ICT Usage, Fiscal Policy and Economic Growth in Nigeria

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Abstract

The study examines impact of ICT usage and fiscal policy on economic growth in Nigeria from 1986 to 2022. The data used for this study were secondary data that were sourced from central bank of Nigeria statistical bulletin in all the variables including capital expenditure, recurrent expenditure, external debt, and information and communication technology. The study conducted stationarity test with Augmented Dickney Fuller (ADF) Unit root test and the result shows that all the variables were stationary at first difference. The co-integration test carried out using Johansen co-integration test also shows that there is long run relationship amongst the variables. The study further employed the vector error correction model (VECM) to estimate the parameters of the model. The result of the vector error correction model presented shows that error-correcting term have the right sign, and is also statistically significant at 5% level. Capital expenditure and external debt has a direct and significant relationship with economic growth at 5% levels. Recurrent expenditure has an inverse relationship, but significant with economic growth at 5% levels. Information and communication has a direct relationship with economic growth but not significant at 5% levels. The study therefore recommends that concerted effort should be made to ensure that digital economy serves as a veritable means of achieving economic growth and at the same time provide effective monitoring mechanism to ensure that government recurrent capital are effectively utilized for the growth of the sector.

Keywords: Digital Economy, Fiscal Policy, Economic Growth, VECM, Nigeria.

1. Introduction

The driving force behind any nation's progress is economic growth, which entails the process of growing wealth. This wealth can be grown through innovation, skill development, and technological improvement. To a greater extent than through increased government spending that supports productivity and economic development, this growth might result from tax policy which promotes revenue production and wealth creation. In order to promote economic growth, fiscal policy employs both government policies and tax

policies. The 1980s economic crisis made it necessary to think creatively about how to expand the economy. As a result of the economic crisis, the government has implemented numerous fiscal policies that are intended to stimulate economic growth. Government have to go into borrowing, borrowing is another additional gear of creating credit and growing wealth, this growth is achieved in a more effective and efficient mechanism through the evolution of telecommunication. Communication is a global village with information and communication technology (ICT) being a vital tool for the process of globalization which fosters economic growth.

Aluthge, Jibir, and Abdu (2021) argued that in developing nations like Nigeria, the variations in the pattern of government spending is expected to not only ensure stabilization but also to drive economic growth and increase employment opportunities. Empirical evidence on the impact of government spending on the growth of an economy, particularly in developing nations like Nigeria is evident through the impact of digital economy and fiscal policy on economic growth with mixed empirical result. Some scholars have claimed that direct relationship exist between digital economy, fiscal policy and economic growth, while some scholar argued that digital economy and fiscal policy has insignificant relationship with economic growth. This controversial result underscore the need to conduct additional academic research on the effects of Nigeria's fiscal policy and digital economy on the country's economic growth. This is the focus of this study.The rest of the research is structured as follows: The literature review is covered in the following section, which is then followed by methodology, which includes data description, data analysis method, and model construction. The results presentation, discussion, conclusion, and recommendation come next.

2. Literature Review

2.1. Theoretical Literature

(A) Theory of Fiscal Policy

- **Theory of John Maynard Keynes**

Fiscal policy is based on the theories of the British economist John Maynard Keynes. His Keynesian economics posited that government caninfluence aggregate demand and the level of economic activity through changes in the levels of taxation and government spending. Keynesian economic theories are based on the assertion that the only way to steer the economy is through proactive actions from our government.

(B) Theories of Economic Growth

- ***The Neoclassical Growth Theory***

This theory was built on the classical theory. The classical theory developed by the classical economists like Adam Smith suggests that economic growth is driven by increases in factors of production, such as labour and capital. Neoclassical economists like Robert Solow building on this theory (the classical theory) introduced the concept of technological advancement as a driver of growth. This theory argues that improvements in technology is the key factor in sustained growth.

- ***Endogenous Growth Theory***

This theory was developed by economists like Paul Romer. The theory posits that economic growth can be influenced by internal factors like government policies and investments in human capital, research, and development. The theory emphasizes the need for innovation and investments in human capital by governments and private sector institutions.

