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Causal Relationship Between Economic Growth and Government Tax Revenue: A Case of Nigeria (1970-2021)

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Abstract

This paper aims at elucidating the mystery surrounding the belief that, high and vibrant economic activities and economic growth are a prima-facie and a leading indicator for high tax revenue as a source of income for the Federal government in Nigeria. The effects of economic growth on government tax revenue are therefore empirically investigated from 1970-2021. The short-run and long-run relationships between the economic growth in Nigeria and its tax revenue are thus explored in this study. Although, theoretical and empirical reports found that there is a causal relationship between economic growth and tax revenue; this study thus further investigated this relationship by applying Johansen's cointegration test, autoregressive distributed lag (ARDL), and Vector Error Correction Model (VECM) to establish the short and long-run relationships that may exist between economic growth and government tax revenue. However, the findings of this study clearly showed that there is an independent relationship between economic growth and government tax revenue with a 76% speed of adjustment. Thus, there is a unidirectional relationship between economic growth and total government tax revenue with a 74.76% speed of adjustment in the short run to reach an equilibrium level in the long run. This implies that there is fiscal independence between economic growth and tax revenue. The empirical analysis also provides evidence of a long-run equilibrium relationship. Based on the findings that GDP, exchange rate, and production capacity strongly and positively affect the performance of tax revenue in Nigeria. The study recommends among others that

appropriate fiscal policies be put in place to moderate the fluctuations in exchange rates of the Naira against other foreign currencies and that the government should support innovative activities by youths through the creation of innovative labs. This would help to create more job opportunities for the youths and also encourage public and private partnerships between the state governments and private investors to improve the economic activities of the country, which will in turn bring about increased tax revenue.

Keywords: Economic Growth, Tax Revenue, Tax Policy, GDP,

1. Introduction

Todaro and Smith (2006) describe economic growth as "the steady process by which the productive capacity of the economy is increased over time to bring about rising levels of national output and income." The growth rate is affected by macroeconomic policies, such as taxation, consumption, and investment. A tax is a compulsory payment from firms and households to the government (Ortiz-Ospina and Rosa, 2016; Sahin et al, 2014). According to the Doing Business Report of the World Bank in 2020, Nigeria was located 131st globally, for the simplicity of conducting business. Thus, it corresponds to a rise from the 149th ranking in 2019. The government has boosted developments in many subcategories like commencing work, handling construction authorizations, obtaining electrical power, inscribing the estate, commerce beyond the boundaries, and carrying out deals (Demirbas et al, 2022; Can et al, 2022). Every tax must be based on a valid statute. If there is no valid statute, no legitimate tax can be imposed (Farayola, 2019). It is a financial charge or other levy imposed upon a taxpayer (an individual or legal entity) by a state or the functional equivalent of a state. Tax is usually considered a major source of government revenue for the funding of various public expenditures (Edame and Okoi, 2014; Can et al, 2015). Neoclassical growth models, to an extent, define the long-term rate of growth of a country through labour supply and its technical progress (Tobin, 1955; Solow, 1956). However, it fails to make any reference to the effects of the tax on economic growth, even though the tax is believed to affect a country's economic growth and should be considered in any economic growth model. Chandril (2014) and Stoilova, (2019) Alani (2017) opined negative effects of taxation on human capital accumulation, whereas, previous studies, suggested negligible or even positive effects; more specifically, it alleged that one percentage point increase in income tax causes long-run stock of human capital to decline by 0.97 percent under the most plausible set of parameters.

Studies reveal that any changes in policy that leads to an increase in tax burden distort economic growth, Auerbach and Smetters (2017). The inverse relationship between tax and economic growth has been established by the supply-side hypothesis. Tax hikes, in particular, have a considerable negative influence on economic growth. Therefore, economic allowances typically coincide with a willingness to support business development with tax breaks; this helps ensure a more equitable taxation system, whereas the others create deviations from the equity principal observation. They do, however, complicate the taxation system and raise administrative costs in any case. As a result, general tax imposition principles are naturally competitive, to the point where no country can be independent in the formulation of taxation policy, because it must consider international

competitiveness in the attraction of capital and investment. Hence, there is, at least, a minimum necessity to introduce such tax reliefs, which would promote prerequisites for the attraction of investments in competition with other countries, (Andrejeva, 2008; Can, & Sagbansua, 2015). Studies have shown that the effects of taxation vary according to the local market conditions (Lin, Li, Hsieh and Huang, and Chen 2018). In this context, it is clear that the level of taxation is the only constant factor that contributes to the formation of the return, at least in the short term. This is a factor that could (even with small oscillations) act as a flywheel or a curb for the demand for product/service, which is undoubtedly true for the part that contains the prevailing economic component under the strong elasticity that it shows in proximity to an expected rate of return close to the rate of alternative investments (Berto, Cechet, Stival, and Rosato, 2020).

Gurdal, Aydin, & Inal, (2021) studied the relationship between tax revenue, government expenditure, and economic growth. The study examined Canada, France, Germany, Italy, Japan, the UK, and the USA—the G7 countries using annual data from 1980 to 2016. To conduct a comparison, the study used two alternative panel causality techniques. According to the results of the time domain panel causality test, there is bidirectional causation between economic growth and government spending but unidirectional causality between tax revenue and government spending. Furthermore, there is no link between economic growth and tax revenue.

Tanchev's (2021) study analyzed the relationship between personal income tax and economic growth in the long and short runs to show which type of income tax (progressive or proportional) is more compatible with Bulgaria's economic growth. The Vector Error Correction and Correlation methods were used to calculate the long-run and short-run effects of the two types of income tax. The study spans from the first quarter of 1999 to the first quarter of 2020. Data from Eurostat (85 observations) were used. The empirical study was separated into two eras. The long-run and short-run correlations between economic growth and progressive income tax revenue in Bulgaria were explored first, followed by the relationship between economic growth and proportional income tax revenue. Personal income tax and economic growth have a long-run equilibrium link, but not a short-run relationship, according to the research findings. The findings show that in the long run, a progressive income tax is more consistent with economic growth than a proportional income tax in Bulgaria. In the short run, neither the progressive nor proportional income taxes have statistically meaningful associations with economic growth. As a result, a progressive income tax stimulates economic growth more than a proportional income tax. From the standpoint of long-run equilibrium, Bulgaria's income tax should be altered from proportional to progressive.

