long run; mobile banking positively and significantly influences economic growth in the short run and long run. The study concluded that financial innovation contributes to economic growth in the long run in Cameroon.

Yinusa et al (2020) investigated financial innovation and economic growth in seventeen African countries from 2004 to 2018. The study used secondary data collected from the World Bank Indicator and the data were analysed using descriptive statistics, correlation matrix and regression analysis (Generalised Method of Moments). The results from the Generalised Method of Moments analysis indicated that Automated Teller Machine showed a positive and significant effect on economic growth; domestic credit indicated a positive and significant effect on economic growth; gross capital formation revealed a positive effect on economic growth; inflation and labour disclosed a negative effect on economic growth. Hence, the study indicated that financial innovation significantly impact of economic growth. Njoku et al (2020) carried out a study on electronic banking and economic growth in Nigeria. The study employed ex post facto and correlational research designs with secondary data obtained from the Central Bank of Nigeria and National Bureau of Statistics from first quarter of 2009 to last quarter of 2018. The secondary data were analysed using unit root test, cointegration, vector error correction model, and granger causality test. The study independent variable electronic banking was measured with point of sales, automated teller machine, mobile banking and internet banking while the dependent variable economic growth was measured using real gross domestic product. The vector error correction analysis indicated that point of sales, internet banking and mobile banking does not significantly affects real gross domestic product while automated teller machine significantly affects real gross domestic product. Hence the study concluded that electronic banking significantly affects economic growth in Nigeria.

Okoye et al (2019) conducted a study of financial technological innovation and economic growth in Nigeria from 2009 to 2019. The employed quarterly secondary data collected from the Central Bank of Nigeria and the data were tested using unit root test, ARDL bound test, error correction model and diagnostic and stability test. The analysis indicated that mobile phone transfers are positively correlated to economic growth in the long-run and at lag 0 in the short run while ATM and POS transfers are negatively associated to economic growth in the long-run but positive at lag 1 in the short run. Hence, the study indicated a positive association between economic growth and financial technological innovation. The study therefore, 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 increase financial inclusion.

Chukwunulu (2019) conducted a study of financial innovation and the Nigerian economy from 2008 to 2017. The study used secondary data from the Central Bank of Nigeria and the data collected were analysed using generalized method of moments. The dependent variable was measured using gross domestic product growth while the independent variables were ATM, POS, Mobile payments and web transactions. The results from the generalized method of moments reveal that ATM positively and significantly influences gross domestic product growth in Nigeria; internet banking positively and significantly influences gross domestic product growth in Nigeria; POS positively and significantly influences gross domestic product growth in Nigeria; and mobile banking positively and significantly influences gross domestic product growth in Nigeria. The study concluded that financial innovation positively and significantly affects economic growth.

METHODOLOGY

This study of digital financial services and economic growth of Nigeria adopted both ex post facto and correlational research designs while the sample size of data for the study was attained through purposive sampling technique. The sample size consists of quarterly data from 2006 to 2021. Data were obtained from Central Bank of Nigeria (CBN) statistical bulletin and National Bureau of Statistics (NBS). The secondary data obtained were analysed using univariate, bivariate and multivariate analysis. Table 1 below shows the variables used in the study.

Table 1: Variables Employed in the Study

Type	Variable	Symbol	Explanation	Source
Dependent	Economic Growth	RGDP	Real gross domestic product	Appah (2023); Jabir et al. (2020); Efanga et al (2020)
Independent	Automated Teller Machine	VATM	Volume of automated teller machine	Iwedi et al (2023); Olubukola et al (2023); Ramos and Olweny (2021)
Independent	Point of Sale	VPOS	Volume of point of sales	Iwedi et al (2023); Olubukola et al (2023); Ramos and Olweny (2021)
Independent	Mobile Banking	VMOB	Volume of mobile banking	Iwedi et al (2023); Olubukola et al (2023); Ramos and Olweny (2021)
Independent	Web Banking	VWEB	Volume of web banking	Iwedi et al (2023); Olubukola et al (2023); Ramos and Olweny (2021)

