

Causal Links between Tax Revenue, Government Expenditure, and Economic Growth in Nigeria: A Wavelet Approach

Alfred Prince Amobi 

Master's Degree Graduate from Babcock University.

Corresponding author: munaprince96@gmail.com

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Abstract

In this study, the causal effects of tax revenue, government expenditure, and economic growth are examined for Nigeria using monthly data from 1981 to 2020. The study used wavelets Granger causality econometrics approach to conduct the empirical analysis. Specifically, our findings from the wavelet decomposition and Wavelet Granger Causality show that a bi-directional causality exists between economic growth and government expenditure in the long run and very long run. In contrast, a unidirectional causality was discovered going from Real GDP to Tax revenue in the long run period. A unidirectional causality runs from tax revenue to government expenditure in the second half of the short run period, during the medium run period, and long run period. The findings of this study carry an important policy message, highlighting the need for caution regarding increased public sector involvement due to the uncertainty associated with oil prices, which currently account for approximately 80% of government revenue. To mitigate this risk, the government should focus on enhancing revenue streams by diversifying its economic activities into other sectors. This approach will help reduce the over-reliance on oil and create a more stable and sustainable financial foundation for the country. Also, the taxation policies to be implemented based on the economic conjuncture of Nigeria are a powerful financial tool, with the potential to serve the economic objectives to be achieved.

Keywords: Economic Growth, Tax Revenue, Government Expenditure, Wavelet Granger Causality, Public Finance, Nigeria.

Introduction

The link between tax income, government spending, and economic growth is debated among academics. Some argue that increased government spending on infrastructure and social programs promotes growth. Taxes can impact labour supply by reducing leisure choices in favour of work, and affect research and development spending, and boost sectors with low productivity. However, some disagree, citing potential negative consequences of higher spending, such as increased taxes, reduced labour supply, and limited private investment. In a study conducted by Thanh and Lien (2017), it was revealed that tax revenue always positively affects economic growth, while government expenditure impacts differently depending on the kind of economic group.

The study explores the relationship between tax revenue, government spending, and economic growth in Nigeria. It addresses the challenge of fiscal sustainability in the country,

where taxation revenue should cover recurrent expenditure, but the tax-to-GDP ratio falls below the target. Notably, Value Added Tax surpasses income tax, and its impact on economic activities needs investigation. Additionally, the study highlights an upward trend in VAT income, with a substantial increase year on year (Chizea, 2021). Understanding these dynamics is crucial for formulating effective fiscal policies and enhancing revenue generation to support sustainable economic growth in Nigeria. The Nigerian government aims to boost non-oil revenue by implementing fiscal stimulus through increased spending to stimulate private consumption and business investments. This includes allocating 30% of the federal budget to capital expenditure. The Economic Recovery and Growth Plan (ERGP) was introduced in 2017 to address Nigeria's economic recession caused by declining oil prices and a lack of diversification (Ugwueze, 2023). The plan aims to restore economic growth, invest in Nigerians, and build a competitive economy (Inoykwe, 2018). Key objectives include diversifying the economy, creating jobs, developing human capital and infrastructure, and improving the business environment (Kalagbor & Harry, 2021). However, implementation faces challenges due to corruption, predatory political culture, and a symbolic approach to development policies (Inoykwe, 2018). Despite accelerated implementation, the desired economic diversification has not been achieved, with oil and gas remaining the economic mainstay (Kalagbor & Harry, 2021). To address this, experts recommend massive investments in infrastructure, human capital, and research and development (Kalagbor & Harry, 2021). Additionally, improving revenue collection mechanisms, especially taxation, is crucial for sustainable economic growth (Okwori & Sule, 2016). Initiatives like the privatization of public assets and tax review aim to expand the tax-to-GDP ratio, leading to increased revenue and reduced financing deficits. However, the sharp decline in oil prices and production, along with inadequate fiscal buffers, has impacted the government's ability to fund critical investments in various sectors, including agriculture, infrastructure, education, and job creation, affecting Nigeria's economy. The need for diverse and dependable sources of revenue, such as value-added tax and corporate income tax revenue, remains essential for sustainable economic growth. The decrease in tax revenue has hindered the Nigerian government's ability to respond to the increasing social and public expenditure required for economic growth. The relationship between government spending and economic growth is controversial, with different perspectives proposed by researchers. Wagner's viewpoint suggests that economic growth drives government spending, particularly in health and education. On the other hand, Keynes argued that government spending stimulates economic growth as an external source. Studies in Serbia have shown that increasing public expenditure and fiscal deficits can lead to macroeconomic imbalances and risks (Lojanica, 2015). In Nigeria, the issue of revenue generation for expenditure is exacerbated by the Federal Inland Revenue Service's inefficiency, failing to capture all operating firms in the tax net due to lack of data and inadequate enforcement (Leyria, Chukwuma & Asian, 2012). This hampers the country's tax structure and fiscal policies. Considering the openness and vulnerability of developing countries like Nigeria to external shocks, the role and size of government become crucial in

stabilization programs. Addressing these challenges and finding a balance between government spending, tax revenue, and economic growth is essential for sustainable development in Nigeria.

According to Okonjo-Iweala (2013), over 75 percent of registered businesses are not in the country's tax net, and 65 percent of them have not filed tax reports in over two years. According to her, this resulted in a loss of over 80 billion Naira, bringing the total revenue for the time to over \$250 million (Okonjo-Iweala, 2013). This report is reprehensible. Recent studies highlight Nigeria's efforts to enhance revenue generation and manage public debt through tax reforms and fiscal policies. Tax reforms, including the 2012 and 2017 National Tax Measures and VAIDS, have positively impacted revenue generation, though challenges persist (Angbazo & Iorlaha, 2024). Effective tax policies are crucial for economic stability, reducing income inequality, and fostering entrepreneurship (Michael et al., 2024). New tax reforms offer potential for revenue mobilization, but institutional and structural inefficiencies hinder their full impact on public debt reduction (Osinuga et al., 2025). Recommendations include implementing a holistic approach to tax reform, integrating policy, technology, and behavioral insights (Angbazo & Iorlaha, 2024), prioritizing modern tax administration technologies, and fostering collaboration between government agencies and the private sector (Michael et al., 2024). On this basis, the goal of this research is to investigate the causality between tax revenue, government expenditure, and economic growth in Nigeria using this new approach, as the results will show if the tax revenue is enough to stimulate growth as well as enough to fund government expenditure.

Problem Statement

The relationship between tax revenue, government expenditure, and economic growth remains a critical issue in Nigeria's fiscal policy. While tax revenue is expected to fund government expenditure and drive economic growth, the effectiveness of this relationship is still debated. Previous studies have explored these links, but few have considered all three variables in Nigeria simultaneously, often leading to inconclusive results, such as Olayungbo & Olayemi (2018) and Gurdal et al (2021). The study addresses methodological loopholes in previous research and aims to provide policymakers with reliable insights to improve fiscal policies in Nigeria. By using country-specific data and employing robust causality testing methods, the study offers a valuable contribution to the existing literature and provides different perspectives on the relationship between government spending, tax revenues, and economic growth.

Additionally, methodological gaps in past research have limited the ability to accurately capture the dynamic interactions between these factors over time. This study addresses these gaps by applying the wavelet approach, which allows for a more precise analysis of both frequency and time dimensions in the causal relationship between tax revenue, government expenditure, and economic growth. The findings will provide policymakers with reliable insights to enhance fiscal policies and economic planning in Nigeria.

