Tax Revenue, Infrastructural Development and Economic Growth In Nigeria.

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ABSTRACT

Extant literatures have found that tax revenue influence infrastructure and economic growth without considering if infrastructure can possibly affect the tax revenue collected. This study examined the dynamic relationship between tax revenue, infrastructural development and economic growth in Nigeria, using an annual secondary time series data from 1981 – 2018. The unit root properties of the series were examined using both Augmented Dickey Fuller (ADF) test and Phillip Perron (PP) test, while the Johansen Cointegration test was employed to examine if the series are cointegrated. The results reveal that the series are all integrated of order 1 and non cointegrated. To examine the direction of causality and the interrelationship among the variables, a vector autoregression (VAR) causality test was carried out, and a VAR at-first difference model was estimated. The results reveal a unidirectional causality running from tax revenue to economic growth and from economic growth to infrastructure, while a bi-directional causality is found between tax revenue and infrastructural development. Findings from the impulse response results show that while tax revenue influences economic growth and infrastructure, infrastructure does not influence economic growth, but significantly influence tax revenue collected. The study recommends that government should better embrace fiscal responsibility by being more accountable to tax payers in terms of providing infrastructures of higher quality that can truly promote economic growth.

Keywords: Tax Revenue, Infrastructural Development, Economic Growth, VAR.

JEL: H2, H54

1. INTRODUCTION

In all societies of the world a social contract exist between the government and the citizenry that clearly defines the role of the government to the citizens, and the role of the citizens to the state. Government is saddled with the responsibility of enhancing overall welfare, by providing basic infrastructures and ensuring macroeconomic stability. The citizens on the other hand are

expected to contribute to the development of the state by being law abiding and in the payment of tax as at and when due, and in carrying out other obligations as may be defined by the state. Tax revenue represents the aggregate of revenue generated by the government from the administration of all forms of taxation in an economy. It accounts for a great percentage of government revenue besides the revenue generated from the sale of crude oil in Nigeria. Tax revenue is used to finance the bulk of government's capital and recurrent expenditures, especially as it relates to building and maintaining infrastructures and in general, to promote economic growth. Hence, the importance of tax cannot be overemphasized in the Nigerian economy.

Economic growth is the sustained increase in the real output of a nation over time and this requires adequate investment in capital intensive project, which is often regarded as the wheel of economic activity because of the crucial role they play in providing the foundation upon which production and distribution stands (Nedozi *et al.,* 2014). Such investments are usually in terms of providing infrastructures in the economy. Infrastructure represents the basic equipment and structures that are needed for a country, region or organization to function properly, more reason why William Ascher and Corinne Krupp describe physical infrastructure as 'the backbone of any developed economy and a pillar of quality of life. Hence, any nation that seeks to be competitive and to achieve a sustained growth and development must focus on its infrastructural development. This infrastructural development however requires huge fund which can be obtained internally or externally, and one of the ways of raising revenue internally for infrastructural development is through taxation

In Nigeria like other countries of the world, the government needs to generate revenue from tax and other sources for the provision infrastructure such as power supply, good roads for efficient transportation system, healthcare facilities, schools, security of lives and properties and defense against internal and external aggression. The provision and supply of these public services usually serves as an encouragement to tax payers because of its developmental impact inform of improvement in standard of living and a well-functioning economic system. Hence, the level of tax revenue generated is expected to influence infrastructural development on one hand, while the level of infrastructure provided is expected to influence the tax revenue through compliance or willingness to pay on the other hand. Hence, the level of tax revenue generated is expected to determine the level of infrastructure on one hand, while the level of infrastructure provided is expected to influence the tax revenue on the other. This implies that government must be able to encourage and ensure compliance on the part of the tax payers by designing tax plans and administration as well as ensuring the willingness and patriotism of the tax payers. However, the level of compliance and hence, tax revenue that will be generated, is greatly influenced among other things by the level of tax literacy and whether or not the tax payers perceives that the level of infrastructures provided by the government adequately justifies the tax paid.

More so, a good infrastructure can promote and increase business transactions within an economy. For instance, the availability of adequate power supply, good road network and efficient communication system among others can increase the ease of doing business and foster production of goods and services, which ultimately leads to economic growth. On the other hand, the increase in economic growth ensures the availability of funds to government for expenditure on infrastructures and to tax payer for the payment of taxes, showing a connection between tax revenue, infrastructure and economic growth.