Lee and Gordon in YadawanandaNeogandAchal Kumar Gaur (2020) investigated the link between tax structure and economic growth. The study's goal was to look into how tax policies affect a country's growth rate. The researchers analyzed cross-country data from 1970 to 2019. The study discovered a negative significant relationship between corporate tax rates and differences in economic growth rates. Furthermore, the results revealed that increasing corporate tax rates caused countries' future growth rates to decrease. Macek (2020) investigated the impact of taxes on economic growth in a study focusing on OECD countries. A multivariate regression model was used in the study to represent the relationship between the dependent and explanatory variables. The study runs from 2000 to 2018. Personal income tax, corporate income tax, social security contributions, and VAT were all tax factors, while GDP, capital accumulation, human capital, and government

spending proxied economic expansion. The study found that corporate income taxes have a statistically significant effect on economic growth.

Ozpence& Mercan (2020) studied the relationship between tax revenues and economic growth, which is the multiplier mechanism, showing that an increase in tax revenues harms economic growth. The study employs VAR analysis and to explore the relationship between tax burden and economic growth, the Granger causality test is used. Methodology: This study employs VAR analysis as well as the Granger Causality test. The analysis in the paper is for Turkey. The study makes use of annual data that spans the years 1970 to 2018. The study begins with VAR analysis and then moves on to the Granger Causality test. According to the VAR analysis, the tax burden reduces third-period growth. According to the Granger Causality test, taxation and economic growth are mutually reinforcing. Conclusion - The data indicate that the tax burden has a detrimental impact on economic growth. As a result, raising tax rates will have a detrimental influence on economic growth, and vice versa. It would be a more favorable effect if politicians decreased their tax rates rather than raised them.

Relating the finding by Oladipupo and Ibadin (2020) to economic growth in Nigeria implies that indirect taxes may not affect economic growth through the channel of infrastructure development. While such findings are intriguing, they call into question the importance of tax revenues in improving welfare by addressing Nigeria's inadequate and almost non-existent infrastructure for the benefit of the Nigerian people. Thus, Oladipupo et al (2020) recommended that the Nigeria Government should make judicious use of tax revenue for the economic development of the nation, provide infrastructural facilities that will improve the welfare of the general populace, and alienate their suffering.

Agunbiade and Idebi (2020) paper examined the relationship between tax revenue and economic growth in Nigeria over the 1981–2019 period, with a special focus on Companies' Income Tax, Value Added Tax, and Petroleum Profits Tax. The data were sourced from the National Bureau of Statistics (NBS) and the Federal Inland Revenue Service (FIRS). The study employed the Vector Error Correction Model (VECM) to establish the nature and strength of the relationship between taxation and economic growth. The Johansen test of cointegration reveals that there is at least one cointegrating equation in the long run between the variables. The Granger causality test found a causal relationship between real GDP and the different tax components. The impulse response functions and the variance decomposition analysis uphold the findings that the impact of the shock in the indirect tax (VAT) and direct tax (CIT and PPT) on GDP growth do not die out over the specified period under consideration. Variance decomposition analysis found that the effect of the shock to the direct tax (CIT and PPT) on GDP growth tends to be low, whereas the effect of the shock to the indirect tax (VAT) on GDP growth tends to be significantly increased over the period.

Worlu and Nkoro (2019) studied the relationship between tax revenue and economic development in Nigeria covering a period of 37 years spanning from 1980 to 2017 focusing on infrastructural development. The study relied on secondary data obtained from the Statistical Bulletin of the Central Bank of Nigeria (CBN), the Federal Inland Revenue Service (FIRS), and pertinent articles. The three-stage least squares estimation technique was used for the analysis. Tax revenue, according to the studies, supports economic growth by subsidizing infrastructure development. Furthermore, the study found no independent relationship between tax revenue and

economic growth as a result of FDI and infrastructure development.

Adereti, Adesina, and Sani, (2019) examined the relationship between Value Added Tax and economic growth in the Nigerian economy. The study used time series data from 1994 to 2018 on the dependent and Independent variables that include GDP, VAT revenue, total tax revenue, and total federal government revenue. The methodology of the study is made up of a mix of Statistics that can be descriptive or inferential. The study's findings suggest a positive relationship between VAT revenue and GDP (GDP).

Arisoy and Unlukaplan, (2019) carried out a study on the effect of direct-indirect tax on the economic growth of Turkey within the period from1968 to 2016. Their findings reveal that actual output is positively related to indirect tax income, whereas direct tax has no effect. Taha, Šliogerienė, Loganathan, Jokšienė, Shahbaz, and Mardani (2018) established the plausibility and the dynamic nexus between financial developments, economic growth, and tax revenue in Malaysia. Given the global economic insecurity that has hampered progress, an examination of these relationships is critical. In this investigation, annual time series data spanning the years 1970 to 2015 was used. It was discovered that substantial evidence existed of a link between each of the variables studied using advanced co-integration and causality analyses. The findings of this study gave evidence for Malaysia's tax-growth nexus. Financial development and tax collection have an inverted U-shaped relationship, but the economic condition has a U-shaped association. The link between economic growth and tax revenue strengthens fiscal policies in the development of transparent and mature financial systems, which increased government revenue collection in Malaysia. The findings of this study may help more researchers and policymakers understand the nature of the link between the factors studied and aid in the creation of new policies for economic sustainability.

Mirovic and Andrasic (2017) conducted a study in the United States of America and examined the effect of taxes on economic growth. The research lasted 20 years, from 1996 to 2016. Personal and corporate income taxes were utilized as tax revenue proxies, while GDP growth and Social Security Contributions on GDP were employed as economic growth proxies. In data analysis, the study used a correlation matrix and other relevant statistical techniques. There is no statistically significant association between Company Income Tax and GDP, according to the research.

Zeng, Li and Li (2013) paper studied the mechanism of how economic growth and tax reform affect total tax revenue and structure over the period (1950 to 2011). Based on the introduction of China's previous main measures in tax reform, the paper uses methods such as descriptive statistics, multi-segment linear regression model, and principal component analysis to analyze how economic growth and tax reform affect the total tax revenue and structure mainly from three aspects as the total amount of the tax, the value-added tax and the corporate income tax, which are under the background of tax reform. The empirical results show that economic growth not only has a significant impact on the total tax revenue and structure changes but also has a long-term stable relationship with total tax revenue. And in a long term, there is no extraordinary growth in tax revenue. In addition, every tax reform shows a clear impact on the tax structure, while the impact of changes in the total tax revenue is diminishing over time.