2.2. Empirical Literature

Sulaiman and Azeez (2012) investigated the impact of external debt on economic growth in Nigeria, using error correction model. The study covers the period between 1970 and 2010. The results from the research revealed that external debt has positive impact on economic growth in Nigeria during the period covered in the study. Similarly, in 2016,Omagbemi empirically examined the impact of external debt on economic growth in Nigeria for the period of 1985 to 2014. The parameters of the study were estimated using ordinary least square multiple regression technique. The results establish a positive and significant impact between external debt and economic growth in Nigeria.Also, in subsequent year, using the same method of error correction technique as in study by Sulaiman and Azeez (2012), Paul (2017) analyzed theimpact of external debt on economic growth in Nigeria from 1985 to 2015. The findings of the study shows that external debt has positive and significant impact on economic growth in Nigeria.

Cheng et al. (2014) examined how information and communication technology (ICT) influence economic growth in Nigeria from 1999 to 2012. The study employed the method of the ordinary least square(OLS) and the results found that ICT contribute significantly to economic growth in Nigeria.However, using a different method of ARDL technique, a contrary finding was made in the study by Akinwale et al. (2018). The study empirically analyzed the impact of Information and Communication Technology (ICT) on economic growth in Nigeria using a time series data covering the period of 1997 to 2016. The results of the findings show that ICT has negative and insignificant impact on economic growth in Nigeria. On the other hand, Ukwuoma (2019) analyzed the effect of ICT on economic growth in Nigeria, covering the period of 2008 to 2018. The data obtained were analyzed with the method of analysis of variance (ANOVA) and the results show that ICT improves economic growth in Nigeria. The findings of this study conforms to that of Cheng et al (2014).

Darma (2014) employing the ordinary least square (OLS) method to examined the impact of federal government capital expenditure on economic growth in Nigeria, the period for this study was from 1980 to 2010. From the study, the result revealed that government capital expenditure has a direct and significant relationship with economic growth in Nigeria. Similarly, Danladi et al. (2015) investigaed how government expenditure impacts economic growth in Nigeria, using autoregressive distributed lag(ARDL) model. The time series study covers the period from 1980 to 2013. From the result of the study, it was empirically revealed that capital expenditure has positive but insignificant impact on economic growth in Nigeria. It also reveals that recurrent expenditure has positive and significant impact on economic growth. On the other hand, the study by Oyeleke et al. (2016) made a contrary finding. The study investigated the impact of government capital expenditure on economic growth in Nigeria from 1970 to 2013. The study employed the method of error correction

model to estimate the parameters of the model and it was revealed from the findings that government capital expenditure has negative impact on economic growth in Nigeria. The findings of this study suggests the existence of a problem in the economy examined as government capital expenditure is supposed to improve economic growth and not retard it.

Subsequently, John (2017) explored the effect of federal government capital expenditure on the Nigerian economic growth, collecting data which covers the period of 1985 to 2014. The study employed multiple regression model and the results indicate a positive effect between government capital expenditure on administration, economic services, social community services, transfers and economic growth in Nigeria. In 2021, Aluthge et al empirically examined the impact of government expenditure on economic growth in Nigeria using an autoregressive distributed lag (ARDL) model. The study covers the period of 1970 to 2019 and the results of the method employed indicate that capital expenditure has positive and significant impact on economic growth both in the long and short run. On the other hand, recurrent expenditure has negative but significant impact on economic growth in Nigeria in the short run, while the impact in the long run was insignificant during the period covered by this study. Furthermore, using the same method of ARDL, Ikubor et al. (2022) investigated the impact of government capital expenditure in economic services' sector on economic growth in Nigeria using a disaggregated data spanning from 1981 to 2020. The results found that government capital expenditure in economic services' sector has positive relationship with economic growth in Nigeria.