Statement of the problem

There is no gain saying that revenue generated from oil has been falling and uncertain in recent time due to fluctuations in the global oil price. The urgent need therefore arises to focus on tax revenue since it constitutes the largest component of non-oil government earnings. To finance the ever increasing infrastructural deficit of the country government needs to generate enough revenue from tax, in addition to the revenue from other sources. Hence, in an attempt to boost tax revenue, the government has embarked on some reforms in the past, which includes: the introduction of the Value Added Tax (VAT) in 1994 and the registering of corporation and entrepreneurs under the Federal Inland Revenue Service (FIRS) among others. These efforts have in the past yielded little or no improvement in the tax revenue that accrues to government. A major reason advanced for this failure is that until more recently, tax administration in Nigeria is seriously characterized by a high level of ineffectiveness and inefficiency, due to noncompliance with tax laws and regulations by tax payers because of weak control, poor tax administration, poor tax education, inconsistent government policies, lack of adequate statistical data and corruption among tax officials (Azubuike, 2009). Consequently, the tax revenue generated over the years has remained grossly insufficient for meeting the increasing infrastructural deficit of the economy and for enhancing the growth potentials.

The Federal government recently improved on the tax policy and administration in Nigeria to increase actual tax revenue when it adopted the electronic tax system which led to the introduction of Taxpayers Identification Number (TIN) to put a check on both the tax payers and the officials. Focus was also shifted to generating more revenue from indirect tax by charging VAT on some transactions that were VAT free and increasing the VAT charged on others. With these efforts, recent tax statistics by FIRS (2019) show that the actual revenue generated from tax has increased above the targeted annually from year 2000 till date. However, the main question is whether the state of infrastructure and economic growth can justify such increase. Despite the increase in tax revenue reported in recent times and the government expenditure on infrastructure reported yearly, the physical state of Nigeria's infrastructure has been very pathetic and this has continued to pose a great concern to all stakeholders in the country. For instance, power supply has been epileptic, roads are bad and have continued to worsen, the structure of public schools and hospitals are very discouraging and there is poor drainage system across the country to mention a few. This condition discourages economic growth and consequently makes the development objectives of the country far from a reality. Hence, the main concern is whether the increase in tax revenue has really translated to infrastructural development and facilitated economic growth.

Extant studies in the literature have revealed that tax revenue as well as infrastructural development is significant in explaining economic growth. For instance, Jerome (2011); Pradhan and Bagchi (2013); Nedozi *et al*. (2014) and Owolabi (2015) reports that the provision of infrastructure significantly affects economic growth. Another strand of study (see inter alia: Garba, 2014; Ayuba, 2014; Arowoshegbe *et al*., 2017; Oshiogbugie & Akpokerere, 2019) finds that tax revenue significantly promotes economic growth. On how tax revenue affects infrastructure, a few other studies such as Inyiama *et al.* (2017) and Ajiteru *et al.* (2018) finds that tax revenue significantly impact of infrastructural development in Nigeria. However, there exist no study in the literature that examines if infrastructure provision can promote the tax revenue generated through increased compliance from the tax payers. More so, to the best of

knowledge, no study has examined the possible impact of economic growth on tax revenue generation and infrastructural development in Nigeria.

Given this background, the objectives of this study are (i) to examine the direction of causality between tax revenue, infrastructural development and economic growth in Nigeria and (ii) to investigate the dynamic relationship between tax revenue, infrastructural development and economic growth in Nigeria. The paper is organized into five sections. Following this introduction is section two which reviews related relevant literatures. Section three focuses on data and methodology, while section four dwells on empirical result and analysis. Section five provides the conclusion and recommendations of the paper.

2. REVIEW OF LITERATURE

Extant literature that examined the role of taxation in the economy attributes to it a lot of functions. Pigou (1920) asserts that taxation corrects for externalities, Ramsey (1927) claims taxation primarily raises revenue and helps in income redistribution. Bakare (2011) buttress that taxation is important for capital formation to augment future output and income i.e., developing an economy requires funds and much revenue is incumbent to plan, implement and sustain the existing infrastructure in the economy. The inability to provide for the required infrastructure engenders adverse effect on economic prosperity. Jerome (2011) corroborates this by claiming that under-developed infrastructure is stunting growth and it mitigates effort to reduce poverty and noted that government remains at the heart of infrastructural service delivery and this requires serious and objective fiscal reform and public sector management.