Source: Desk Research 2023

This study is guided by the linear model below:

$LogRGDP = \beta_0 + \beta_1 LogVATM + \beta_2 LogVPOS + \beta_3 LogVMOB + \beta_4 LogVWEB + \varepsilon$ ------------------ (1)

RESULTS AND DISCUSSIONS

Descriptive Statistics

The descriptive statistics result shows the mean (average) for each of the variables, their maximum values, minimum values, standard deviation and the Jarque-Bera (JB) statistics (normality test). Table 2 below, provides the summary of the descriptive statistics of the data covering the period of sixty-eight (68) observations (4 x 17yrs).

Table 2: Descriptive Statistics

	LOGRGDP	LOGVATM	LOGVPOS	LOGVMOB	LOGVWEB
Mean	4.394068	3.098350	1.929350	1.799838	1.438643
Median	4.240503	3.136242	2.214075	2.218950	1.516226
Maximum	5.295870	3.893719	2.841322	2.768697	1.955640
Minimum	4.050532	1.796505	0.271842	-1.221849	0.527630
Std. Dev.	0.378273	0.550655	0.768078	0.979187	0.377589
Skewness	1.648448	-0.451219	-0.927668	-1.361624	-0.694309
Kurtosis	3.865351	3.5790847	3.5021530	3.878472	2.474097
Jarque-Bera	32.91866	3.076281	10.45536	23.19875	6.247025
Probability	0.108913	0.214780	0.055365	0.000009	0.044002
Sum	298.7966	210.6878	131.1958	122.3890	97.82774
Sum Sq. Dev.	9.587055	20.31578	39.52628	64.24005	9.552404
Observations	68	68	68	68	68

Source: Output from E-Views 12

The descriptive statistics of the test variables is provided in Table 2. It can be observed that the four quarterly years for which the time series was collected ranges between 2006 -2022 of 17 years constituted an observations period of 68(4 x 17). The real gross domestic product (LOGRGDP)) of the 17 quarterly years has a Mean value of 4.394 with Standard deviation 0.378 and it ranges between the Mini (4.050) and Max (5.295). The automated teller machine (LOGVATM)) of the 17 quarterly years has a Mean value of 3.098 with Standard deviation 0.550 and it ranges between the Mini (1.796) and Max (3.893). The point of sale (LOGVPOS) of the 17 quarterly years has a Mean value of 1.929 with Standard deviation 0.768 and it ranges between the Mini (0.271) and Max (2.841). The mobile banking (LOGVMOB) of the 17 quarterly years has a Mean value of 1.799 with Standard deviation 0.979 and it ranges between the Mini (-1.221) and Max (2.768). The web banking (LOGVWEB) of the 17 quarterly years has a Mean value of 1.438 with Standard deviation 0.3775 and it ranges between the Mini (0.527) and Max (1.955). It can be said that automated teller machine (VATM) is more consistent compared to point of sale (VPOS), mobile banking (MOB)

and web banking (VWEB) since it has the highest Mean value, Standard Derivation, and Maximum value.

The skewness statistics indicated that all the three dimensions of digital financial services (VATM, VPOS VMOB and VWEB) are negatively skewed which implies that the variables has a short right tail while the measure of economic growth (RGDP) is positively skewed which implies that the variable has a long right tail. According to the information provided by kurtosis showed that four out of five variables real gross domestic product (RGDP), automated teller machine (VATM), point of sale (VPOS) and mobile banking (MOB) have leptokurtic values, which suggest that the variables are higher than the kurtosis value of (3) that is clearly mesokurtic while web banking (VWEB) produce a platykurtic value because it value of 2.474 is less than the kurtosis value of (3). Finally, the Probability of the Jarque-Bera stat for real gross domestic product (RGDP), automated teller machine (VATM) and point of sale (VPOS) was greater than 0.05 implying that the data set on these variables were normally distributed while mobile banking (VMOB) and web banking (VWEB) was less than 0.05 implying that the data set on these variables were not normally distributed, hence, the researcher need to carry out a normality and diagnostics test to confirm the normality of the variables before further estimation.