3. Methodology

The study examines impact of digital economy and fiscal policy on economic growth in Nigeria, covering the period from 1986 to 2022. The time series data were obtained from Central Bank of Nigeria Statistical Bulletin on all the variables. These data were analyzed using vector error correction model. Vector error correction was adapted as the appropriate method because all the variables attained their stationarity at first difference and have long run relationship. The advantage of vector error correction model (VECM) is that it can be used to check the speed of adjustment from the short run disequilibrium state to long run equilibrium. Thus, in line with theory, this study adopts the model of Aluthge et al. (2021) and did a slight adjustment to the model. In the model of Aluthge et al. (2021), variables such as government capital expenditure, recurrent expenditure, labour force, trade openness, inflation and non-oil revenue were included. However, this study included the variables such as government capital expenditure, recurrent expenditure, information and communication technology, external debt and gross domestic product in its model. The reason for dropping some of the variables in the model of Aluthge et al. (2021) is to avoid specification biasness. Thus, only the variables that can explain the relationship are included. The model of Aluthge et al. (2021) is specified as follows

$$GDP = f(CAP, LF, REC, TPN, INF, NOILR)$$

Where, GDP = Gross Domestic Product; CAP = Capital Expenditure; REC = Recurrent Expenditure; LF = Labour Force; TPN = Trade Openness; NOILR = Non-oil Revenue.

3.1. Model Specification

- ***The Functional Form of Model Specification***

$GDP_t = f\ (CEX_t, REX_t, EXD_t, ICT_t)$ ..... (1)

Where, CEX = Capital Expenditure; REX = Recurrent Expenditure; EXD = Eternal Debt; ICT = Information and Communication Technology contribution to GDP..

- ***The Mathematical Form of Model Specification***

$GDP_t = \beta_0 + \beta_1 CEX_t + \beta_2 REX_t + \beta_3 EXD_t + \beta_4 ICT_t$ ..... (2)

Where, β_0, β_1, β_2, β_3, and β_4 are the parameters

- ***The Econometric Form of Model Specification***

$GDP_t = \beta_0 + \beta_1 CEX_t + \beta_2 REX_t + \beta_3 EXD_t + \beta_4 ICT_t + \mu_t$ ..... (3)

Where,
β_0 = is the intercept term for regression, μ_t = Stochastic error term
t = time, which is used because we are dealing with time series data.
All other variables are as defined above.

3.2 Definition and justification of Variables

3.2.1. Gross Domestic Product (GDP)

Gross Domestic Product (GDP) refers to the total market value of finished goods and services produced in country in a given period of time usually a year. GDP shows a country's economy at glance, and it's used to calculate an economy's size and rate of growth. The growth of a country's GDP indicates the economic health of the country. GDP was considered in this study as the dependent variable in this study and as a proxy for economic growth since it captures changes in production of goods and services in an economy. The study by Igbayue (2020) employed GDP as a dependent variable in his study while investigating the relationship between ICT and economic growth in Nigeria.

3.2.2. Capital Expenditure (CEX)

Capital expenditure is the amount of money spent by government on the development of machinery, equipment, building, road construction, education, among others. This study considered this variable because infrastructure happens to be one of the projects government allocates funds to and also considering the importance of sound infrastructure to the growth of the country in terms of growth of production/output. Capital expenditure being a part of spending by government and as part of fiscal policy measure was considered in this study as an independent variable. So many studies has investigated the relationship between government capital expenditure and economic growth in Nigeria. Study by Aluthge et al

(2021) among other studies revealed that government capital expenditure has positive and significant relationship with economic growth in Nigeria both in the short run and long run. This study subsequently, employing government capital expenditure as one of the dependent variables, and following economic theories expects a positive relationship between economic growth and capital expenditure in Nigeria.

3.2.3. Recurrent Expenditure (REX)

Recurrent expenditure on goods and services refers to those expenditures that does not give rise to creation or acquisition of fixed asset. In government, recurrent expenditures are incurred on an annual basis to maintain the running and operations of government and it includes expenditures on wages and salaries among others. This study considered recurrent expenditure of government as an independent variable as recurrent expenditure happens to be one of the spendings of government which is part of fiscal policy. So many researchers considered recurrent expenditure in their studies. Study by Aluthge et al (2021) considered recurrent expenditure while investigating its impact on economic growth in Nigeria. The study however revealed that government recurrent expenditure has no significant relationship with economic growth in Nigeria both in the short run and long run.