The importance of infrastructure on economic prosperity comes from its effect on production, consumption and technological advancement among others. Most of these infrastructures are provided by the public sector and it is financed to a large extent through taxation (Duffy-Deno & Eberts, 1989). Garba (2014) added that a country's tax system is central to other macroeconomic indexes, both in developed and developing countries and Adegbie *et al.* (2012) note tax revenue policy to be one of the essential components of development. Nagvi (2003) elaborates on this that taxation influences the types of physical investments that motivate business activities. Also, Akinola (2001) put it forward that through taxation, government ensures resources are channel towards important project in infrastructure to provoke growth and economic prosperity.

Empirically, studies have examined the relevance of tax revenue on infrastructure and the separate impact of tax revenue and infrastructure on economic growth and economic development. Garba (2014) conducted a study on tax revenue and economic growth in Nigeria, using Vector Error Correction Model (VECM) and found a significant relationship between tax revenue and economic growth. Decomposing the tax structure, the study found only petroleum tax, company income tax and value added tax as positively influencing growth, while custom and excise duties show an indirect relationship. In a similar study by Arowoshegbe *et al.* (2017) conducted using Ordinary Least Square (OLS) it was also discovered that both petroleum tax, company income tax positively influence growth in Nigeria. On the contrary, Adegbie *et al.* (2012) found custom and exercise duties to significantly contribute to growth and development in Nigeria.

Owolabi-Merus (2015) empirically investigates infrastructural development and economic growth nexus in Nigeria within the period of 1983 and 2013. The study adopted OLS and

granger causality econometric techniques and found that infrastructural development is significant and has a positive impact on economic growth. This finding corroborates the assertion of Romer (1987) and Lucas (1988) that economic prosperity can only be achieved by increasing capital accumulation. Also, it supports the report of Nedozi *et al*. (2014) who investigated infrastructural development and economic growth in Nigeria, using simultaneous equation model. Jerome (2011) examined infrastructure, economic growth and poverty reduction in Africa and found out that not only is Africa experiencing infrastructural deficit, but there is also poor maintenance of the existing ones which put them in a dismal situation and further compound the problem of economic growth and development in the region. Pradhan and Bagchi (2013) on the effect of transportation infrastructure on economic growth in India, using the VECM approach present a bi-directional causality both between transport infrastructure and economic growth as well as gross domestic capital formation and economic growth.

Similarly, Kamuri and Sharma (2017) conducted a study on physical and social infrastructure in India and its influence on economic development between the period of 1995 and 2013. They adopted unrestricted Vector Autoregressive (VAR) Model and granger causality and discovered both economic and social infrastructures have a positive linkage with economic growth in the country. In China, Shi *et al.* (2017) on the other hand, reported a U-shape relationship between infrastructural investment and growth, while looking at the role of infrastructural capital on China's regional economic growth, using VECM technique. They argue for crowd-out of private capital when infrastructural investment becomes too dominant.

Some studies have also reported that tax revenue significantly affects infrastructures in Nigeria. Inyiama *et al.* (2017) examined the effect of Federal Government of Nigeria's tax resources on infrastructural development in Nigeria. The research adopted ex-pos-facto research design as secondary data covering the period of 2006-2015 were used for the analysis. Using a multiple linear regression technique, the result reveals that tax revenue resources had positive and insignificant effect on infrastructural development in Nigeria. In agreement with this finding, Ajiteru *et al.* (2018) investigated the effect of tax revenue on infrastructural development in Osun state, using a survey data and found tax revenue to be a very strong tool for infrastructural development in the state. They identified that the inability to raise tax might lead to underdevelopment in the region. From the review of literature, studies have looked at the effect of taxation on infrastructural development, effect of taxation on growth as well as the effect of infrastructural development on economic growth and development, using various estimation techniques, but to best of knowledge, no study have examined the dynamic relationship between tax revenue, infrastructural development and growth. This study seeks to explore this gap by investigating the interrelationship between tax revenue, infrastructural development and economic growth in Nigeria.