Research Objectives

1. To analyze the short-term and long-term causal relationships between tax revenue, government expenditure, and economic growth in Nigeria.
2. To evaluate whether tax revenue is sufficient to stimulate economic growth and adequately finance government expenditure.
3. To assess the frequency and time-based variations in the causality paths of tax revenue, government spending, and economic growth.
4. To address methodological limitations in previous studies by employing a wavelet-based analytical framework for improved accuracy.
5. To provide policy recommendations based on empirical findings, aiding in the formulation of effective fiscal policies in Nigeria.

Literature Review

The impact of taxes on government spending and economic growth remains a subject of ongoing debate with no definitive resolution. Various growth theories have included taxes, but their effects are interpreted differently in each model. Neoclassical models suggest a momentary impact on growth, while endogenous growth models indicate a long-term effect. The relationship between government spending and taxation is also understood differently, leading to different perspectives and disagreements. In contrast to Baghestani and McNown's (1994) theory of institutional differentiation, which states that the state's taxation and expenditure are independent of one another, tax-expenditure and expenditure-tax theories, which express opposing viewpoints, are indicative of theoretical disagreements. Adolph Wagner in 1883 developed a fascinating development thesis which stated that as a nation develops its public sector, public spending will also grow tremendously. The theory of public expenditure is the theory of the costs of providing goods and services through public sector budget. Following Wagner's law, as national income increases, public expenditure rises also to cater for the need of the people, and as the economy grows and income goes up, the demand for goods will rise which in turn raises the public expenditure. Due to this rise in per capita income, public provision of consumer goods also increases. In economic literature, Wagner (1883) offered a theory of government expenditure.

Moreover, long-run or steady-state economic growth is primarily influenced by discount factors (rates of capital depreciation, population increase, and technological advancement), according to the premises of neoclassical growth models of Solow (1956), Cass (1965), and their following revisions. Although distortive taxation and productive government expenditures may have an impact on human or physical investment propensities, these changes only affect the steady-state factor ratios, not the rate of economic growth, because the rate of economic growth changes and resets at an old or new steady-state (Bleany, Gemmell & Kneller, 2001). By logical deduction, neoclassical growth models indicate that government expenditure has only a short-term impact on economic growth. In contrast, endogenous growth models such as those proposed by Barro

(1990; 1991) and King & Rebelo (1990), among others, claim that distortive taxation and productive expenditures will have a significant impact on both long-run level output path and growth rate with a change in highly regressive tax rate, while it will increase with an increase in government productive spending. Non-distortionary taxation and unproductive government spending do not affect the steady-state growth rate, according to endogenous growth models (Sala-I-Martin & Barro, 1995). On this foregoing, we decided to use the Barro model of economic growth as it stressed the role public sector as a determinant of economic growth in the long term (Barro 1990).

Initially, the link between government spending and taxation was a common topic of research, with empirical investigations being conducted across time considering the theories' varied claims. While some research supported the tax-expenditure theory, others supported the expenditure-tax theory. Although there is less research that agrees with institutional difference theory and the theory of financial cohesiveness than with the other two theories, they are essential studies that reveal distinct perspectives on the subject. In some of their studies, Hondroyannis and Papapetrou (1996), Afonso and Raoult (2009), Chang et al. (2002), Chowdhury (2011), Darrat (2002), Günaydn (2004), Obeng (2015), Siami-Namini et al. (2018), Dritsaki (2018), and Karlsson (2019) found appropriate results in all country groups, consistent with the tax–expenditure theory.

The spending-tax hypothesis has been supported by Carneiro et al. (2004), Lojanica (2015), Reddick (2002), Saunoris and Payne (2010), Zapf and Payne (2009), and Kazungu (2019). In the example of the United States, Baghestani and McNown (1994) discovered that spending and income decisions are unrelated, supporting the institutional difference theory that taxes are unrelated to government spending. The institutional difference hypothesis was also supported by results obtained by Akçalayan and Kayran (2010), Chang et al. (2002), and Kollias and Makyrdakis (2000).

Other empirical studies, such as those by Al-Zeaud (2012), Baharumsah et al. (2016), Lincoln and Hasan (1997), Kollias and Makyrdakis (2000b), Mehrara et al. (2011), Miller & Russek (1990), Payne-Ewing (1998), and Vamvoukas (2001), have found that the taxation and expenditure decisions stated by financial cohesion theory have a mutually causal relationship (2012). Panel studies, on the other hand, revealed a different picture. There could be a one-way or two-way causal relationship between expenditures and incomes or between revenues and expenditures, leading to the conclusion that no such relationship exists.

Subsequently, Empirical research on the relationship between taxes and economic growth has also produced mixed results, with some indicating a positive relationship and others indicating a negative one. Other research, on the other hand, posits that there is no link between the two variables. Lee and Gordon (2005), Mamatzakis (2005), Saqib et al. (2014), Taha et al (2011), Widmalm (2001), Zeng and Du (2003), and Amri et al. (2019) investigated the effects of taxes on economic growth using a variety of variables, with the similar conclusion that taxation has a negative impact on economic growth.

Despite the different samples and country groups used in their research, Abdiyeva and Baygonuşova (2016), Anastassiou and Dritsaki (2005), Lee and Gordon (2005), Ray et al. (2012), Tosun and Abizadeh (2005), Egbunike et al. (2018), Aydin and Esen (2019), Eneche and Stephen (2020), Karagianni et al (2011) found a similar trend. In summary, taxes have been proven to be either the cause or a positive trigger of economic growth. There is also no link between taxes and economic growth, according to certain studies.

In Nigeria, Onakoya & Afintinni (2016) examined the impact of various taxes on Nigeria's economic growth over a 30-year period (1980-2013). The research found a long-run relationship between taxes and economic development, with positive associations between Petroleum Profit Tax and Company Income Tax with economic growth, but a negative relationship with Customs and Excise Duties. Recommendations included institutional reforms for Customs, corruption-free tax collection mechanisms, and modernization of the tax system at all levels of government.

Furthermore, economists and political scientists have debated the relationship between government spending and economic growth. Lupu and Asandului (2017) studied eight Eastern European countries and found a long-term integrated relationship between government spending and economic growth using the ARDL approach. Odhiambo (2015) examined South Africa and discovered a short-run causal relationship between government spending and economic growth, but in the long-run, government spending did not drive economic growth. The research sheds light on the complex and dynamic nature of the relationship between government expenditure and economic growth. Aworinde & Onakoya (2015) investigated the linear and nonlinear causal linkages between government expenditure and output nexus in Nigeria for the period 1961- 2013. Making use of a nonparametric causality test of Diks and Panchenko (2006) as well as the Hacker and Hatemi-J bootstrap parametric causality test using the VAR model, it showed that there was evidence of unidirectional linear and nonlinear causality from national income (output) to government expenditure.

In addition, Rosoiu (2015) analysed Romania's quarterly data from 1981q1 to 2014q1 to examine the impact of government revenues and expenditures on economic growth. The study found that both government revenues and expenditures had positive effects on the country's economy, emphasizing the importance of considering both aspects in fiscal policy decisions. Gebreegziabher (2018) examined the effects of fiscal policy, particularly government expenditure and taxation, on economic growth in Ethiopia within a period of 40 years using the Autoregressive Distribution Lag modelling approach. In the study, the researcher discovered that in both the short and long run, the effect of a better human capital formation, higher availability of capital stock and labour force had a noticeable effect on the growth of the economy.