3.2.4. Eternal Debt (EXD)

External Debt at any point in time refers to the outstanding amount of those actual current, and not contingent liabilities that requires payment of principal and interest by the debtor (resident of an economy) at some point in the future to a nonresident of an economy. It measures an economy's financial obligation to make future payments and is also an indicator of a country's vulnerability to solvency and liquidity problems. Due to the shortage of capital needed for activities in the economy, governments in developing countries resort to borrowing to bridge the resource gap, however, how this action of borrowing affect the economy has been a controversial issue. Since government borrow to spend and spending by government is one of the fiscal policy measure, this study considered external debt as one of the dependent variable. Mbah et al considered external debt while investigating its impact on economic growth in Nigeria and found that external debt impacts negatively and significantly on output in Nigeria. This study will either validate or contradict this finding.

3.2.5. Information and Communication Technology (ICT)

Information and Communication Technology refers to the verse set of communication technological tools and resources that are utilized for the purpose of processing, transmitting, storing, creating, sharing, or exchanging textual, vocal, pictorial or numerical information. These communication technological tools includes; the internet, computers, wireless networks, cellphones, and many others. The fast growth, use and importance of ICT can be explained by so many factors, but for this study, ICT was considered in terms of

its contribution to GDP in terms of billions of Naira. Contribution of ICT to GDP (billions of naira) was used in this study as an independent variable representing digital economy.

3.3 Estimation Technique

This study used the technique of Vector Error Correction Model (VECM) to analyze data used in this study. This method was employed as the right method for this study because all the variables were stationary at first difference and they have an equilibrium relationship. The advantage of vector error correction model (VECM) is that it can be used to check the speed of adjustment from the short run disequilibrium state to long run equilibrium.

3.4. Diagnostic test

3.4.1. Unit root Test

Stationarity test is conducted to ascertain the stationarity level of the variables of interest. This would help to avoid spurious regression since time series data usually exhibit trends which can lead to misleading result. To guide against this problem, the Augmented Dickey Fuller unit root test will be conducted in this study to ascertain whether the variables have unit root or not and the order of integration of the variables.

3.4.2. Co-integration Test

In this study, co-integration test result will be conducted using the Johansen co-integration test. This test helps to ascertain the existence of a long run relationship among variables.Modeling time series in order to keep their long-run information intact is done through cointegration. Cointegration test is necessary to avoid running a spurious regression.

3.5. Data Sources

This study utilized time series secondary data for the analysis of effect of digital economy and fiscal policy on economic growth in Nigeria for the period of 1986 to 2020. All the variables used in this study including GDP, recurrent expenditure, capital expenditure, ICT contribution to GDP, and external debt were all sourced from the Central Bank of Nigeria (CBN) Statistical bulletin.

4. Presentation of Results and Interpretation

This section presents the results obtained from EViews 10 and their interpretations.

4.1. Stationarity Test

Stationarity test is conducted to ascertain the stationarity level of the variables of interest. This would help to avoid spurious regression since time series data usually exhibit trends which can lead to misleading result. To guide against this problem, the Augmented Dickey Fuller unit root test was employed and the result is presented in Table 1.

Table 4.1: Summary of the ADF Unit Root Test

ADF Stat @Level	Critical Value @ 5%	ADF Stat@1st Diff.	Critical Value @ 5%	Order of Integration
-0.72114	-2.94840	-3.82242	-2.9484	I(1)
-1.13159	-2.94584	-6.13216	-2.9484	I(1)
-2.77101	-2.94584	-7.78253	-2.9484	I(1)
-1.20143	-2.9484	-4.36903	-2.9484	I(1)
-0.40167	-2.945842	-4.64938	-2.9484	I(1)

Source: E-views 10 Output.