Unit Root Test

The unit root test helps to determine the nature of data used to prevent spurious results and it will help in determining the technique appropriate for analysis. Augmented Dickey Fuller (ADF) and PhillipsPerron Test (P-P) was employed for this study to determine the order of integration of the time series data. The unit root result was presented in table three (3) below.

Table 3 Unit Root Result

Method 1	Augmented Dickey Fuller (ADF)						
Variables	Level T-Stat	Critical value @ 5%	Level Prob Value	1st Diff T-Stat	Critical value @ 5%	1st Diff Prob Value	Order of Integration
LOGVRGDP	-2.1286	-2.9055	0.2344	-8.5832	-2.9062	0.0000	1(1)
LOGVATM	-1.4252	-2.9043	0.5649	-10.572	-2.9062	0.0000	1(1)
LOGVPOS	-1.2850	-2.9234	0.6319	-8.1544	-2.9043	0.0000	1(1)
LOGVMOB	-1.9403	-2.8234	0.3122	-8.6730	-2.9062	0.0000	1(1)
LOGVWEB	-0.7317	-2.9534	0.8309	-12.900	-2.9069	0.0000	1(1)
Method 2	PhillipsPerron Test (P-P)						
LOGVRGDP	-2.0877	-2.9066	0.2502	-8.6081	-2.9052	0.0000	1(1)
LOGVATM	-1.4265	-2.9023	0.5765	-10.602	-2.9063	0.0000	1(1)
LOGVPOS	-1.2958	-2.9055	0.6269	-8.1522	-2.9061	0.0000	1(1)
LOGVMOB	-1.9218	-2.9055	0.3205	-8.8168	-2.9062	0.0000	1(1)
LOGVWEB	-2.3473	-2.9055	0.1606	-11.447	-2.9062	0.0000	1(1)

Source: Output from E-Views 12

The Augmented Dickey Fuller (ADF) and Phillips-Perron (P-P) unit root result showed that real gross domestic product (RGDP), automated teller machine (VATM), point of sale (VPOS), mobile banking (VMOB) and web banking (VWEB) are all non-stationary at levels but after first differencing, they become stationary at first difference I(1) and none of the variables is integrated at order 1(0) and 1(2). Before correlation analysis, cointegration analysis, vector error correction test and granger causality test is conducted, there is a need to conducted diagnostic tests. This will help to avoid spurious results.

Table 4: Correlation Matrix

	LOGRGDP	LOGVATM	LOGVPOS	LOGVMOB	LOGVWEB
LOGRGDP	1	0.61959...	0.35543...	0.32647...	0.25077...
LOGVATM	0.61959...	1	0.90813...	0.88053...	0.84352...
LOGVPOS	0.35543...	0.90813...	1	0.97239...	0.85170...
LOGVMOB	0.32647...	0.88053...	0.97239...	1	0.81595...
LOGVWEB	0.25077...	0.84352...	0.85170...	0.81595...	1

Source: Output from E-Views 12

The results in table 4 disclosed a correlation coefficient of R-value (0.619) which illustrated strong positive relationship between automated teller machine (VATM) and real gross domestic product (RGDP). Correlation coefficient of R-value (0.355) illustrated a moderate positive correlation between point of sale (VPOS) and real gross domestic product (RGDP). Furthermore, the table indicated a correlation coefficient of R-value (0.326) which illustrated moderate positive relationship between mobile banking (VMOB) and real gross domestic product (RGDP). And, finally, the table produced a correlation coefficient of R-value (0.250) which illustrated a weak positive relationship between mobile banking (VMOB) and real gross domestic product (RGDP) in Nigeria.

Diagnostic Test

In order to check for the reliability of the estimated model, diagnostic tests were conducted, thus, Breusch-Godfrey serial correlation LM test, Breusch-Pegan Hetroskedasticity test, Jarque-Bera normality test and Ramsey RESET (functional form) tests were carried out.