Gurdal et al. (2021) examined tax revenue, government expenditure, and economic growth in G7 countries using annual data from 1980 to 2016. The study employed two panel causality techniques and found bidirectional causality between economic growth and government expenditure, unidirectional causality from tax revenue to government

expenditure, and no link between economic growth and tax revenue in the time domain. In the frequency domain, bidirectional short-run and long-run causation between economic growth and tax revenue were observed, along with long-run causality between economic growth and government spending. Finally, Karlsson (2019) investigated the causal relationship between government revenue and expenditure in China using wavelet analysis. The study found mixed results on the unit roots of revenue and expenditure time series, making cointegration analysis challenging. However, wavelet analysis at different time horizons showed that government revenue Granger-causes government expenditure in shorter periods (tax-and-spend hypothesis), while bidirectional causality (fiscal synchronization) exists in longer time horizons. This approach addressed non-stationarity issues and allowed for a better understanding of the dynamic relationship between revenue and expenditure over various time scales.

Data and Methodology

This study is an investigation of the relationship between tax revenue, government expenditure and economic growth in Nigeria. Given that economic growth is the core response variable, this study relies on the theoretical foundation of the Barro growth model. Barro (1990) designs a growth model in which public services serve as a productive input for private businesses.

Following Barro's (1990) model, and in line with the broad objectives of the study, we adopt, with modifications, the model specified by Gurdal, Aydin and Inal (2020) that links economic growth, tax revenue, and government expenditure. The Barro (1990) endogenous growth model establishes the relationship between government spending, taxation, and economic growth, often represented as:

$$EG_t = AK_t^\alpha (GEXP_t)^\beta (L_t)^{1-\alpha} \quad \text{----- (1.1)}$$

where:

- EG_t = Economic Growth (e.g., GDP growth rate)
- A = Total factor productivity
- K_t = Capital stock
- $GEXP_t$ = Government expenditure
- L_t = Labor input
- α, β = Elasticities of capital and government spending

Since government expenditure is funded by tax revenue, we introduce **TRE** as a financing source:

$$GEXP_t = \gamma TRE_t + \varepsilon_t \quad \text{----- (1.2)}$$

where γ represents the fraction of tax revenue allocated to government spending.

By substituting this into the Barro model, we obtain:

$$EG_t = AK_t^\alpha (\gamma TRE_t)^\beta (L_t)^{1-\alpha} + \varepsilon_t \quad \text{----- (1.3)}$$

Taking logs:

$$\ln EG_t = \ln A + \alpha \ln K_t + \beta \ln TRE_t + (1-\alpha) \ln L_t + \varepsilon_t \quad \text{----- (1.4)}$$

This forms the baseline econometric model, which we extend using wavelet analysis.

Empirical Model for Causality Analysis

To analyze the causality paths between TRE, GEXP, and EG over time and frequency, we specify a vector autoregression (VAR) model:

$$\begin{bmatrix} EG_t \\ GEXP_t \\ TRE_t \end{bmatrix} = C + \sum_{i=1}^p \Phi_i \begin{bmatrix} EG_{t-i} \\ GEXP_{t-i} \\ TRE_{t-i} \end{bmatrix} + \varepsilon_t \quad \text{-----(1.5)}$$

where:

- C is the intercept vector
- Φ_i are coefficient matrices
- p is the lag order
- ε_t is the error term

The VAR model allows us to test Granger causality between the variables.

3. Wavelet Transformation for Time-Frequency Decomposition

Wavelet Transform (WT) is a mathematical tool that decomposes a time series into different frequency components while preserving time information. To capture the dynamic and multi-scale interactions, we transform the variables using the wavelet transform:

$$W_x(s, \tau) = \int_{-\infty}^{\infty} x(t) \psi^* \left(\frac{t - \tau}{s} \right) dt \quad \text{-----(1.6)}$$

where:

- $W_x(s, \tau)$ is the wavelet coefficient of $x(t)$ at scale s and time τ
- ψ^* is the complex conjugate of the wavelet function

Applying this to our VAR model, we obtain a wavelet-based VAR (WVAR) model:

$$\begin{bmatrix} W_{EG}(s, \tau) \\ W_{GEXP}(s, \tau) \\ W_{TRE}(s, \tau) \end{bmatrix} = C(s) + \sum_{i=1}^p \Phi_i(s) \begin{bmatrix} W_{EG}(s, \tau - i) \\ W_{GEXP}(s, \tau - i) \\ W_{TRE}(s, \tau - i) \end{bmatrix} + \varepsilon(s, \tau) \quad \text{----}$$

(1.7)

This allows us to:

1. Capture both short-term and long-term relationships between TRE, GEXP, and EG.

2. Identify time-varying causal linkages at different frequency bands.
3. Distinguish between high-frequency (short-term) and low-frequency (long-term) causality effects.

Final Empirical Wavelet-Adjusted Model

Using the wavelet-filtered data, we estimate the causal relationships using a wavelet-adjusted autoregressive distributed lag (W-ARDL) model:

$$\Delta W_{EG}(s, \tau) = \lambda_0 + \sum_{i=1}^p \lambda_1 \Delta W_{TRE}(s, \tau - i) + \sum_{j=1}^q \lambda_2 \Delta W_{GEXP}(s, \tau - j) + \eta_{s, \tau}$$

----(1.8)

where:

- λ_1 and λ_2 capture the wavelet-adjusted short-run effects
- $\eta_{s, \tau}$ is the error term
- EG is economic growth
- TRE is Tax Revenue
- GEXP is Government Expenditure

If λ_1 is significant, tax revenue has a direct impact on economic growth. If λ_2 is significant, government expenditure influences growth.

Empirical Results

Wavelet Data (Return Series)

Ordinarily, wavelet transform does not use absolute values in estimating the wavelet analysis, rather, it makes use of return series. Many economic and financial time series (e.g., GDP, tax revenue, government expenditure) are non-stationary—they exhibit trends over time.

Wavelet analysis requires data to be approximately stationary so that meaningful frequency-based decomposition can be performed. Also, return series (log differences) help remove trends and make the data stationary.

These are generated using the formula below, i.e.

$$R_t = \log\left(\frac{P_t}{P_{t-1}}\right) * 100 \quad 2.1$$

To generate the return series for tax revenue, we will use equation 2.2

$$TRE_{rt} = \log\left(\frac{TRE_t}{TRE_{t-1}}\right) * 100 \quad 2.2$$

To generate the return series for government expenditure, we will use equation 2.3

$$GEXP_{rt} = \log\left(\frac{GEXP_t}{GEXP_{t-1}}\right) * 100 \quad 2.3$$

To generate the return series for real GDP, we use equation 2.4

$$RGDP_{t_t} = \log\left(\frac{RGDP_{t_t}}{RGDP_{t-1}}\right) * 100 \quad 2.4$$

where TRE_{r_t} , $GEXP_{r_t}$ and $RGDP_{t_t}$ represent the respective return series of tax revenue, government expenditure, and real GDP generated from the present series of tax revenue (TRE_t), government expenditure ($GEXP_t$) and real GDP ($RGDP_t$) as well as the previous value of the tax revenue (TRE_{t-1}), government expenditure ($GEXP_{t-1}$) and real GDP ($RGDP_{t-1}$).

Table 1: Summary of Descriptive Statistics

	TRE _R	GEXP _R	RGDP _R
Mean	0.006165	0.006182	0.001141
Median	0.004865	0.006062	0.001375
Maximum	0.080381	0.043762	0.007297
Minimum	-0.046099	-0.033550	-0.005598
Std. Dev.	0.016085	0.010696	0.001959
Skewness	1.215577	0.546028	-0.306631
Kurtosis	7.700786	6.088318	4.337593
Jarque-Bera	0.001141	214.1588	43.21470
Probability	0.001375	0.000000	0.000000
Sum	2.952836	2.961137	0.546341
Sum Sq. Dev.	0.123679	0.054688	0.001835
Observations	479	479	479

Source: Author's Compilation

Notes: Table 1 presents the descriptive statistics of ordinary (annual) and return series (monthly) of tax revenue, government expenditure, and Real GDP for annual and monthly datasets from January 1981 to December 2020.