The ADF unit root test presented in Table 1 shows that all the variables are not stationary at level but at first difference. Thus, the variables are integrated of order one. Also, the null hypothesis that the model has unit root can be rejected since the ADF statistics for all the variables are greater in absolute terms than the corresponding critical values at 5 percent.

4.2. Lag Selection Criteria

The VAR lag selection criteria is used to know the appropriate lag length for the study. This is presented in Table 2.

Table 4.2: VAR Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	46.57603	NA	6.40e-08	-2.375773	-2.15358	-2.2991
1	233.7465	310.1682*	6.15e-12*	-11.64266*	-10.30950*	-11.18245*
2	258.9106	34.51080	6.68e-12	-11.65204	-9.207918	-10.808

* indicates lag order selected by the criterion

Source: Eviews 10 Output.

The result presented in Table 2 indicates that the appropriate lag length for the model is lag one since all the criteria chose lag one. Therefore, the Akaike Information Criterion is selected because it has the lowest value.

4.3. Co-integration Test

This test helps to ascertain the long run relationship among variables. In order to show if there is long run relationship among the variables of this model, the Johansen co-integration test was conducted.

Table 4.3: Johansen Cointegration Test Result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.734269	110.6697	69.81889	0.0000
At most 1 *	0.639668	64.28523	47.85613	0.0007
At most 2	0.455316	28.55973	29.79707	0.0689
At most 3	0.187711	7.295490	15.49471	0.5435
At most 4	0.000543	0.019010	3.841466	0.8902

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.734269	46.38451	33.87687	0.0010
At most 1 *	0.639668	35.72550	27.58434	0.0036
At most 2 *	0.455316	21.26424	21.13162	0.0479
At most 3	0.187711	7.276480	14.26460	0.4570
At most 4	0.000543	0.019010	3.841466	0.8902

Max-eigenvalue test indicates 3 cointegratingeqn(s) at the 0.05 level

Source: Eviews 10 Output.

The cointegration test using Johansen test is presented in Table 3 and it reveals that Trace statistic has 2 cointegrating equations while the Maximum Eigen value has 3 cointegrating equations. This is revealed from the Trace and Max-Eigen statistics values which are greater than the critical values at 5 percent. The study therefore concludes that there is long run relationship amongst the variables.

4.4. Vector Error Correction Mechanism

Having established the order of integration, it was discovered that all the variables are integrated of order one and that is long run relationship amongst the variables, the study

employed the vector error correction model to estimate the parameters of the model. The result is presented in Table 4.

Table 4.4: Vector Error Correction Estimates

	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-1.077129	0.19581	-5.500836	0
CEX(1)	0.935239	0.2796	3.344941	0.0011
REX(1)	-1.184764	0.43014	-2.754389	0.0068
EXD(1)	0.213765	0.08492	2.517316	0.0132
ICT(1)	0.08718	0.15414	0.565584	0.5728
C	271.4911	96.3922	2.816525	0.0057
R-squared	0.669145	S.E. equation		394.0516
Adj. R-squared	0.612101	F-statistic		11.73034
Sum sq. resids	4503024			

Source: Eviews 10. Output.

The result of the vector error correction presented in Table 4 shows that error correcting term shows the right sign and also statistically significant. The value which is -1.0771 implies that about 1.077 percent disequilibrium in the previous years will be corrected for in the current year. The result further shows that capital expenditure has a positive relationship with economic growth. The value of 0.9352 indicates that 1 percent increase in capital expenditure, on average, will increase economic growth by 94 percent in the short run. With this positive value, capital expenditure is capable of creating the infrastructural facilities needed to bolster growth in Nigeria. This conforms to the a priori expectation and also corroborates the findings ofDarma (2014) and John (2017). It is however contrary to the findings of Oyeleke et al. (2016) which established a negative relationship.