Table 5: Results of Diagnostic Test

Method Adopted	Results
Serial Correlation LM Test	F-Sta 3.610, Prob 0.2310
Heteroskedasticity Test of Breusch-Pagan-Godfrey	F-Sta 4.632, Prob 0.0820
Heteroskedasticity Test White	F-Sta 14.532, Prob 0.0634
Heteroskedasticity Test Harvey	F-Sta 4.631, Prob 0.1234
Normality (Jarque-Bera)	JB 8.800, Prob 0.0733
Stability Diagnostic Ramsey Reset Test	F-Sta 0.612, Prob 0.4367

Source: Output from E-Views 12

The result of diagnostic tests is reported in Table 5 above. The result of the serial correlation test using Breusch-Godfrey LM test indicates that the series is statistically insignificant, signifying that the error terms are not serially correlated. This implies that error terms are independent implying that the error term in one period does not depend on the error term in another period; therefore, we accept the null hypothesis of no serial correlation. Also, The table 5 above showed the heteroskedasticity diagnostic test using Breusch-Pagan-Godfre heteroskedasticity test, White heteroskedasticity and Harvey heteroskedasticity test as the criteria for decision. The results of heteroskedasticity test illustrate a high P-value, this suggests an acceptance of the null hypothesis and conclude that is there is no heteroskedasticity in the model. Normality (Jarque-Bera) test is shown to be statistically insignificant at 5% probability value, pointing that the series are normally distributed. This means an acceptance of the null hypothesis of normally distributed series and reject the alternative that the series are normally distributed. And, finally, the result of Ramsey test suggests that the estimated parameters of the models are stable.

Results of Stability Tests
In order to ascertain the stability of the parameters of the model, the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) tests were conducted. If the plots of CUSUMQ break in the lower/upper bounds, the parameters are said to be unstable.
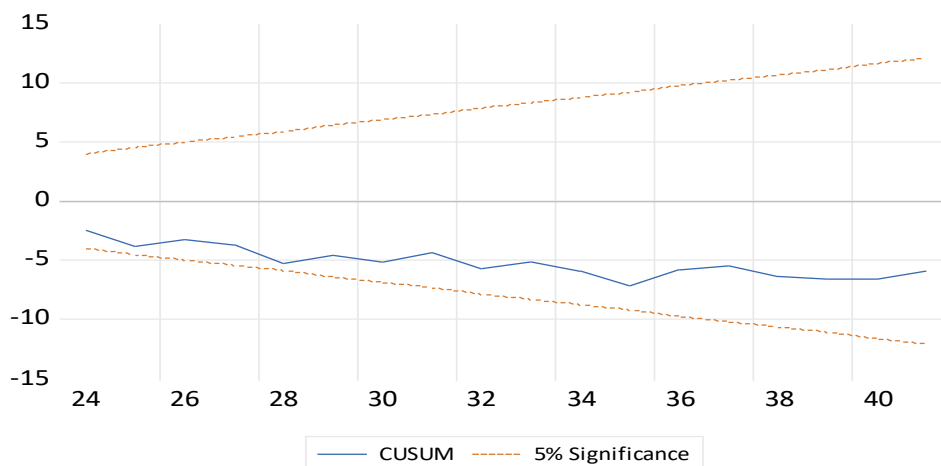

Figure 1: Cumulative sum of square recursive residuals plots

Source: Output from E-Views 12

The plots in Figure 1 above falls within the boundaries, as the (CUSUM) and (CUSUMQ) plots do not fall in any of the 5% critical lines. This shows that the estimated parameters used in this study are stable for the period under study, this confirms the stability of the model.