3. MATERIALS AND METHODS

Theoretical Framework

Following Ayuba (2014) and Inyiama *et al.* (2017), this study is anchored on the Benefit Received Theory as propounded by Erik in 1919. The theory assumes that citizens tend to pay more taxes when they feel they have sufficient benefits from the activities of the state. This means that people are motivated to pay tax when they perceive that the tax they pay to the

government is actually been used for their own benefit in the form of building infrastructure and promoting economic growth. Hence, this theory is relevant to this study as it evaluate the benefits of tax just as measured by the capital infrastructure provided by the state and the level of economic growth.

Model specification

In order to capture the interrelationship between tax revenue, infrastructural development and economic growth in Nigeria, a vector autoregression (VAR) model is specified. The VAR(p) model as developed by Sims (1980) is specified as:

$$Y_t = a + A_1 Y_{t-1} + A_2 Y_{t-2} + A_p Y_{t-p} + \xi_t \quad (1)$$

where: $Y_t = (y_{1t}, y_{2t}, \ldots, y_{nt})$: is an (nx1) vector of time series variables. a: is a fixed (nx1) vector of intercepts. A_i (i=1, 2,…,p): are fixed (nxn) coefficient matrices. ε_t: is an (nx1) vector of uncorrelated error term (white noise).

The VAR(p) model for this study is specified as VAR-in-first-difference following the stationarity properties I(1) and the non-cointegration of the series (see Table 1 & 2 below) as follows:

$$\Delta TAXREV_t = \theta_1 + \sum_{i=1}^{p} \alpha_i \Delta TAXREV_{t-i} + \sum_{i=1}^{p} \beta_i \Delta INFRD_{t-i} + \sum_{i=1}^{p} \delta_i \Delta RGDP_{t-i} + \xi_{1t} \quad (2)$$

$$\Delta INFRD_t = \theta_2 + \sum_{i=1}^{p} \alpha_i \Delta TAXREV_{t-i} + \sum_{i=1}^{p} \beta_i \Delta INFRD_{t-i} + \sum_{i=1}^{p} \delta_i \Delta RGDP_{t-i} + \xi_{2t} \quad (3)$$

$$\Delta RGDP_t = \theta_3 + \sum_{i=1}^{p} \alpha_i \Delta TAXREV_{t-i} + \sum_{i=1}^{p} \beta_i \Delta INFRD_{t-i} + \sum_{i=1}^{p} \delta_i \Delta RGDP_{t-i} + \xi_{3t} \quad (4)$$

Where TAXREV is tax revenue proxy by aggregate net tax returns, INFRD is infrastructural development proxy by government's capital expenditure, RGDP is real gross domestic product used as proxy for economic growth, θ_i are the intercepts, $\alpha_i, \beta_i, \delta_i$ are the coefficients of tax revenue, infrastructural development and economic growth respectively. P is the number of lags and ξ_{it} (i=1,2,3) is the stochastic error term with zero mean and a constant variance.

Nature and source of data

This study adopted an ex-post facto research design since the data for the study is an already existing or established data. Specifically, annual time series data on government expenditure on infrastructure, tax revenue and economic growth covering a period of 37 years from 1981-2018 were sourced from the Central Bank of Nigeria (CBN) statistical bulletin, and the World Development Indicator (WDI).

Unit root test

Macroeconomic time series data are characterized by unit root problem, which usually results in a spurious regression, Hence, the Augmented Dickey-Fuller (ADF) and the Phillip Peron (PP) test are combined to test the unit root properties of the series, for a robust result. The ADF (Dickey & Fuller, 1981) test adopted in this study is specified with time trend as follows:

$$\Delta Z_t = \alpha_1 + \alpha_2 t + \alpha_3 Z_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Z_{t-1} + \xi_t \quad (5)$$

Where: $\Delta Z_t = Z_t - Z_{t-1}$, 'p' is the number of lags in the dependent variable, ε_t is the stochastic error term. The null hypothesis to be tested is non stationarity, against the alternative hypothesis that stationarity exist. The Phillip Perron (PP) test (Phillip & Perron, 1988), test the null hypothesis that the series are integrated of order 1. An advantage of the PP test over the ADF is that it is non-parametric and hence, does not require the selection of serial correlation as is the case with ADF test. In both tests, we reject the null hypothesis if the test statistic is less than the critical value in real terms. The optimum lag length in the ADF regression ensures that the residuals are not to be serially correlated and should imitate a white noise process. The null hypothesis for this test is that the variables; TAXREV, INFRD and RGDP possess unit root, while the alternative hypothesis test the absence of unit root in the variables.