The coefficient of the lagged value of recurrent expenditure is -1.1848 and it implies that on average, 1 percent increase in recurrent expenditure will bring about 1.18 percent reduction in the economic growth. The outcome is not surprising as majority of government establishments in Nigeria are not productive but rather receive salaries that do not commensurate with the services they render. This has however resulted in continuous increase in recurrent expenditure than capital expenditure. The findings of this study corroborate the findings of Aluthge et al. (2021) which show a negative impact but support the findings of Danladi et al. (2015).

Furthermore, the coefficient of the lagged value of external debt stands at 0.2138. This suggests that on average, 1 percent increase in external debt will increase economic growth by 0.21 percent. This is possible if the borrowed fund is effectively utilized, otherwise, it will not produce any meaningful results. The outcome of the finding here supports the findings of Sulaiman and Azeez (2012) and Omagbemi (2016) as they both found positive relationship between external debt and economic growth in their study areas.

In the same vein, the coefficient of the information and communication technology (ICT) shows a positive value of 0.0872, which implies that on average, 1 percent increase in ICT will increase economic growth by 0.09 percent. As the world is going digital, investment in ICT is crucial in contributing to economic growth. This conforms to the a priori expectation and also in tandem with the findings of Cheng et al. (2014). It however negates the findings of Akinwale et al. (2018) which exhibit a negative and insignificant impact.

On the statistical significance of the model, the result reveals that, with the exemption of ICT which is not statistically significant, other variables such as capital expenditure recurrent expenditure and external debt are statistically significant at 5 percent level based on their p values which is lower that the critical values at 5 percent. The p values are 0.0011 for capital expenditure, 0.0068 for recurrent expenditure, 0.0132 for external debt and 0.5728 for ICT.

The R-squared value of 0.6691 which is moderately high suggests that 67 percent variations in GDP can be explained by CEX, REX, EXD and ICT, while the remaining 33 percent are explained by the error term. Thus, the model can be used for economic prediction. The F-statistics which is the joint test for significance shows that the variables are jointly statistically significant as the value stands at 11.7303.

4.5. Post-Estimation Diagnostic Tests

The tests are necessary to establish the reliability and validity of the estimates. Thus, the serial correlation and heteroscedasticity tests are conducted.

Table 4.5: VEC Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	20.98710	0.1790

Source: Eviews 10 Output.

The result in Table 5 shows a probability value of 0.1790 which is greater than the critical value at 5 percent. This result indicates that there is no serial correlation in the model. The study therefore accepts the null hypothesis which states that there is no serial correlation in the residual.

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Joint test:		
Chi-sq	**df**	**Prob.**
78.65666	100	0.9434

Table 4.6: VEC Residual Heteroskedasticity Test

Source:Eviews 10. Output.

The heteroscedasticity test in Table 6 reveals a probability value of 0.9434. This is greater than the critical value at 5 percent level and it suggests that there is no heteroscedasticity in the model. Based on this finding, the null hypothesis is accepted and it is concluded that there is no heteroscedasticity in the model.

5. Conclusion and Recommendations.

The study examines how digital economy and fiscal policy affect economic growth in Nigeria, using a time series data from 1986 to 2022. The VECM were employed to check the speed of adjustment of the model. However, the result found that capital expenditure, external debt, and ICT have positive impact on economic growth in Nigeria, while recurrent expenditure has negative impact on economic growth. The result further shows that capital expenditure, recurrent expenditure and external debt are statistically significant, while ICT is statistically insignificant. The post estimation tests carried out suggests that the estimates are reliable and can be used for economic predictions. The study concludes that digital economy and fiscal policy are crucial in contributing to economic growth in Nigeria. Based on the findings, the recommendations are as follows-

i. Government should increase capital expenditure but to the critical sectors that can spur growth in the economy.
ii. Government should make policies that will give room for public sector establishments to generate revenue themselves and pay certain percentage of their workers' salaries. This would propel them to look inward and be more productive and contribute to economic growth.
iii. Government should ensure the effective use of the borrowed funds by setting up committee that will monitor and be accountable for how the funds are expended.
iv. Government should invest in ICT since the world is going digital. It will create a lot of jobs and contribute to economic growth.

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