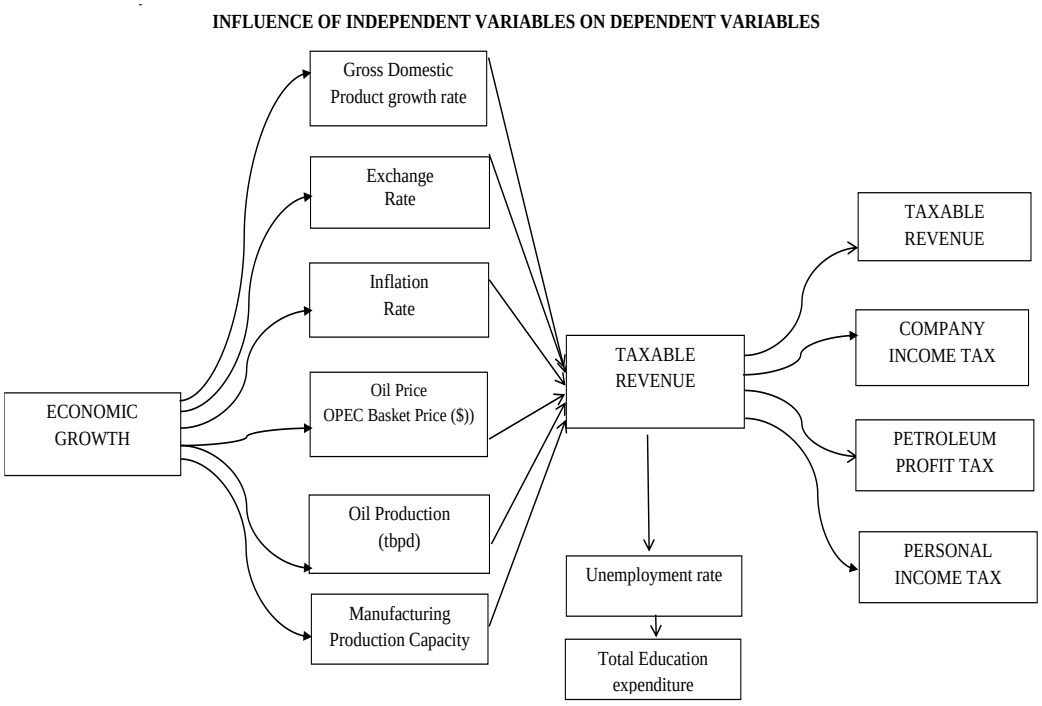
Tosun and Abizadeh (2007) study examined empirically the changes in the tax mix of the OECD countries in

response to economic growth from 1980 to 1999. Economic growth, as measured by GDP per capita, has been proven to have a considerable impact on the tax mix of OECD nations. According to the analysis, different taxes react differently to the development of GDP per capita. While the shares of personal and property taxes have increased in response to economic expansion, the shares of payroll and goods and services taxes have decreased.

1.1 Empirical Gaps

Agunbiade *et al* (2020), Oladipupo *et al* (2020), Worlu *et al* (2019), Adereti (2019), Akwe (2019), and many more authors have examined the relationship between economic growth and taxable revenue in Nigeria mostly able to identify the positive/negative and significant/insignificant impact between economic growth and tax revenue, but they failed to link tax revenue as a major source of revenue generation required to stimulate economic growth and development. There have been reviews in China and other Asian countries where Taxable revenue was used as a major driver of growth but few types of research have been conducted on Nigeria and this study seeks to fill that gap. Therefore against this backdrop that this paper intends to shed more light on the true impact of economic growth on total taxable revenue in Nigeria, thus suggesting the policy instrument the Nigeria government will target to achieve the ultimate goal of revenue generation through tax revenue and at the same time maintain stable economic growth.

2.1 Conceptual Review



Source: Author's Creation (Sike, 2022)

Figure 2.1: Conceptual Model

The above model demonstrates the causal relationship between the explanatory (independent) variables (Gross domestic product growth rate, Exchange rate, Inflation rate, Oil Price, Oil production, manufacturing production capacity) of economic growth indicators and the explained variable (Tax Revenue) with unemployment and education expenditure as the control variable.

2.2 Theoretical Frameworks

This study adopts Wagner's theory on Tax, being the most appealing to the objectives of the study. The law of increasing state spending was propounded by German economist Adolph Wagner (1835- 1917). He posited that an increased share of public expenditure in the Gross National Product would accompany the development of an industrial economy. With the growth of an economy, new functions and activities emerge and are taken up by the government, while existing economic operations are carried out thoroughly.

Wagner's law implied that there is a functional relationship between economic growth and the growth of government sectors, which tend to increase public expenditure (Anyanwu 2018). Wagner highlighted certain forms of government activities that lead to increasing public expenditure such as, keeping law and order, participation in the production of economic goods including the provision of certain social products, increase in demand for public goods, urbanization, and pressure on social amenities, social security, and provision of welfare. (Nnamocha 2021) in Ajudua *et al*, 2019). In their research of public expenditure in the United Kingdom between 1891 and 1955, Wiseman and Peacock advanced a hypothesis concerning the growth of government spending. They posited that government expenditure increases in a jerk and step-like manner rather than at a steady, continuous rate (Ajudua et al, 2019). An interpretation of the theory based on the absolute expansion of public spending has been used. This has been utilized to formulate six different versions of the law (Mann, 1980): the traditional version by Peacock et al (1967) PE=f(GDP), where PE is public expenditure and GDP is gross domestic product; Pryor's version (1968), C=f(GDP) where C is consumption expenditure; the version by Goffman (1968), PE=(GDPcap) where GDPcap is the gross domestic product per capita; the version by Musgrave (1970), PE/GDP=f(GDPcap); the version by Gupta (1967) and Michas (1975), PEcap=f(GDPcap) and finally a modified version of Peacock and Wiseman's formulated by Mann (1980), PE/GDP=f(GDP).