Cointegration test

A precondition for the test of causality is for a long run relationship to exist among the variables of the study, hence, following the unit root test which shows the stationarity property of the series, the study employed the Johansen cointegration test to examine the long run relationship among the variables. Johansen and Juselius (1990) developed the trace test statistic and the maximum eigen-value test statistic for detecting the number of cointegrating vectors. This is defined in eq(6) and eq(7) respectively as:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} Log(1 - \hat{\lambda}_i) \quad (6)$$

$$\lambda_{\max} = -TLog(1 - \hat{\lambda}_{r+1}) \quad (7)$$

Where λ_i is the eigen-values and T is the total number of observations. The null hypothesis for the trace test statistic is that the number of distinct cointegrating relationships is less than or equal to 'r' against the alternative hypothesis that it is more than 'r'

4. EMPIRICAL RESULTS

Unit root test result

The result of the Augumented Dickey-Fuller (ADF) test and Philip Peron (PP) test employed both at level and then first difference to test for the stationarity of each of the series is presented below.

Table 1: Unit root test

	ADF		PP		
variables	levels	first difference	levels	first difference	remarks
lrgdp	-2.4213	-3.2593	-2.5665	-3.1798	I(1)
ltaxrev	0.7498	-4.158	0.428	-3.7553	I(1)
linfrd	-1.2093	-6.1929	-1.3315	-6.1563	I(1)

Source: Researcher's computation using Eviews 9.0

Table 1 above shows that for both types of unit root test employed in the study, all the variables are not stationary in their level form since the test statistic could not reject the null hypothesis of non stationarity at 5 percent level, suggesting that stationarity be checked at a higher order differencing. The results higher order differencing reveal that the series became stationary at first difference. Hence, since the variables are integrated of the same order I(1), it becomes important to seek if a long-run relationship exist among the series using a cointegration test.

Cointegration test result

The result of the Johansen and Juselius (1990) cointegration test using both trace statistic and the max-eigen value statistic as employed in this study is presented in Table 2 below.

Table 2.Cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value
None	0.417	27.064	29.797	0.417	18.872	21.132
At most 1	0.166	8.192	15.495	0.166	6.372	14.265
At most 2	0.051	1.820	3.841	0.051	1.820	3.841

Source: Researcher's computation using Eviews 9.0

Table 2 above shows the cointegration test conducted to ascertain if a long-run relationship exists among the series. Considering the results of the trace and the max-eigen statistic, no long-run relationship exists among the series, because both the trace and the max-eigen statistic fall short of the critical value at 5 percent. This might not be an entirely surprising result owing to the nature of Nigeria's infrastructure. These infrastructures are either of low quality that wear away in a short time or lack adequate maintenance to keep them in production for a long time. Examples can be found in Nigeria's road network, refineries, to mention a few.

VAR Lag Order Selection Criteria

Table 3 below shows that the lag order selection criteria (i.e. LR, FPR, AIC, SC and HQC) were unanimous on 1 as the optimal lag of the model. Therefore, the model is estimated as VAR(1) after which the parsimony was achieved as reported below

Table 3. Lag order selection

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-99.6261	NA	0.0840	6.0368	6.1715	6.0827
1	60.2478	282.1305*	1.18e-05*	-2.8381*	-2.2994*	-2.6544*
2	64.6019	6.9152	1.57E-05	-2.5648	-1.6221	-2.2433
3	69.3504	6.7039	2.09E-05	-2.3147	-0.9679	-1.8554
* indicates the optimal lag selected						

Note: LogL is LogLikelihood, LR is sequential modified LR test statistic, FPE is Finite Prediction Error, AIC denotes Akaike Information Criterion, SC is Schwarz Information Criterion and HQC is Hannan Quinn Criterion.

VAR Causality result

To capture the first objective of this study, which is to examine the direction of causality between TAXREV, INFRD and RGDP, the causality result based on the vector autoregression is presented in Table 4 below.