Table 6: Johansen Cointegration Test

Date: 04/28/23   Time: 22:45
Sample (adjusted): 4 68
Included observations: 65 after adjustments
Trend assumption: Linear deterministic trend
Series: LOGRGDP LOGVATM LOGVPOS LOGVMOB LOGVWEB
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.578804	104.7127	69.81889	0.0000
At most 1 *	0.273330	48.50992	47.85613	0.0433
At most 2	0.193505	27.75656	29.79707	0.0845
At most 3	0.154314	15.777830	13.494712	0.0302
At most 4 *	0.065490	4.402672	3.841465	0.0359

Trace test indicates 3 cointegrating eqn(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 *	0.578804	56.20275	33.87687	0.0000
At most 1	0.273330	27.75336	20.58433	0.0014
At most 2	0.193505	13.97873	21.13162	0.3668
At most 3	0.134314	14.37515	9.264600	0.0256
At most 4 *	0.065490	4.402672	3.841465	0.0359

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Output from E-Views 12

From table 6 above, the trace and max-eigenvalue test show that there are three Error Correction Terms or co-integrating equation. The existence of co-integration among the variables indicates that there is a long run equilibrium relationship among the variables in the model. Thus, our econometric model is fit to run the VECM technique and the output in table 7 below was obtained.

Table 7: Vector Equilibrium Correction Model

Dependent Variable: D(LOGRGDP)
System: UNTITLED
Estimation Method: Least Squares
Date: 03/25/23   Time: 14:32
Sample: 3 68
Included observations: 68

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGVATM(1)	0.053281	0.203029	0.262430	0.7932
D(LOGVPOS(2)	0.393460	0.155929	2.523334	0.0122
D(LOGVMOB(3)	0.090002	0.383736	0.234541	0.8147
D(LOGVWEB(4)	0.088635	0.014630	6.058620	0.0000

Observations: 68				
R-squared	0.687825	Mean dependent var		0.008121
Adjusted R-squared	0.525570	S.D. dependent var		0.245554
S.E. of regression	0.201658	Sum squared resid		2.399301
F-statistic	0.000032			
Durbin-Watson stat	1.783881			

Source: Output from E-Views 12

The following phase involved determining which variable was significant and which was not. This was investigated using the VECM probability table. A variable was significant if it falls below the 5% level of significance (0.05). From the table 7 above, the correlation coefficient (r^2) of approximately 68.7% denotes a good model fit. This means that up to 68.7% of the variation in the outcome variable is explained by the explanatory variables. This implies that only 31.3% percent of the variation is accounted for by variables not considered in the model. The significant F-statistic (0.000032) indicates that all the independent variables can jointly influence the dependent variable. Durbin Watson Statistics is in the threshold of 1.78 which signals the non existence of autocorrelation. Furthermore, the table 7 displayed how quickly the independent variables changed how the dependent variable changed both now and over the following period. The table confirmed that there was a long-run relationship between the dependent variable and two of the independent variables while two of the independent variables indicate no log-run relationship.

Using table 7, D(LOGVATM(1) represented log of automated teller machine and its probability value of 0.793 was statistically insignificant at 5% level of significance to prove that the variable was insignificant in impacting the dependent variable real gross domestic product LOGRGDP. The coefficient value was 0.0532 and carries a positive sign to show that the insignificance was a negative one. D(LOGPOS(2) represented log of point of sales and its probability value of 0.0122 was statistically significant at 5% level of significance to prove that the variable was significant in impacting the dependent variable real gross domestic product LOGRGDP on the long-run. The coefficient value was 0.393 and carries a positive sign to show that the significance was a positive one. D(LOGVBOM(3) represented log of mobile banking and its probability value of 0.8147 was statistically insignificant at 5% level of significance to prove that the variable was insignificant in impacting the dependent variable real gross domestic product LOGRGDP which implies that there

is no long-run relationship. Finally, D(LOGVWEB(4) represented log of web banking and its probability value of 0.000 was statistically significant at 5% level of significance to prove that the variable was significant in impacting the dependent variable real gross domestic product LOGRGDP on the long-run.