The second critical issue is the method of measuring government spending. Wagner believes that all levels of government (both central and local) and all potential expenditures should be considered. According to Peacock and Scot (2000), many authors' views are incorrect because Wagner expressly specifies that public firms, notably public utilities, must be regarded as part of the public sector. In this regard, Peacock et al (2000) propose three possible solutions: a) additional spending from the public sector to that of public companies, which is in itself a component of that expense, b) add the components of added value in the public sector which are, to a great extent, the wages and salaries of public employees along with the imputed rent of government buildings and finally, c) consider total public employment as a proportion of total employment. For several of the variants stated above, variables in time series form are used in this study. In the analyses, least squares regressions and

ARDL are used, as well as unit roots and cointegration to account for the underlying properties of the variables. In the case of the latter, it has been necessary to elaborate on the corresponding econometric theory, and it was not until the 1990s [Henrekson (1990, 1993), Murthy (1993)] that this method was used to test Wagner's Law for the first time. This type of analysis improved the reliability of the more recent works, allowing a distinction between long-term relationships and the short-term dynamic relationship.

3. Data and ModelSpecification

This study investigates the empirical causal relationship between economic growth and government tax revenue. Yearly data was collected for the period 1970 to 2021 providing 52 observations. On that basis, the study modifies the works of Ogundipe *et al* (2016); Egbo, *et al*, (2016); Iheanacho (2016) to formulate its structural equation as below; as a result, the modified structural equation is further approximated to that of Pesaran et al. (2001) and Toda-Yamamoto (1995) to be consistent with analytical framework of ARDL. All data was directly obtained or compiled from Federal Inland Revenue Service (FIRS) database, the Central Bank of Nigeria (CBN) fact book, and the National Bureau of Statistics (NBS) annual bulletin.

A general form of an ARDL model is:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots . + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \cdots + \alpha_q x_{t-q} + \varepsilon_t \quad \ldots 3.1$$

Therefore, the model specification for the study objectives is stated below in equation3.2.

$$\Delta Tax\_R_t = \alpha_0 + \sum_{i=1}^{n} \beta_{1i} \Delta Tax\_R_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta\, GDPR_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta\, EXR_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta\, INF_{t-i} + \sum_{i=0}^{n} \beta_{5i} \Delta\, OP_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta\, OPR_{t-i} + \sum_{i=0}^{n} \beta_{7i} \Delta\, POC_{t-i} + \sum_{i=0}^{n} \beta_{8i} \Delta\, UE_{t-i} + \sum_{i=0}^{n} \beta_{9i} \Delta\, EDU_{t-i} + \beta_1 Tax\_R_{t-1} + \beta_2 GDP_{t-1} + \beta_3 EXR_{t-1} + \beta_4 INF_{t-1} + \beta_5 OP_{t-1} + \beta_6 OPR_{t-1} + \beta_7 POC_{t-1} + \beta_8 UE_{t-1} + \beta_9 EDU_{t-1} + \varepsilon_t$$

……3.2

3.1 Unit Root Identification

Various time series techniques are used to model the dynamic relationship between time series variables (Gujarati, 2004). However, it is important to determine the characteristics of the individual series before conducting further analysis. Therefore, unit root tests for stationarity are examined on the levels and first differences for all variables using the most common unit root tests, which are the Augmented Dickey-Fuller (ADF)and the Philip-Perron tests (PP). In some circumstances, the lack of power in both the ADF and PP tests is widely acknowledged, then the NG-Perron (NP test must be done (Ng-Perron, 2001). Usually, ADF yields superior results than the PP test, if the data set has no missing observations and structural breaks whilst the PP test also yields superior results than the ADF test, if the dataset has some missing observations and structural breaks (Green, 2003). In this research, the ADF test was employed since there are no missing gaps and significant structural breaks in the dataset.

3.2 Bound Test

Having conducted the pre-test of stationarity and found that no variable is at the order I(2), capable of invalidating our approach; therefore, we formulate that special type of ARDL (the unrestricted error correction model (ECM)); including determining the appropriate lag structure and ensuring that the errors are independently generated i.e. serially independent. The detail shall be found in the model specification. The bound test, therefore, ensures that the model so formulated is diametrically and dynamically stable. The above presupposes assuming there is proof of a long-run link between the variables. Therefore, all that is required is to perform a bound test on equation 3.2 by subjecting the F-stat of (H0: 0=1=2=3=0;) versus the alternative that H0 is not true. The absence corresponds to zero coefficients, implying that we have a long-run relationship.

3.3 Long Run Co-Integration: Johansen Approach

Since the influential work of Granger & Newbold (1974) and Engle and Granger (1987) on the treatment of integrated time series data, many studies have been conducted using the co-integration methodology to yield consistent results and avoid spurious regression problems, particularly in causality testing. The purpose of the co-integration test in this study is to examine whether total tax revenue and economic growth share a common stochastic trend, that is, whether they move on the same wavelength in the long run though, there might be some disequilibrium in the short run. The researcher employed Johansen's (1988) approach to determine whether any combinations of the variables are co-integrated. Johansen &Juselius (1990) recommend the trace test and the maximum eigenvalue t-statistics in making the inference of the number of co-integrating vectors. For trace statistics, the null hypothesis is the number of co-integrating vectors that is less than or equal to co-integrating vectors *(r)* against an unspecified alternative. In the case of the maximum eigen-value co-integration test, the null hypothesis is the number of co-integrating vectors *(r)* against the alternative of $r+1$(Ng *et al.*, 2008). If the trace statistic is greater than the eigen-value (critical value), we conclude that the model contains at least one co-integrating equation. Where this condition is violated at a higher order, determines the maximum number of co-integratingequations.

3.2 Optimal Leg-lengthDetermination

The choice of appropriate lag length is vital in autoregressive modeling because we want to have Gaussian error terms that are, standard normal error terms that do not suffer from non-normality, autocorrelation, or heteroscedasticity, Nkoro*et al*, (2016). The optimal number of lags can be determined using appropriate model order selection criteria such as the Akaike Information Criterion (AIC), the Schwartz Bayesian Criterion (SBC), or the Hannan-Quinn criterion (HQC). The value of the general ARDL (p, q1, q2, …,qk) model is given by:

$$AIC_p = (1 + log2\pi) - \frac{n}{2log\delta^2} - p \quad \ldots 3.3$$

$$SBC_p = log(\delta^2) + (logn/n)p \quad \ldots 3.4$$

$$HQC_p = log\delta + \left(2\log log^{n/n}\right)p \quad \ldots 3.5$$

Where; δ^2 is the Maximum Likelihood (ML) estimator of the variance of the regression disturbance, n is the

number of estimated parameters, and p = 0, 1, 2, …, P, where P is the optimum order of the model selected (Nkoro, *et al*, 2016).