Table 4: Causality Test

VAR Granger Causality Test			
Null Hypothesis	chi-sq	prob	causality flow
lrgdp ≠›ltaxrev	2.3209	0.888	ltaxrev→lrgdp
ltaxrev≠›lrgdp	11.209	0.082	
lrgdp≠›linfrd	15.361	0.0176	lrgdp→linfrd
linfrd≠›lrgdp	5.6243	0.4666	
linfrd≠›ltaxrev	13.321	0.0382	linfrd↔ltaxrev
ltaxrev≠›linfrd	21.979	0.0012	

Source: Researcher's computation using Eviews 9.0

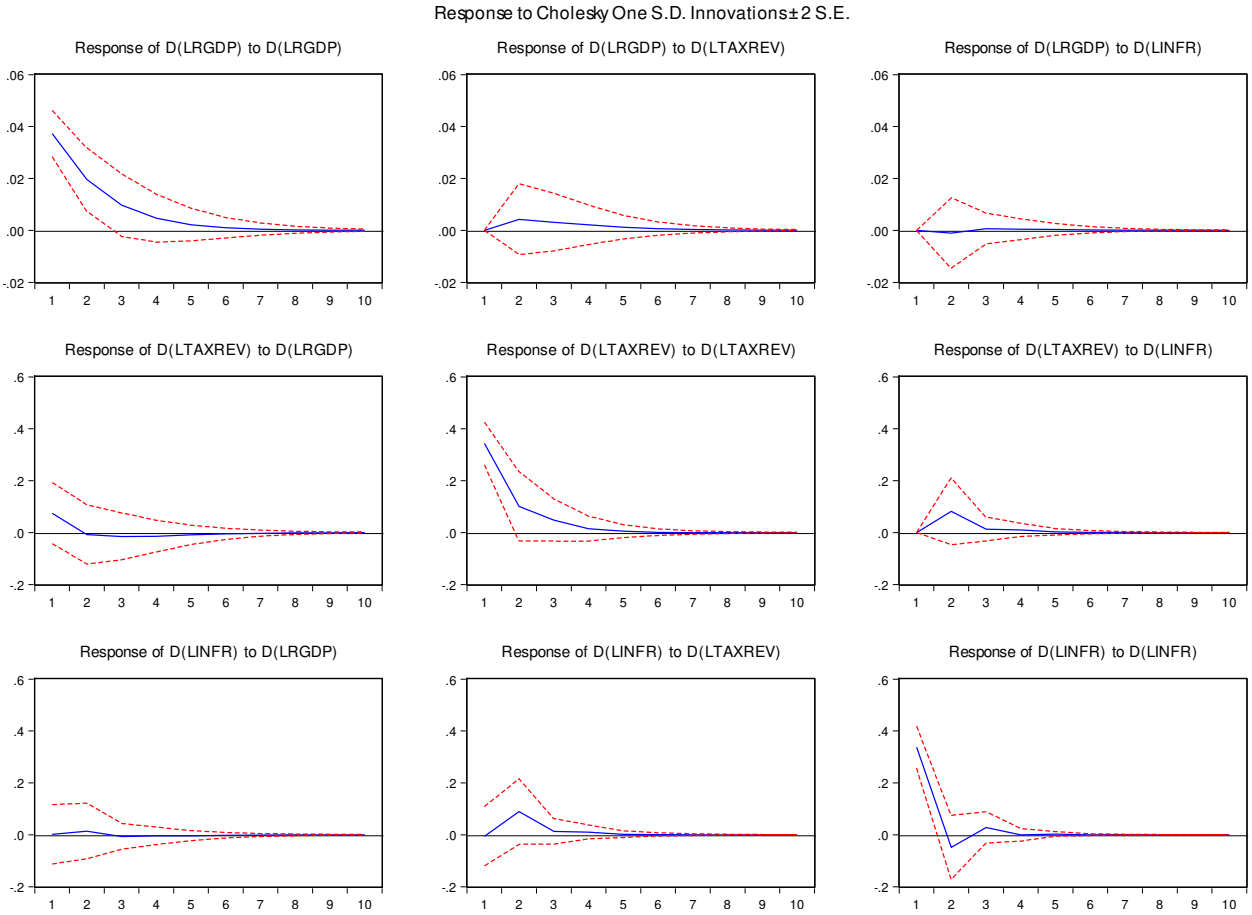
Table 4 present the causality result among tax revenue (ltaxrev), infrastructural development (linfrd) and economic growth (rgdp). The results reveal a uni-directional causality flowing from tax revenue to economic growth, a uni-directional causality flowing from economic growth to infrastructure and a bi-directional causality between infrastructure and tax revenue. The implication of this result is that tax revenue is an important factor in predicting changes in national output and changes in national output significantly predicts the level of infrastructural development. For infrastructure and tax revenue, they are both important in predicting changes in each other.