Table 8: Granger Causality Test Result

Pairwise Granger Causality Tests
Date: 04/29/23   Time: 02:52
Sample: 1 68
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOGVATM does not Granger Cause LOGRGDP	66	0.13519	0.8738
LOGRGDP does not Granger Cause LOGVATM		2.54288	0.0869
LOGVPOS does not Granger Cause LOGRGDP	66	0.12904	0.0121
LOGRGDP does not Granger Cause LOGVPOS		2.80347	0.0684
LOGVMOB does not Granger Cause LOGRGDP	66	0.25983	0.7720
LOGRGDP does not Granger Cause LOGVMOB		2.74732	0.0720
LOGVWEB does not Granger Cause LOGRGDP	66	0.00965	0.0003
LOGRGDP does not Granger Cause LOGVWEB		0.33525	0.7165

Source: Output from E-Views 12

The result from the Granger causality test was shown in table 12 above. Firstly, the result revealed automated teller machine (LOGVATM) does not causality real gross domestic product (RGDP) in Nigeria likewise real gross domestic product (RGDP) does not causality automated teller machine (LOGVATM) in Nigeria based on the P-values (0.873 and 086 > 0.05). Secondly, the result revealed that point of sale (LOGVPOS) does causality real gross domestic product (RGDP) in Nigeria but real gross domestic product (RGDP) in Nigeria does not causality point of sale (LOGVPOS) based on the P-values (0.012 < 0.05 and 0.0.684 > 0.05). Thirdly, the result revealed mobile banking (LOGVMOB) does not causality real gross domestic product (RGDP) in Nigeria likewise real gross domestic product (RGDP) does not causality mobile banking (LOGVMOB) in Nigeria based on the P-values (0.772 and 072 > 0.05). Fourthly, the result revealed that web banking (LOGVWEB) does causality real gross domestic product (RGDP) in Nigeria but real gross domestic product (RGDP) in Nigeria does not causality web banking (LOGVWEB) based on the P-values (0.0003 < 0.05 and 0.0.7165 > 0.05).

Table 9: Summary of hypothesis result

Null Hypotheses	Indicators	Correlation Values	R-	VECM Value	Prob	Decision
H01	ATM vs RGDP	0.619		0.793		Accept
H02	POS vs RGDP	0.355		0.012		Reject
H03	MOB vs RGDP	0.326		0.814		Accept
H04	WEB vs RGDP	0.250		0.000		Reject

Source: Compiled by Researchers from Table 4 and Table 7

Hypotheses Testing and Discussion of Findings

We previously stated four hypotheses for testing the impact of digital financial services on economic growth of Nigeria. To test the hypothesis, Vector Error Correction model and correlation metric was used to calculate the overall dependence of the dependent variable on the independent variables. The outcome of the vector error correction analysis and correlation will be used to test the hypothesis in this study. For the purpose of this study, a hypothesis is accepted at a 5% level of significance. A null hypothesis would only be rejected in favor of the alternate if the P-value (probability value) is less than 0.05. A p-value greater than 0.05 will see the null hypothesis is accepted. The results of the hypothesis tested are as follows;

H01: Automated teller machine have no positive and significant influence on real gross domestic product.

Using the summary of hypothesis result in table 9, automated teller machine was positively and insignificant in influencing real gross domestic product in Nigeria with R-value of 0.619 and Prob value of 0.793. Therefore, based on this finding, the null hypothesis was accepted and the alternative was rejected, hence, automated teller machine positively and insignificantly influences real gross domestic product in Nigeria. This result agree with Iwedi et al (2023) study that indicates that automated teller machine positively and not significantly affects financial inclusion in Nigeria. However, the outcome of the current study disagree with Olubukola, et al (2023) result that indicates that volume of automated teller machine positively and significantly affects gross domestic product. Chukwunulu (2019) result from the generalized method of moments reveal that ATM positively and significantly influences gross domestic product growth in Nigeria Similarly, Wang et al (2022) results indicated that financial innovation and technological innovation have a positive effect in promoting economic growth, and the influence of financial innovation input in promoting economic growth is larger than that of technological innovation output.