3.3 Unconstrained (Conditional) ECM

When the null hypothesis is not accepted, then there is no long-run equilibrium, we, therefore, specify and estimate the Restricted Error Correction Model (RECM) including the level model. The outcomes help to determine both the short-run dynamic effect and the long-run equilibrium relationship among the variables. However, before then, it becomes pertinent to introduce the conventional ECM for cointegrated data thus from where the conditional ECM was obtained according to Pesaran*et al*. (2001):

$$\boldsymbol{Tax\_R_t} = \alpha_0 + \sum_{i=1}^{n}\beta_{1i}\Delta Tax\_R_{t-1} + \sum_{i=0}^{n}\beta_{2i}\Delta GDPR_{t-i} + \sum_{i=0}^{n}\beta_{3i}\Delta EXR_{t-i} + \sum_{i=0}^{n}\beta_{4i}\Delta INF_{t-i} + \sum_{i=0}^{n}\beta_{5i}\Delta OP_{t-i} + \sum_{i=0}^{n}\beta_{6i}\Delta OPR_{t-i} + \sum_{i=0}^{n}\beta_{7i}\Delta POC_{t-i} + \sum_{i=0}^{n}\beta_{8i}\Delta UE_{t-i} + \sum_{i=0}^{n}\beta_{9i}\Delta EDU_{t-i} + \beta_1 CIT_{t-1} + \beta_2 GDP_{t-1} + \beta_3 EXR_{t-1} + \beta_4 INF_{t-1} + \beta_5 OP_{t-1} + \beta_6 OPR_{t-1} + \beta_7 POC_{t-1} + \beta_8 UE_{t-1} + \beta_9 EDU_{t-1} + \varepsilon_t + \boldsymbol{\nabla_i Z_{t-1}} + \boldsymbol{\varepsilon_t}$$

… 3.6

Where, Z_{t-1} is the error correction term equilibrating the OLS residual series for long run cointegration equation of: -$y_t = \alpha_0 + \alpha_1 x_{1t} + \alpha_2 x_{2t} + V_t$ … 3.7

When we, therefore, replace the error correction term (Z_{t-1}) in equation 3.2 with the same lagged level as below; we derive the conditional or unrestricted ECM because their coefficients are not restricted as below:

$$Tax\_R_t = \beta_0 + \beta_i \sum_{1=i}^{m}\Delta Tax\_R_{t-i} + \sigma_i \sum_{1=i}^{m}\Delta GDPg_{t-i} + \vartheta_i \sum_{1=i}^{m}\Delta CIT_{t-i} + \gamma_i \sum_{1=i}^{m}\Delta PPT_{t-i} + \rho_i \sum_{1=i}^{m}\Delta PIT_{t-i} + \delta_i \sum_{1=i}^{m}\Delta EDU_{t-i} + \partial_0 y_{t-1} + \alpha_1 x_{1t-1} + \alpha_2 x_{2t-1} + \varepsilon_t$$

…3.8

As a result, the determination of the maximum lag uses one or more info criteria such as the Akaike info criterion (AIC), Schwarz (Bayes) criterion (SC), Hannan-Quin info Criterion (HQ).

3.4 VECM and Granger Causality

As noted previously, several cointegrating vectors can be fully identified by using trace and eigenvalue test statistics. The cointegration between dependent and exogenous explanatory variables shall be seen to exist. However, it can be noticed that there is at least a single aspect of causality (Granger 1969). Causality refers to the ability of one variable to predict the other. In Granger's (1969) causality test for two variables, *xt*, and *yt*involved in the following specification of vector model to be estimated:

$$y_t = \alpha_1 + \sum_{i=1}^{n}\delta_i X_{i-1} + \sum_{j=1}^{m}\rho_i y_{j-1} + \varepsilon_{1t} \quad \ldots 3.9$$

$$x_t = \alpha_2 + \sum_{i=1}^{n}\pi_i X_{i-1} + \sum_{j=1}^{m}\gamma_i y_{j-1} + \varepsilon_{2t} \quad \ldots 3.10$$

It also assumes that ε_{yt} andε_{xt} are uncorrelated white noise error terms. Hence, the series *xi* does not Granger cause *yi* , if $\delta_1 = \delta_2 = \delta_3 = \cdots = \delta_i = 0$ while the latter hypothesis is tested using the F- test. If there is no cointegration between variables of interest then the standard causality test of Granger (1969) can be applied. However, if the cointegration exists, then the causality can be examined by using the Vector Error Correction Mechanism (VECM)

as formulated below:

$$\Delta y_t = \alpha_0 + \alpha_{1i} \sum_{i=1}^{n} \Delta y_{t-1} + \alpha_{2i} \sum_{i=1}^{n} \Delta x_{t-1} + \alpha_{3i} \sum_{i=1}^{n} \Delta ECT_{t-n} + \varepsilon_t \quad \ldots 3.11$$

The short-term dynamics of the VECM in equation (3.10) can be tested using the Wald test (c2)test with the hypothesis that the set of parameters is simultaneously equal to zero. If the test fails to reject the null hypothesis, this suggests that removing the variables from the model willnot substantially harm the fit of the model itself. The long-term causality is tested by examining whether the error correction term coefficient in the model is statistically different from zero. This confirms that the respective EC term is significant with the expected negative sign in their equation. In essence, this test is vital to explore the endogeneity problems in the system (Kumar, 2011).

3.5 Post-Estimation Diagnostic Tests

The Autocorrelation Test, Heteroscedasticity Test, Normality Test for Residuals (Histogram and Jarque-Bera Test), and Parameter Stability Test (CUSUM Graph) were also used to examine the stability of the model's calculated parameters in the study and also verify the compliance to the fundamental model's basic assumptions.

4. EstimationResults

4.1 Descriptive Statistics and Test of Normality

This sub-section presents the descriptive statistics of the Country-specific economic growth indicators that determine the tax revenue in Nigeria. It displays their mean, median, maximum/minimum value, standard deviation, and the Jarque-Bera normality test, which is a goodness-of-fit test to determine if the sample data has the skewness and kurtosis that indicate normal distribution. This is a prerequisite for fitting the panel regression model. Table 4.1 below shows the descriptive statistics of all the variables in the study. The Jarque-Bera test for time series data variables was used to assess normality.