Impulse Response Result

The impulse response result derived from the estimation of the VAR at-first-difference model specified in eq(2) – eq(4) is presented in the Figure 1 below. The impulse response plots describe the response of each of tax revenue (TAXREV), infrastructural development (INFRD) and economic growth (RGDP) to a one standard deviation shock in one another. The plots perfectly support the cointegration result of no long run relationship and the VAR causality result presented in Table 2 and 4 above respectively. There are nine impulse response plots presented,

which shows the evolution of each of the variables of interest along a specified time horizon, in terms of how they are affected by one standard deviation shock to one or more of the other endogenous variables in the system.

Figure 1: Impulse Response Result



Interestingly, the impulse response plots in Figure 1 above reveal that response of all the endogenous variables to one standard deviation shock in the innovations is only in the short run. This is so because the impulse response plot for each seizes to react to shock and reverts to equilibrium (zero line) after the 3rd period. It therefore supports the cointegration result of no long run relationship among the variables.

The response of real gdp to one standard deviation shock to taxrev was positive as the plot lie above the zero line. In reaction to the shock, real gdp increased slightly from 1st to 2nd period, falling gradually thereafter in a nonresponsive manner till is reverts to equilibrium at the 6th period. This means that increase in tax revenue will boost economic growth in the short run. On the response of real gdp to one standard deviation shock to infrd, the plot lie almost entirely on the zero line from the 1st period. It depicts that infrastructure has not significantly influence growth, both in the short run and the long run.

Taxrev responded to one standard deviation shock to real gdp positively, falling sharply from 1st to 2nd period. Thereafter, it became slightly negative and nonresponsive up to the 5th period,

when it reverts to equilibrium. This shows that an increase in the real national output will contribute to the increase in tax revenue in the short run. Also, taxrev respond positively to shock to infrd, by increasing sharply from 1st to 2nd period and the falling sharply to revert to equilibrium line in period 3. It depicts that improving the state of infrastructures in the economy can positively affect tax revenue in the short run.

The plot showing the response of infrd to one standard deviation shock to real gdp lie on the zero line through the time horizon, but was very slightly positive only in period 2. This means that economic growth have a slightly positively and one time effect on infrastructural development in the short run. The response of infrd to one standard deviation shock to taxrev reveals that infrd respond positively to shock to taxrev, by increasing sharply from 1st to 2nd period and the falling sharply to revert to equilibrium line in period 3. It shows that increase in tax revenue will improve the state of infrastructures in the economy in the short run

Post-Estimation diagnostic Results

Before the empirical results can be used for forecasting and policy formulation purpose, it is essential to subject it to a post estimation test which indicates the adequacy of the model in terms of the reliability of its estimates for inference purpose. Table 5 below presents the results of heteroskedasticity test and serial correlation test, while the parameter stability test is presented in Figure 2.

Table 5: Post-Estimation Test

heteroskedasticity test	Chi-sq	df	Prob.
	23.44613	36	0.947
serial correlation test	Lags	LM-Stat	Prob
	1	6.647981	0.6737

Source: Researcher's computation using Eviews 9.0

Table 5 above shows the result for both heteroskedasticity and serial correlation test for the VAR model. The null hypothesis for both tests states that there is no heteroskedasticity and serial correlation in the model. With probability values of 0.95 and 0.67 for heteroskedasticity and serial correlation respectively, there is no sufficient evidence to reject the null hypothesis of no heteroskedasticity and serial correlation.