H02: Point of sales have no positive and significant influence on real gross domestic product.
Using the summary of hypothesis result in table 9, point of sales was positively and significant in influencing real gross domestic product in Nigeria with R-value of 0.355 and Prob value of 0.012. Therefore, based on this finding, the null hypothesis was rejected and the alternative was accepted, hence, point of sales services positively and significantly influence real gross domestic product in

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Nigeria. This result concur with Olubukola, et al (2023) study that indicates that volume of point of sales positively and significantly affects gross domestic product. Similarly, Chukwunulu (2019) results from the generalized method of moments revealed that POS has positive and significant influences on gross domestic product growth in Nigeria. Wang et al (2022) results indicated that financial innovation and technological innovation have a positive effect in promoting economic growth, and the influence of financial innovation input in promoting economic growth is larger than that of technological innovation output. The result disagreed with Njoku et al (2020) who of vector error correction analysis indicated that point of sales does not significantly affects real gross domestic product.

H0₃: Mobile banking have no positive and significant influence on real gross domestic product.

Using the summary of hypothesis result in table 9, mobile banking was positively and insignificant in influencing real gross domestic product in Nigeria with R-value of 0.326 and Prob value of 0.814. Therefore, based on this finding, the null hypothesis was accepted and the alternative was rejected, hence, mobile banking services positively and insignificantly influences real gross domestic product in Nigeria. This result concurs with Iwedi et al (2023) study that indicates that mobile banking positively and not significantly affects financial inclusion in Nigeria. Njoku et al (2020) result from the vector error correction analysis indicated that mobile banking does not significantly affects real gross domestic product in Nigeria. However, Olubukola, et al (2023) result disagreed with this study finding, their findings indicates that volume of mobile banking positively and significantly affects gross domestic product. Ramos and Olweny (2021) results from the regression analysis indicated a positive and significant association between mobile banking and gross domestic product in Kenya. Satia and Okle (2020) indicates that mobile banking positively and significantly influences economic growth in the short run and long run in Cameroon

H0₄: Web banking have no positive and significant influence on real gross domestic product.
Using the summary of hypothesis result in table 9, web banking was positively and significant in influencing real gross domestic product in Nigeria with R-value of 0.250 and Prob value of 0.000. Therefore, based on this finding, the null hypothesis was rejected and the alternative was accepted, hence, web banking services positively and significantly influence on real gross domestic product in Nigeria. This result concurs with Ramos and Olweny (2021) study that indicated a positive and significant association between internet banking and gross domestic product in Kenya. Similarly, Chukwunulu (2019) results from the generalized method of moments revealed that internet banking has positive and significant influences on gross domestic product growth in Nigeria. However, Olubukola et al (2023) disagreed with the study result and their finding indicates that volume of web transactions negatively affects the gross domestic product in Nigeria. Njoku et al (2020) result from the vector error correction analysis indicated that internet banking does not significantly affect real gross domestic product.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings from the tests conducted, the study generally, concludes that digital financial services positively and significantly impact on economic growth of Nigeria. Other Sub-variables of the study was concludes that, automated teller machine positively and insignificantly impact on real gross domestic product in Nigeria, point of sales positively and significantly impact on real gross domestic product in Nigeria, mobile banking positively and insignificantly impact on real gross domestic product in Nigeria, and also, the study concludes that web banking positively and significantly impact on real gross domestic product in Nigeria. Based on the empirical findings, the study recommends the following.

1.   The study recommended that improvement of digital financial services in term of point of sales and web banking by citizens would enhance the real gross domestic product of the country.
2.   The study recommended that digital financial services contributes to economic growth in the long run in Nigeria, hence, federal and state government should plan for long term investment in providing digital financial serves.
3.   The research recommends that the central bank of Nigeria should monitor the operation of automated teller machine and mobile banking so as to encourage people to use them more often.
4.   The study also recommends that, policies aimed at promoting and enhancing the availability and penetration of digital financial services should be implemented and made effective as this will also increase real gross domestic product of the country.

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