The hypothesis tested was:

H_o: JB=0 (normally distributed) vs H_1: JB $\neq 0$ (not normally distributed)

$\alpha = 0.05$ or 0.1; Test statistic=JB

Where JB is Jarque-Bera test; Critical region: Reject H_0 if p-value < α value of 0.05

Table 4.1: Results of Descriptive Statistics and Test of Normality

Statistic	TAX_R	EDU	EXR	GDPR	INF	OP	OPR	POC	UE
Mean	2047.722	116.3398	84.81600	0.241154	18.38346	37.49704	2013.058	15.49281	4.674904
Std. Dev.	2823.805	180.2646	105.4263	0.318586	15.81988	29.94202	336.3303	5.077220	1.591069
Jarque-Bera	9.453920	24.04996	13.30942	1563.647	68.72353	10.80592	3.308589	6.431626	131.4809
Probability	0.008853	0.000006	0.001288	0.000000	0.000000	0.004503	0.191227	0.040123	0.000000
Observations	52	52	52	52	52	52	52	52	52

Variable Label

CIT	Company Income Tax	OPR	Oil Production

EDU	Education Expenditure	PIT	Personal Income Tax
EXR	Exchange Rate	POC	Production Capacity
GDPR	Gross Domestic Product Growth Rate	PPT	Petroleum Profit Tax
INF	Inflation Rate	TAX_R	Taxable Revenue in Nigeria
OP	Oil Price	UE	Unemployment Rate

Source: Out of E-VIEWS 12 Output

Table 4.1 analyses the descriptive statistics of the variable profile. It is noted that the tax revenue of the country proxied with the total tax revenue (TAX_R) was at the mean of 2047.722 billion. This suggests that the average tax revenue of the country is low compared to other developing economies. It also observed that the maximum and minimum TAX_R stood at 7594.400 and -4.04b. This is an indication that some of the country's tax revenue was once very low but has drastically picked up and hence an upward growth in the total tax revenue is observed in the country. As indicated in the Table, the Education Expenditure, Exchange Rate, Gross Domestic Product Growth Rate, Inflation Rate, Oil Price, Oil Production, Production Capacity, and Unemployment Rate returns a mean value of 116.3398b, 84.816N/$, 0.2411%, 18.38%, 37.497$, 2013.058mbpd, 15.492% and 4.67% respectively.

More importantly, regarding the test for normality, as observed in table 4.1, the test for all the variables returned a p-value less than 0.05 (5%) level of significance except for oil production (OPR), thus, implying that the variables are not normally distributed. As such, the variable natural logarithm transformation is used to correct for the non-normality seen in the series before modeling.

4.1.1 Series Plot

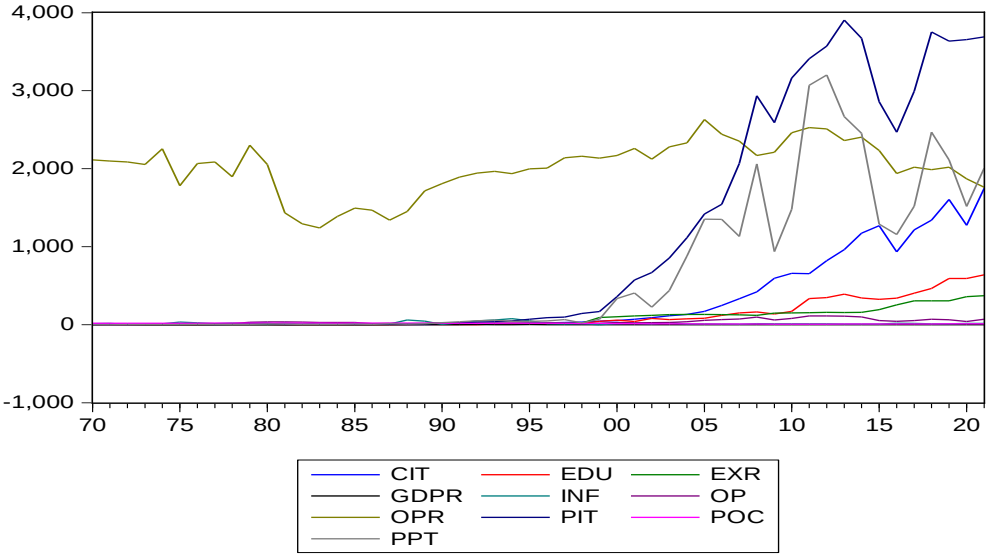


Figure 4.1 The time plot at the level for the economic growth and taxable revenue variables for the period 1970-2021.
Source: E-VIEWS 12 Output

Figure 4.1 presents the trend analysis of the yearly data on all variables selected for the study (Economic growth and Tax revenue indicators) from the period 1970 to 2021. During these periods all the variables seem to be stable and

low from 1970 through 2000. However, high volatility is observed from 2001 to 2021 and is more pronounced in the exchange rate variable. Although, the country's production capacity, education expenditure, and petroleum profit tax have remained consistently stable with relatively low volatility in the past 10 years. Since the effect of the covid-19 on the global economy, the recovery process continued up to the year 2021 as evident in the sharp rise in the country's GDP growth rate variable. Another upward shoot was experienced in 2015 due to instability in the real exchange rate in the economy.

4.3.2 Unit Root Test Results

The series must be stationary to execute the cointegration bounds test. The unit root test was performed using the Augmented Dickey-Fuller test at the level and at the first difference of each series on the condition that the null hypothesis is non-stationary, hence the rejection of the unit
root hypothesis supports stationarity.

The hypothesis tested is:

H_0: $\gamma = 0$ (unit root is present) vs. H_1: $\gamma \neq 0$ (unit root is not present)

$\alpha = 0.05$, Test statistic= ADF test statistic

Critical region: Reject H_0 if, ADF test statistic >Mackinnon critical value for rejection of the hypothesis of a unit root at a 5% significance level.

Table 4.2 Augmented Dickey-Fuller Test Results at Level, 1st and 2nd Difference with Intercept but no trend

Augmented Dickey-Fuller test statistic

Variable	Null Hypothesis	Level		1st Difference		2nd Difference	
		t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
EDU	EDU has a unit root	2.744	1.000	-4.606	0.001	NA	NA
EXR	EXR has a unit root	2.892	1.000	-5.064	0.000	NA	NA
GDP	GDPR has a unit root	-6.158	0.000	NA	NA	NA	NA
INF	INF has a unit root	-3.622	0.009	NA	NA	NA	NA
OP	OP has a unit root	-1.623	0.464	-6.590	0.000	NA	NA
OPR	OPR has a unit root	-1.816	0.369	-7.303	0.000	NA	NA
POC	POC has a unit root	-0.995	0.749	-12.986	0.000	NA	NA
TAX	TAX_R has a unit root	0.138	0.966	-6.097	0.000	NA	NA
UE	UE has a unit root	3.183	1.000	-7.251	0.000	NA	NA

NA = test is not required since stationarity is obtained

Variable Label

EDU	Education Expenditure	OPR	Oil Production
EXR	Exchange Rate	POC	Production Capacity
GDPR	Gross Domestic Product Growth Rate	TAX_R	Taxable Revenue in Nigeria
INF	Inflation Rate	UE	Unemployment Rate
OP	Oil Price		

Source: E-VIEWS 12 Output

Table 4.2 showed the results of the unit root test. The results revealed that time series were non-stationary at levels.