Results of the Wavelet Granger Causality Test

The energy decomposition of the relevant variables (RGDP, GEXP, and TRE) is analysed through multi-resolution analysis (MRA) to understand the short-term, medium-term, and long-term dynamics. Various applications of multiresolution analysis (MRA) and wavelet techniques in economic and electrical systems have been discussed so far. Crowley and Lee (2005) employed maximal overlap discrete wavelet transforms to analyze European business cycles, revealing different categories of eurozone members based on their correlations. Aguiar-Conraria et al. (2008) used cross-wavelet tools to examine the evolving relationship between monetary policy and macroeconomic variables across different frequencies. Gaouda et al. (2000) introduce MRA for detecting and classifying short-duration variations in electrical distribution systems, enabling measurement of signal characteristics during events. Mao et al. (2020) applied ensemble Empirical Mode Decomposition to analyze GDP fluctuations in major countries, finding that economic growth primarily fluctuates in 3-5-year cycles. They also used causal decomposition to

detect mutual causation among entities, revealing varying strengths and directions of causal relationships at different time scales. These studies demonstrate the utility of MRA and wavelet techniques in uncovering time-frequency dynamics in complex systems. The results are reported in Table 3. Following the above, the distributional patterns of RGDP, GEXP and TRE are grouped into four periodic phases beginning with short run period ($D_1 + D_2$), then medium run period ($D_3 + D_4$), long run period ($D_5 + D_6$) and very long run period (S_6) (Raza et al., 2016). The results of the energy decomposition of variables are reported in Table 2. According to the results, high frequencies are observed in the distribution of RGDP during the short run period ($D_1 + D_2$) with a total scale of 74.37% (i.e., $67.69 + 6.68 = 74.37$). However, the variation in RGDP stabilises after the medium run in the rest of periods. The results show a similar distributional pattern in both GEXP and TRE as both variables witness high frequencies in the medium run ($D_3 + D_4$) with a total scale of 61.73% (GEXP) and 62.95% (TRE). However, stability is maintained in the remaining parts of the periods.

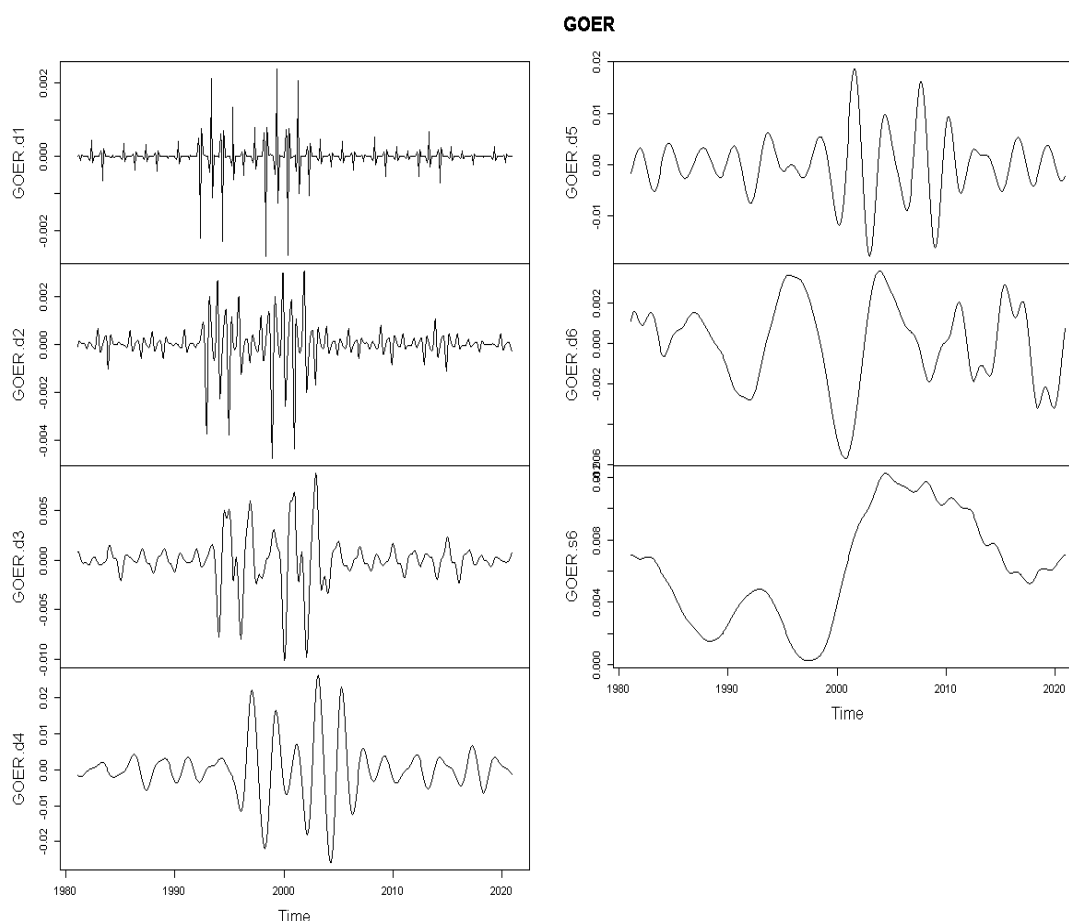


Figure 1: Time and frequency decomposition of Government Expenditure
Source: Author's computation from RStudio (2022)