Figure 2: Parameter Stability Test

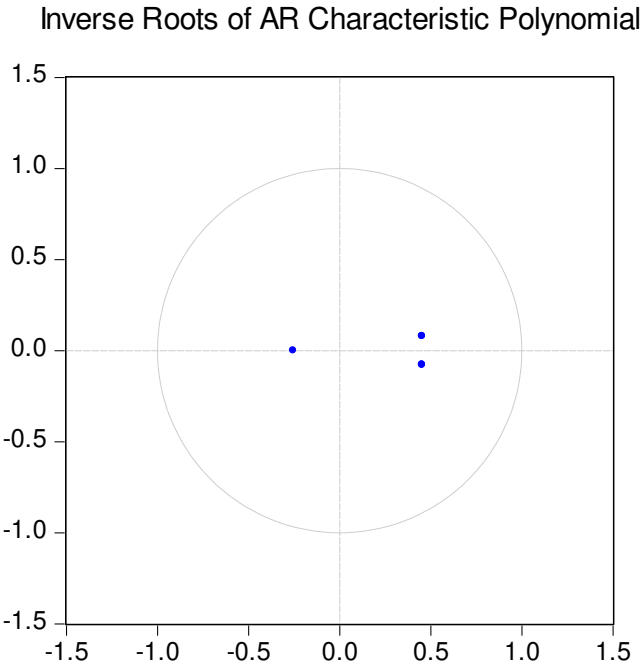


Figure 2 above test for parameter stability in the VAR model. The model is stable if all points fall with ±1 of the inverse roots of AR characteristic Polynomial. Hence, the figure above establishes that the parameters in the model are stable. This means the results of the impulse response function is valid.

5. CONCLUSIONS AND RECOMMENDATIONS

This study examined the interrelationship between tax revenue, infrastructural development and economic growth in Nigeria using the vector autoregression model. The unit root results shows that all the variables are integrated at order one – I(1), while the cointegration result showed that there is no existence of long run relationship among the variables. Hence, a VAR-at-first difference model was estimated.

The empirical findings from the VAR causality analysis reveal that a uni-directional causality runs from tax revenue to economic growth, and from economic growth to infrastructure. It also reveals a bi-directional causality between tax revenue and infrastructure, meaning that both tax revenue and infrastructure causes each other in Nigeria.

The impulse response results reveal that economic growth and tax revenue respond positively to shock in each other. This means that increase in tax revenue generated will increase government's recurrent and capital expenditure which in turn promote growth and expansion of economic activities in the country, leading to economic growth. Moreover, the growth and expansion of economic activities will increase tax base by increasing the income of tax payers and this creates an avenue for the government to collect more tax, leading to an increase in tax revenue. This findings support those of Garba (2014), Arowoshegbe *et al.* (2017) and Oshiogbugie and Akpokerere (2019), which finds tax revenue to be significant in influencing economic growth.

Contrary to the findings of Jeromi (2011), Pradhan and Bagchi (2013) and Owolabi-Merus (2015), this study finds that government expenditure on infrastructure has not been growth enhancing since infrastructural development does not affect economic growth in Nigeria. However, economic growth slightly influence infrastructure. Among the other reasons that can be advanced for this is the very poor quality of infrastructure provided and the fact that infrastructure expenditure figures are usually inflated and does not reflect the reality.

The findings from our empirical results further show that tax revenue positively influence infrastructural development. This corroborates the findings of Inyiama *et al.* (2017) and Ajiteru *et al.* (2018). Also, based on the results, infrastructural development significantly influences the level of tax revenue in Nigeria. This is a pointer to the fact that generating adequate revenue from tax is important for building infrastructure and promoting economic growth and development in the country. An interesting but not surprising discovery from the result is that tax revenue collection is likely to be significantly influenced by the level of infrastructural development in the economy. A possible explanation for this is that beyond improving tax laws, the provision of good infrastructure in terms of quality and quantity seems to motivate and encourage tax payers, thereby leading to greater tax compliance, which consequently reduce tax evasion.

Based on these findings, it is recommended that the government should embrace fiscal responsibility and accountability by efficiently and effectively utilizing the tax revenue in providing the needed and quality infrastructure for the citizens. This is highly potent in enhancing the citizen's voluntary compliance to tax laws, and will improve government tax revenue, promote the development of infrastructures and enhance economic growth that translates into economic development.

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