However, some of the variables/series became stationary at the 1st difference [I(1)] and none at the 2nd difference [I(2)] accordingly. The augmented Dickey-Fuller unit root test demonstrated that mistakes were statistically independent and had constant variance. Therefore, meeting the precondition for the application of the ARDL model requires the series to be of I(0) and I(1) only. As such, the ARDL bounds test is applied to the data series to see whether a short-run or long-run relationship exists.

4.2 Model Estimation

4.2.1 Determination of Lag Length

The estimation of lag duration is a trade-off between the constraints of dimensionality and shortened models that are unsuitable for indicating dynamic adjustment. If the lag duration is too short, the autocorrelation of the error factors may result in estimators that appear significant but are wasteful. As a result, one would get incorrect results. We can see from the so-called curse of dimensionality that even with a relatively short lag period, a considerable number of factors are necessary. On the other hand, when the number of parameters increases, as the degrees of freedom diminish, ineffective estimators may develop. Information criteria are similar to the previously discussed trade-off. On the one hand, the model must precisely reflect the observable process (error terms must be as little as feasible) but having too many variables leads to inefficient estimators. As a result, the information criteria are calculated by dividing the squared sum of residuals by the number of delays. As observed from the Vector Autoregressive Lag order is one based on the Akaike Information Criterion (AIC). Hence, the lag of order-1 will be used in the model specification.

4.2.2 Bounds Cointegration Test

Cointegration tests were performed using Pasaran, Shin, and Smith's (2001**)** approach and Autoregressive Distributed Lag (ADRL) bound test approach to achieve the main aims and objectives of this study by recommending a short-run model or the long-run model with the error correction term (ECM). These models will be used to explain the kind of relationship that exists between Nigeria's economic growth variables and its tax revenue variables in the short or long run. In Table 4.2, (Trace Cointegration test for Model 1 with (TAXR) as the dependent variable) the F-statistic test (11.513) is greater than the critical value upper bound(3.39), which indicates the presence of cointegrating among the variables, denoting the rejection of the null hypothesis of no cointegrating equation between the tax revenues and economic growth variables at 5 percent level of significance. The existence of a cointegrating equation indicated that there exist long-run relationships between the eight variables and hence, the ARDL long-run model with error correction term is employed to study the long-run effect of the independent variables on the dependent variables.

4.2.3 ARDL Model Estimation Model

Table 4.3: Estimated ARDL (1,1,1,1,1,1,1,1) Short-Run Model

Dependent Variable: D (LNTAXR)

Sample (adjusted): 1972 2021

Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.134191	0.047572	2.820799	0.0075
D(LNTAXR(-1))	-0.796489	0.249493	-3.192435	0.0028
D(LNEXR(-1))	0.686828	0.158577	4.331200	0.0001
D(LNEDU(-1))	0.067374	0.046871	1.437426	0.1586
D(LNGDPR(-1))	-0.122111	0.063660	-1.918176	0.0624
D(LNINF(-1))	0.042353	0.033515	1.263701	0.2138
D(LNOP(-1))	0.216295	0.146400	1.477427	0.1476
D(LNOPR(-1))	1.607462	0.488131	3.293096	0.0021
D(LNPOC(-1))	-1.579135	0.448783	-3.518706	0.0011
D(LNUE(-1))	0.130639	0.428290	0.305025	0.7620
ECM(-1)	-0.747561	0.243671	-3.067908	0.0039

R-squared	0.500811	Mean dependent var	0.150239
Adjusted R-squared	0.372814	S.D. dependent var	0.298792
S.E. of regression	0.236629	Akaike info criterion	0.146890
Sum squared resid	2.183734	Schwarz criterion	0.567535
Log-likelihood	7.327742	Hannan-Quinn criteria.	0.307074
F-statistic	3.912680	Durbin-Watson stat	1.972584
Prob(F-statistic)	0.000977		

Source: EVIEWS 12 Output

Discussion of Findings

Ho: *Economic growth has no impact on total taxable revenue in Nigeria.*

The analysis shows the existence of a long-run association between economic development and overall taxable revenue in Nigeria. In Table 4.3, the short-run part of the ARDL (1,1,1,1,1,1,1,1) model with error correction term having required negative sign and statistically significant at a 5% level of significance. The coefficient of ect(-1) was -0.74756 and indicates that the deviation from the long-run term total tax revenue (TAXR) will be corrected by 74.76% in the model in the coming year and thus the speed of adjustment towards an equilibrium which also represents the long-run equation. Thus, there is a unidirectional relationship between economic growth and total government tax revenue with a 74.76% speed of adjustment in the short run to reach an equilibrium level in the long run. The residuals are also free of serial correction and heteroscedasticity and were normally distributed. Also, the CUSUM chart indicated that the model is stable statistically at 5%.

As a result of the model, the Exchange rate (LNEXR), Education expenditure (LNEDU), Inflation rate (LNINF), Oil price (LNOP), Oil production (LNOPR), and Unemployment rate (LNUE) return a positive coefficient with the total tax revenue (LNTAXR), which mean that a unit increase in any of them will bring a corresponding coefficient magnitude increase in the total tax revenue (LNTAXR). Only, the GDP growth rate (LNGDPR) and production capacity (LNPOC) return a negative coefficient as the relationship with the total tax revenue (LNTAXR) which is also

not statistically significant at the 5% level, implying that the relationship cannot be generalized. Furthermore, the inflation rate, education spending, and oil price have no significant positive impact on total tax revenue (LNTAXR). Summarily, the model, therefore, shows that it has a substantial impact on economic growth indicators and total taxable revenue (TAXR) in Nigeria since the ADRL model returns an F-statistic of 3.912680 with a p-value of 0.000977, which is less than the 0.05 (5%) level of significance.