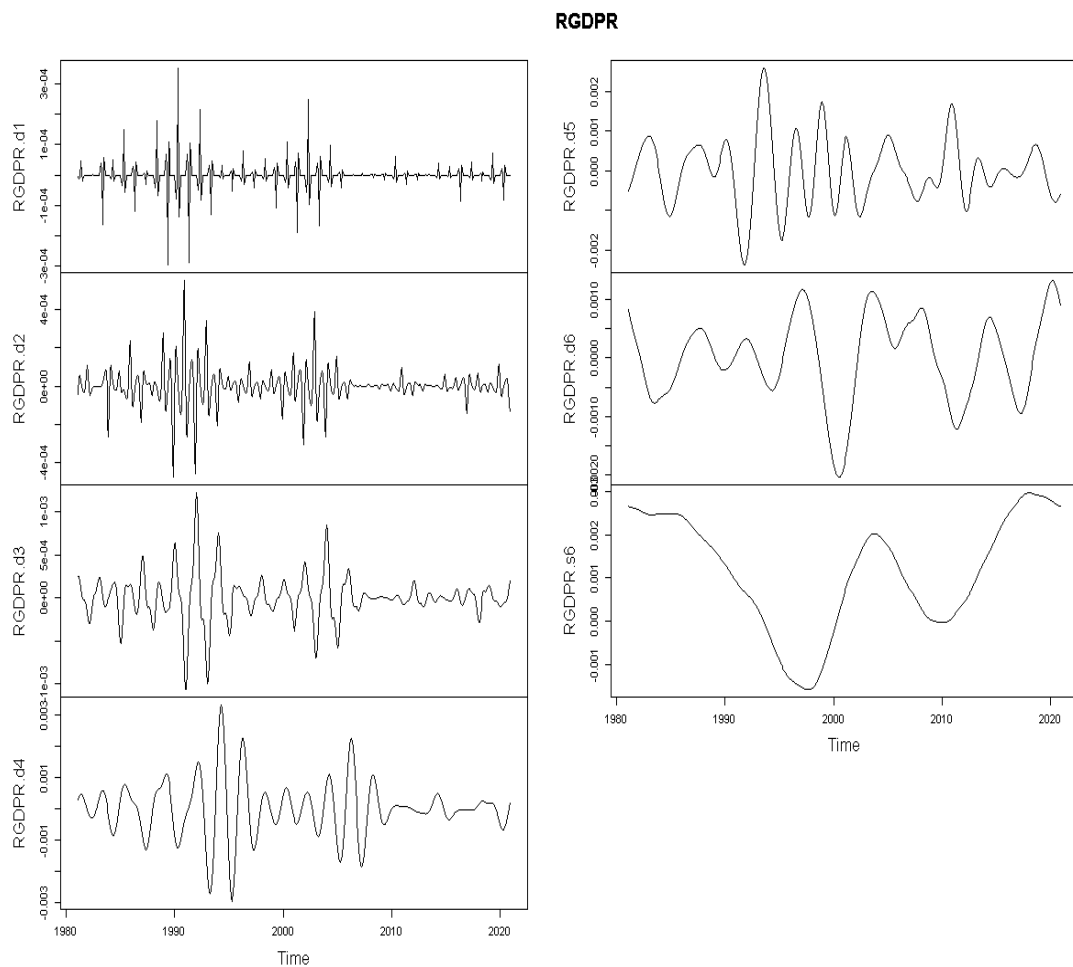


Figure 2: Time and frequency decomposition of Real GDP

Source: Author's computation from RStudio (2022)

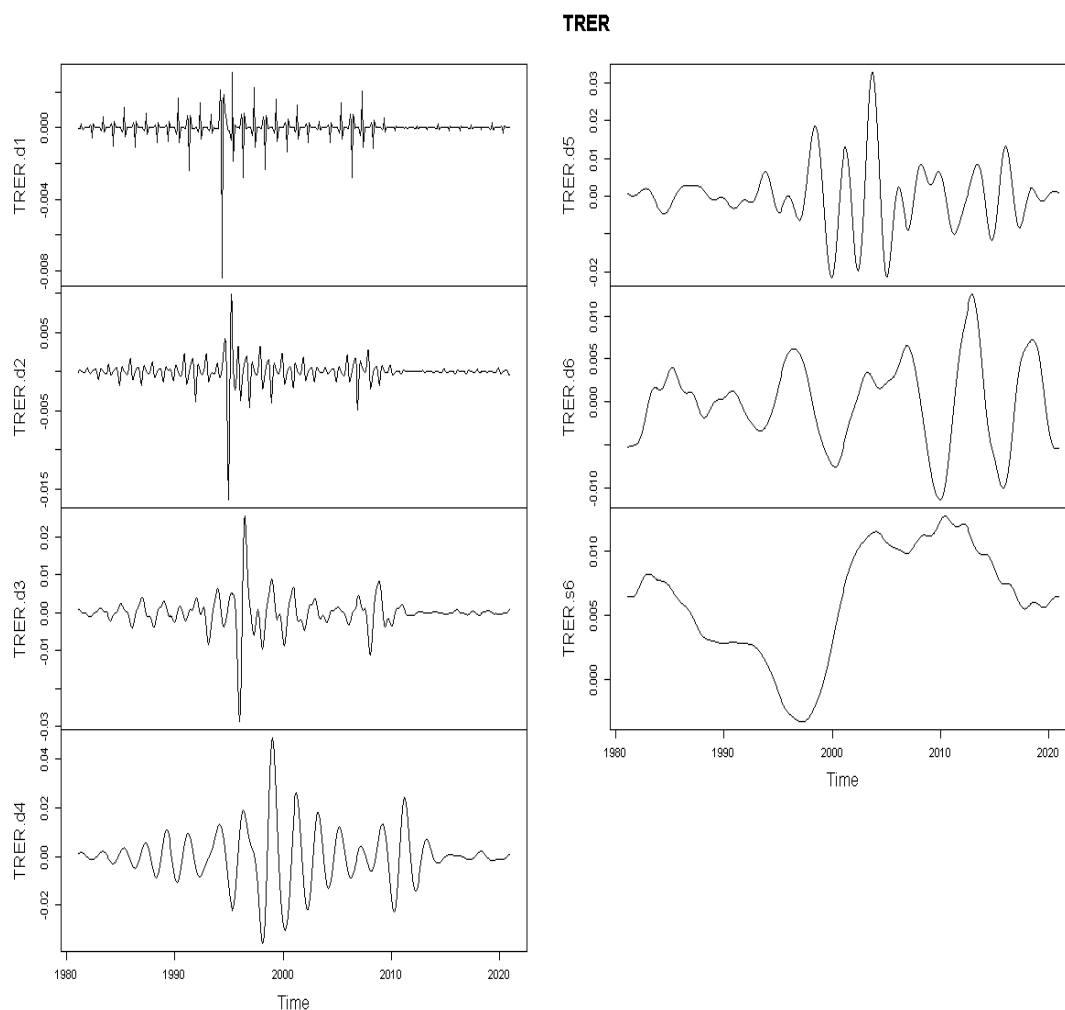


Figure 3: Time and frequency decomposition of Tax revenue
Source: Author's computation from Rstudio (2022)

Table 2: Energy Decomposition of RGDP, GEXP and TRE

Wavelet Scales	RGDP (%)	GEXP (%)	TRE (%)
D_1 (2–4-month cycles)	67.69	27.75	17.60
D_2 (4–8-month cycles)	6.68	2.17	8.74
D_3 (8–16-month cycles)	9.25	25.46	25.63
D_4 (16–32-month cycles)	13.33	36.27	37.32
D_5 (32–64-month cycles)	2.65	7.26	9.06
D_6 (64–128-month cycles)	0.34	0.94	1.43
S_6 (above 128-month cycles)	0.06	0.15	0.22