Therefore, the null hypothesis is hereby rejected, and thus, we uphold the alternative hypothesis which states that "Economic growth has an impact on total taxable revenue in Nigeria" in the short run. Although, the economic growth variable is seen to be explaining the taxable revenue to the tune of 50% as reported by the model R-square and after correcting for the over-proliferation of regressors in the model the R-square adjusted returned just 37.28% variation caused by the economic growth variables on the total tax revenue (LNTAXR) in Nigeria.

4.2.4Post-Model Estimation Diagnostics

Since the p-value associated with the Observed R-squared is greater than 0.05 (5%), thus there is no presence of serial correlation in the model. Also, the report of the CUSUM chart (shown below in Fig. 4.2) indicated that

Model Stability Test (CUSUM)

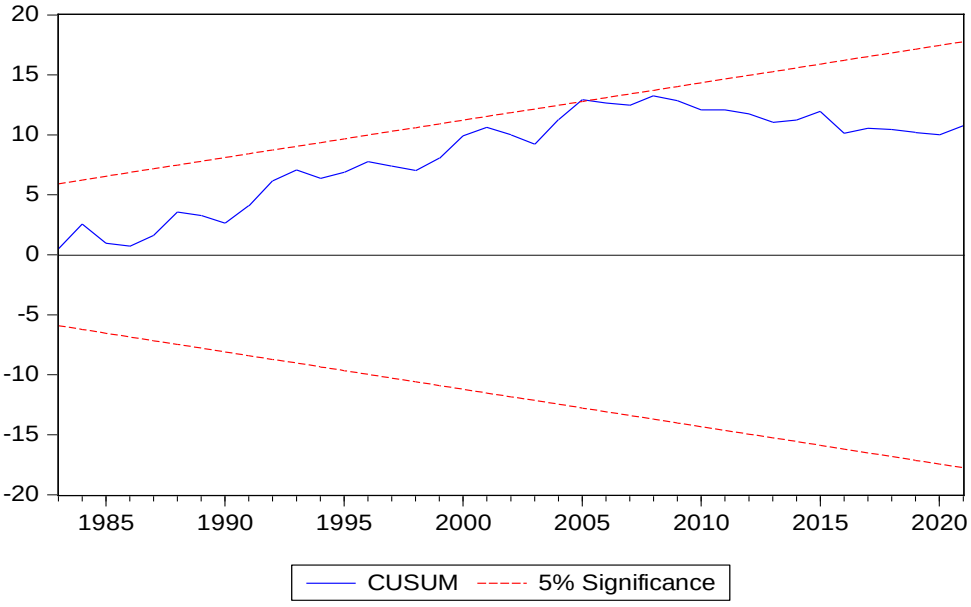


Fig 4.2 CUSUM graph for the Model

Source E-Views 12

the model was statistically stable at a 5% level of significance. Hence, the effect of structural breaks is observed in the model.The model was also observed to be free of heteroscedasticity since the p-value of the Observed R-square is observed to be greater than the level of significance of 0.05 (5%). Lastly, the Jarque-Bera test with a test statistic of 5.0529 and p-value of 0.0799 which is greater than the 0.05 (5%) level of significance implies that the residual of the model is normally distributed as expected and required for any ordinary least squares which is one of its fundamental

assumptions.

5.0Conclusion

From the ARDL model results for the postulated hypothesis, there is an indication that economic growth has a positive and statistically significant influence on total tax revenue in Nigeria. The results necessitated the rejection of the null hypothesis. Thus, establishing that economic growth has a significant effect on total tax revenue in Nigeria. The finding for hypothesis one (H_1) agrees with the results of some reviewed empirical studies. Thus, the study agrees with the study of Terefe *et al* (2018) that economic growth has a positive and significant impact on tax revenue, which is premised on enhanced tax revenue. The finding further agrees with the study of (Ade *et al*., 2018a, 2018b) that, economic growth has a positive significant effect on the country's tax revenue. The study also aligns with the findings of (Ayenew, 2016; Tosun &Abizadeh, 2007) who found that economic growth, measured by GDP per capita, has had a significant effect on the tax mix of the OECD countries. The study also shows that while the shares of personal and property taxes have responded positively to economic growth, shares of the payroll and goods and services taxes have shown a relative decline.

5.1 Recommendations

- Based on the study's findings which established a positive relationship between most of the selected economic growth indicators and tax revenue performance, the study recommends that the Nigerian government when considering improving tax revenue performance should encourage more fiscal expansionary policies which include reduced tax rates on corporate profits and increased government spending on the manufacturing sector. This will attract more foreign investors due to reduced profit tax and ease of doing business in the country.
- The studies concluded that GDP, exchange rate, and production capacity strongly and positively affect the performance of tax revenue in Nigeria. Based on the findings, the study recommends that the government should support innovative activities by youths through the creation of innovative labs. This would help to create more job opportunities for the youths. Similarly, encourage public and private partnerships between the state governments and private investors.
- According to the study findings, inflation was found to negatively influence the tax revenue performance in Nigeria, therefore the Central Bank of Nigeria should ensure appropriate fiscal policies are put in place to moderate the fluctuations in exchange rates of the Naira against other foreign currencies. Similarly, the government should put more effort into fighting corruption and political instability.
- Lending interest rates should be monitored through periodical interest rate capping to prevent rising interest rates that result in to increase in the cost of production and prices of goods. This would help to reduce inflation rates in Nigeria.
- In addition, the performance of tax revenue was negatively and insignificantly impacted by unemployment. This suggests that as unemployment rates rise, savings decline, reducing the amount of money available for

investment. Therefore, to absorb both skilled and unskilled labour, the government should encourage the growth of the informal sector by offering incentives and low-interest loans. Due to the employment growth, there will be a rise in personal income taxes. The Federal government should increase the State governments' shares in the National Income (FAAC) annual budget. This is because, through state governance, more job opportunities would have been created therefore increasing their share of personal income tax.

- Lastly, For Nigeria to have a sustainable fiscal strategy, taxation is essential. Because the nation currently uses a cash budget system, this is even more crucial. The growth of non-oil revenue is essential due to the necessity to reduce revenue instability and the incapacity of the lower levels of government to satisfy their ever-increasing budgetary obligations. The various levels of government must work to improve (a) how taxpayers and tax administrators are treated, (b) how much money is invested in the tax system, and (c) how wisely taxpayer funds are used to increase non-oil revenue contribution to economic growth of Nigeria.

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