Source: Researcher's Calculation

Wavelet Correlation

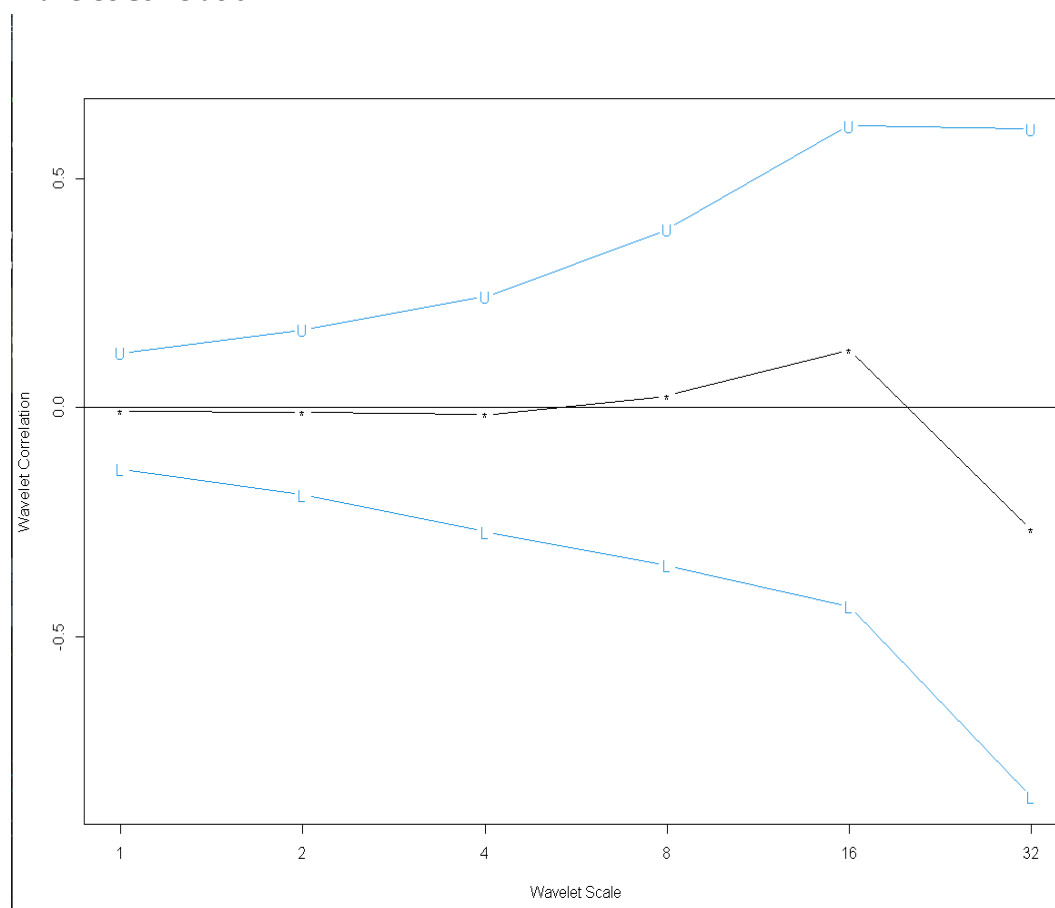


Figure 4: The wavelet correlation analysis for tax revenue and economic growth

Source: Author's computation using RStudio (2022)

Notes: Figure 4 represents the wavelet correlation of return series of tax revenue and real GDP from January 1981 to December 2020. The upper (U) and lower (L) bounds are 95% confidence interval while the black dotted line denotes the correlation between tax revenue and real GDP in Nigeria.

The wavelet correlation shows the positive and negative association that exists between the variables series which are tax revenue and real GDP. When the correlation is positive (0.0 – 0.5 on the horizontal line) it shows the series are having a positive relationship. And when it is a negative correlation (0.0 – -0.5 on the horizontal line), it implies series are having a negative relationship. The wavelet correlation is also measured on a vertical wavelet scale 1 - 32 where 1 – 4 measures the short run period, 4 – 8 measures the medium run period, 8 - 16 measures the long run period and 16 – 32 measures the very long run period. The black line depicts the wavelet correlation, while the blue lines represent the upper and lower limits. The short run analysis shows there is existence of a slightly negative relationship between the series, in the medium run we start having a positive correlation between tax revenue and real GDP while the long run analysis and very long run period show there is a positive relationship, but it was declining towards the middle of the very long run period.

Our research findings align with existing studies that highlight the significant impact of tax revenue changes on economic growth. Consistent with Lahura & Castillo (2016) and Furceri & Karras (2008), these results confirm that tax increases tend to slow economic growth, while tax cuts stimulate it. The observed long-term elasticity of GDP to tax revenue falls within the reported range of -0.22 to -1.0, reinforcing the negative relationship. Additionally, my findings support Karras (2019), indicating that tax changes influence investment more than consumption and can affect inflation dynamics. However, as Lahura & Castillo (2016) note, while tax cuts may boost growth, the corresponding rise in tax revenue may not fully compensate for the initial reduction. Furthermore, my study aligns with Çollaku et al. (2023), suggesting that in developing economies, fluctuations in tax revenue can negatively impact GDP over time, indicating a bidirectional causal relationship.

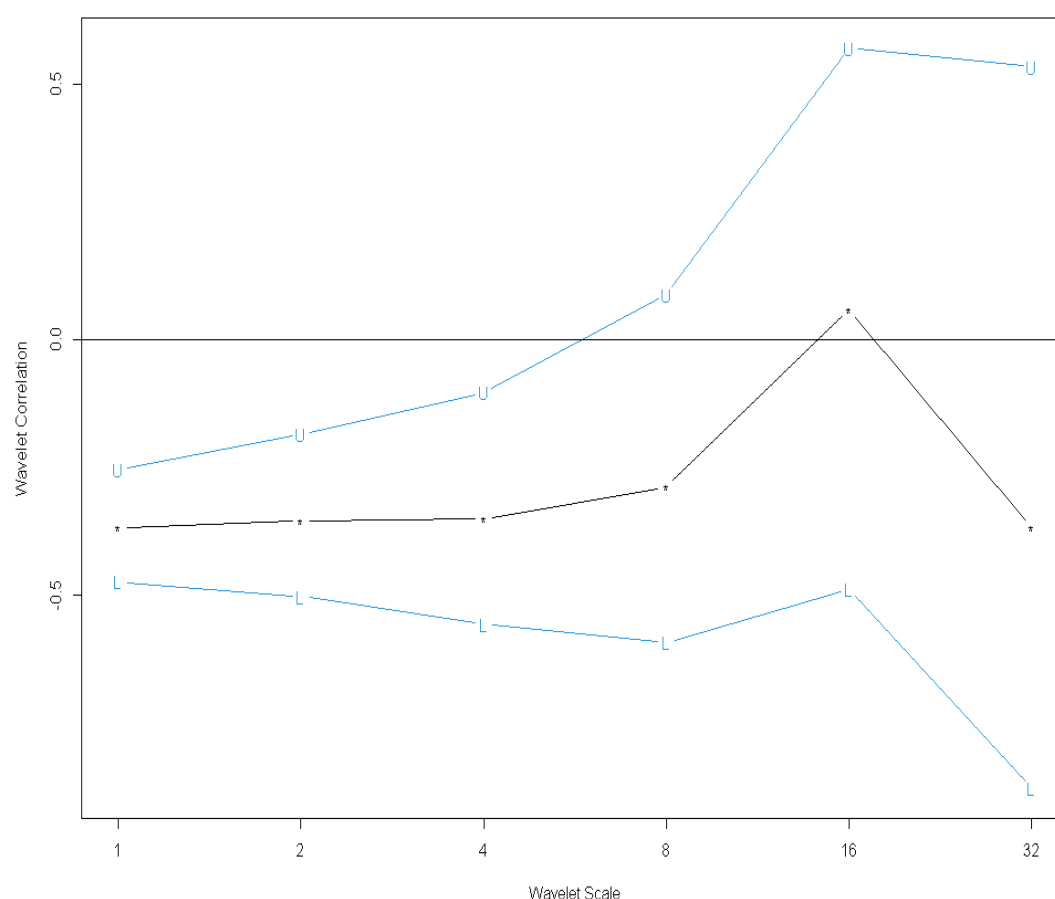


Figure 5: The wavelet correlation analysis for government expenditure and economic growth

Source: Author's computation using RStudio (2022)

Notes: Figure 5 represents the wavelet correlation of return series of government expenditure and real GDP from January 1981 to December 2020. The upper (U) and lower

(L) bounds are 95% confidence interval while the black dotted line denotes the correlation between government expenditure and real GDP in Nigeria.

In figure 5 the short run, medium run and long run analysis show there is existence of a negative relationship between the series, but in the long run we start having an upward movement towards positive correlation between government expenditure and real GDP while the very long run analysis shows there is a positive relationship, but it was declining at the beginning of the very long run period. The research findings align with existing studies on the long-term relationship between government expenditure and economic growth. Consistent with Arpaia & Turrini (2007), our results indicate that government expenditure exhibits a significant long-run impact on economic growth, with elasticity estimates suggesting a strong connection between fiscal spending and potential output. While short-term effects may vary, as highlighted by Debnath & Mazumder (2016) and Kukk (2007), this study reinforces the view that in the long run, government expenditure plays a crucial role in shaping economic performance, particularly in developing economies.

Wavelet Granger Causality

Having examined the Wavelet energy decomposition of variables, we proceed to reporting and discussing the Wavelet Granger causality test results as shown in Table 3. In the first segment of Table 3, results show no evidence of causality between the raw series of RGDP (economic growth) and raw series of GEXP (government expenditure) in Nigeria in line with Ajayi and Aluko (2016). However, a bi-directional causality exists between economic growth (RGDP) and government expenditure (GEXP) in the long run period ($D_5 + D_6$) and very long run period (S_6). These periods coincide with the periods of low frequencies in both RGDP and GEXP, meaning that RGDP and GEXP mutually explain changes in each other during their low-frequency periods. The implication of this finding is that economic growth (RGDP) and government expenditure (GEXP) are mutually dependent in Nigeria, meaning that policy actions administered to adjust the level of either RGDP or GEXP are expected to unleash significant influence on either GEXP or RGDP in the long run.

In the second segment of Table 3, we found similar causality outcomes between RGDP (economic growth) and TRE (tax revenue). First, there is no evidence of causality between the raw series of RGDP and that of TRE, but a unidirectional causality was found running from RGDP to TRE in the long run period ($D_5 + D_6$) while a bidirectional causality was found between RGDP and TRE in the very long run periods (S_6) in support of the finding by Arvin, Pradhan and Nair (2021). These periods coincide with the periods of low frequencies in both RGDP and TRE, meaning that either unidirectional causality from RGDP to TRE or bidirectional causality between RGDP and TRE are taking place their low frequency periods during the long run. Interestingly, a unidirectional causality from TRE (tax revenue) to RGDP (economic growth) exists in the second half of the medium run period (D_4). This period coincides with the period of highest frequency in TRE and medium frequency in RGDP. The outcome of this analysis implies that either economic growth (RGDP) policies or tax

revenue (TRE) policies are only sufficient for both RGDP and TRE in the long run, while in the medium run, only tax revenue policies are sufficient for economic growth.

In the third segment of Table 3, results show that no causality exists between the raw series of TRE (tax revenue) and GEXP (government expenditure). However, evidence of a unidirectional causality running from tax revenue (TRE) to government expenditure (GEXP) was found in the second half of the short run period (D_1), during the medium run period ($D_3 + D_4$), and long-run period ($D_5 + D_6$). These periods coincide with the periods of high, medium, and low frequencies in both TRE and GEXP, meaning that tax revenue causes changes in high, medium, and low frequencies of government expenditure during the short run, medium run and long run periods. This finding is in support of the finding reported by Apergis *et al.* (2012), Yinusa *et al.* (2017), Arvin, Pradhan, and Nair (2021), Gurdal, Aydin, and Inal (2021), and negates the finding by Irandoust (2018). This finding also confirms the finding earlier reported in this study regarding the significant impact of tax revenue on government expenditure. Thus, our finding suggests that Nigerian government largely depends on revenue collected from various tax sources to carry out its expenditure obligations in the economy.

Table 3: Wavelets Granger Causality between TRE, GEXP, and RGDP

	Time Domain	Frequency bounds (months)						
1st Segment	GEXP							
		D1	D2	D3	D4	D5	D6	S6
RGDP	Raw series	2-4M	4-8M	8-16M	16-32M	32-64M	64-128M	>128M
H₀	RGDP does not cause government expenditure							
	0.177	0.999	0.994	0.555	0.102	0.001	0.000	0.000
H₀	Government expenditure does not cause RGDP							
	0.169	0.998	0.550	0.132	0.000	0.069	0.016	0.000

	Time Domain	Frequency bounds (months)						
2nd Segment	GEXP							
		D1	D2	D3	D4	D5	D6	S6
RGDP	Raw series	2-4M	4-8M	8-16M	16-32M	32-64M	64-128M	>128M
H₀	RGDP does not cause tax revenue							
	0.686	1	0.989	0.78	0.295	0.027	0.000	0.000
H₀	Tax revenue does not cause RGDP							
	0.753	1	0.993	0.832	0.045	0.108	0.069	0.000

	Time Domain	Frequency bounds (months)						
3 rd Segment	GEXP							
		D1	D2	D3	D4	D5	D6	S6
TRE	Raw series	2-4M	4-8M	8-16M	16-32M	32-64M	64-128M	>128M
H ₀	Tax revenue does not cause government expenditure							
	0.376	0.842	0.009	0.017	0.000	0.018	0.000	0.216
H ₀	Government expenditure does not cause tax revenue							
	0.963	1	0.661	0.396	0.1432	0.072	0.067	0.002

Evaluation of Research Hypotheses

H₁: There is no causal relationship between tax revenue, government expenditure and economic growth in Nigeria

With regards to the results in Table 3, the null hypothesis of no causal relationship between tax revenue, government expenditure and economic growth cannot be rejected for the raw series of the variables since the p-values for the non-granger causality between each pair of the variables are greater than 0.05, meaning that there is no causal relationship between the raw series of tax revenue, government expenditure and economic growth in Nigeria. However, when we consider the time and frequency dimensions of the series, the null hypothesis of no Granger causality between the three variables is rejected. Specifically, our findings show that a bi-directional causality exists between economic growth (RGDP) and government expenditure (GEXP) in the long run period ($D_5 + D_6$) and very long run period (S_6). In contrast, a unidirectional causality was found running from RGDP to TRE in the long run period ($D_5 + D_6$). A unidirectional causality runs from tax revenue (TRE) to government expenditure (GEXP) in the second half of the short run period (D_1), during the medium run period ($D_3 + D_4$), and long run period ($D_5 + D_6$). These findings further suggest that while RGDP and GEXP Reciprocally illustrate how alterations occur within each other during their periods of reduced frequency, both unidirectional causality from RGDP to TRE and bidirectional causality between RGDP and TRE are taking place in different periods of their low frequency during the long run, and that tax revenue causes changes in high, medium, and low frequencies of government expenditure during the short run, medium run, and long run periods.

Conclusion and Policy Implementation for Nigeria

This research investigates the correlation between tax revenue, government expenditure, and economic growth in Nigeria from 1981 to 2020. The research uses the endogenous growth model framework and employs the Wavelet Granger causality test to determine the direction of causality among the variables. The results indicate a lack of causal linkages between the unprocessed data series of tax revenue and government expenditure, tax revenue and economic growth, as well as government expenditure and economic growth in the context of Nigeria. However, when considering the time and frequency dimensions of the series, the results show that there is a bi-directional causality between economic growth

and government expenditure in the long run periods, coinciding with periods of low frequencies in both variables. Additionally, there is a unidirectional causality from economic growth to tax revenue in the long run periods, also corresponding to periods of low frequencies. Moreover, a unidirectional causality runs from tax revenue to government expenditure in the short run, medium run, and long run periods, coinciding with periods of high, medium, and low frequencies in both variables. The study emphasizes that the time and frequency properties of tax revenue, government expenditure, and economic growth are essential for understanding their causal relationship and should be considered in policy formulations.

The research has established a clear connection among tax revenue, government expenditure, and economic growth in Nigeria, outlining their reciprocal influences. Considering these findings, the following suggestions are put forth:

1. Expand the tax revenue base by creating more job opportunities, promoting corporate growth, and developing untapped resources. Increasing employment ensures a broader taxpayer base as more individuals contribute to Pay-As-You-Earn (PAYE) tax and Value Added Tax (VAT) through increased consumption.

Example: Investment in Infrastructure & Industrial Zones

- The Lagos Free Trade Zone (LFTZ) and Lekki Deep Seaport have attracted foreign and local investments, generating thousands of jobs in logistics, manufacturing, and services.
- The National Social Investment Programme (NSIP) (e.g., N-Power, TraderMoni) creates jobs and supports small businesses, indirectly increasing tax compliance.
- Agriculture empowerment programs, such as the Anchor Borrowers' Programme (ABP), help farmers scale their businesses, improving income tax collections from the agricultural sector.

Also, a thriving corporate sector leads to higher corporate tax revenues (Company Income Tax, CIT) and more employment, increasing PAYE contributions.

Example: Incentives for SMEs and Startups

- The Finance Act 2019 reduced CIT for small businesses (turnover < ₦25 million) to 0% while keeping medium-sized businesses at 20%, allowing them to grow before reaching full tax obligations.
- The Startup Act 2022 provides tax breaks for tech startups, enabling them to expand, generate more revenue, and contribute to tax collections in the long term.
- The Dangote Refinery, when fully operational, will contribute significantly to CIT, PAYE from employees, and VAT from downstream petroleum product sales.

Furthermore, Nigeria has abundant natural resources beyond crude oil that remain underdeveloped, limiting tax revenue diversification.

Example: Expansion of the Solid Minerals & Renewable Energy Sectors

- The Federal Government's renewed focus on solid minerals (e.g., gold, lithium, and bitumen) is increasing tax collections from the mining sector.

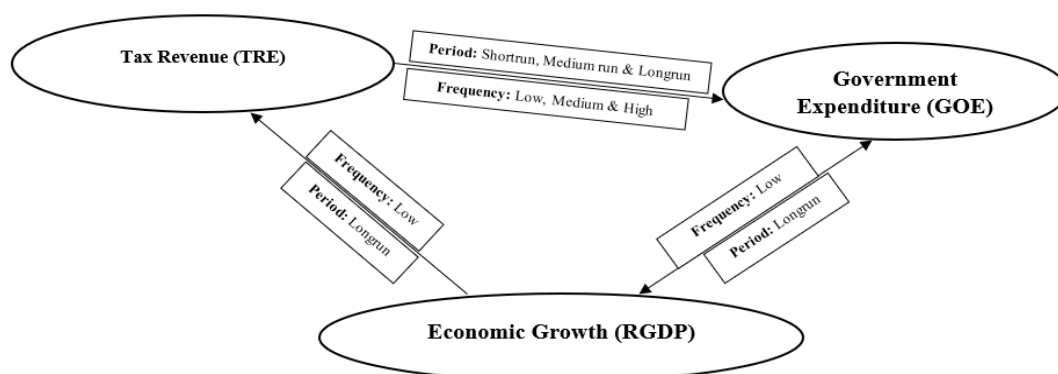
- States like Zamfara and Osun are formalizing gold mining to boost Internally Generated Revenue (IGR).
- The Renewable Energy Fund encourages solar energy expansion, creating jobs and increasing VAT/corporate taxes from solar companies.

These will increase the government's access to funds for productive capital projects and essential expenditure obligations.

2. Utilize expansionary fiscal policies periodically to boost economic growth by increasing spending on capital projects, which enhances demand for goods and services.
3. Formulate tax revenue policies that prioritize economic growth. The taxation framework should be designed to promote investment and saving, aiming to stimulate and foster economic growth.
4. Examine the interconnected loop of causation between economic growth, tax revenue, and government spending across various temporal and frequency intervals. Enhanced economic growth results in higher tax revenue, subsequently driving an upsurge in government expenditure. This, in turn, nurtures additional economic expansion.
5. Eliminate tax concessions and incentives that may not yield the desired results in attracting foreign direct investments and focus on revenue growth instead.

By implementing these recommendations, Nigeria can work towards achieving sustainable economic growth and development while ensuring effective management of tax revenue and government expenditure.

Summary of New Evidence from the Wavelet Granger Causality Test



NB: Arrows point to the direction of causality

Source: Researcher's Initiative

References

- Abdiyeva, R., & Baygonuşova, D. (2016). Tax revenues and economic growth relationship in transition economies: The case of Kyrgyzstan. *Academic Review International Refereed Journal of Social Sciences*, 53, 59-71.
- Afonso, A., & Rault, C. (2009). Bootstrap panel Granger-causality between government spending and revenue in the EU. *Economics Bulletin*, 29(4), 2542-2548.

- Aguiar-Conraria, L., Azevedo, N., & Soares, M. J. (2008). Using wavelets to decompose the time–frequency effects of monetary policy. *Physica A: Statistical mechanics and its Applications*, 387(12), 2863–2878.
- Ajayi, M. A., & Aluko, O. A. (2016). The causality between government expenditure and economic growth in Nigeria: a Toda-Yamamoto approach. *Journal of Economics and Business Research*, 22(2), 77.
- Al-Zeaud, H. A. (2012). Government revenues and expenditures: causality tests for Jordan. *Interdisciplinary Journal of Contemporary Research in Business*, 4(7), 193–204.
- Amri, K., Masbar, R., & Aimon, H. (2019). Is there a causality relationship between local tax revenue and regional economic growth? Panel data evidence from Indonesia. *Regional Science Inquiry*, 11(1), 73–84.
- Anastassiou, T., & Dritsaki, C. (2005). Tax revenues and economic growth: an empirical investigation for Greece using causality analysis. *Journal of Social Sciences*, 1(2), 99–104.
- Angbazo, D. A., & Iorlaha, M. (2024). Effect Of Tax Reforms On Revenue Generation In Nigeria: A Conceptual And Theoretical Review. https://abjournals.org/jarms/wp-content/uploads/sites/21/journal/published_paper/volume-4/issue-4/JARMS_NNXYP5SO.pdf
- Apergis, N., Payne, J. E., & Saunoris, J. W. (2012). Tax-spend nexus in Greece: are there asymmetries? *Journal of Economic Studies*, 39(3), 327–336.
- Arpaia, A., & Turrini, A. (2007). Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment. *Available at SSRN 2004461*.
- Aworinde, O., & Onakoya, A. (2015). Testing the validity of Wagner's Law in Nigeria: Evidence from Non-Linear Causality. *Ago-Iwoye Journal of Social and Behavioral Sciences*, 4(1), 217–230.
- Aydin, M., & Esin (2019). Renewable and non-renewable electricity consumption-economic growth nexus: evidence from OECD countries. *Renewable Energy*, 136, 599–606.
- Baghestani, H., & McNown, R. (1994). Do Revenues or Expenditures Respond to Budgetary Disequilibria? *Southern Economic Journal*, 61(2), 311–322.
- Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, 98.
- Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106, 407–443.
- Barro, R., & Sala-i-Martin, X. (1995). *Economic growth*. McGraw-Hill: New York.
- Carneiro, F. G., Faria, J. R., & Barry, B. S. (2004). Government revenues and expenditures in Guinea-Bissau: causality and cointegration. *Africa Region Working Paper*. 65. 1–11.
- Cass, D. (1965). Optimum growth in an aggregative model of capital accumulation. *Review of Economic Studies*, 32(3), 233–240.
- Chang, T., Liu, W. R., & Caudill, S. B. (2002). Tax-and-spend, spend-and-tax, or fiscal synchronization: new evidence for ten countries. *Applied Economics*, 34(12), 1553–1561.
- Chizea, D. B. (2021, August 16). Economics and Politics: The Role of Fiscal Policy in Sustaining Nigeria's Rising VAT Revenue. [WEBTV Interviewer].
- Chowdhury, A. (2011). State government revenue and expenditures: a bootstrap panel analysis (No. 2011-03). Marquette University, *Center for Global and Economic Studies and Department of Economics*.
- Çollaku, L., Balaj, D., & Hajdini, A. (2023). Correlation between tax revenues and gross domestic product: Evidence from the developing economy. *Corporate and Business Strategy Review*, 4(1), 31–38.
- Crowley, P. M., & Lee, J. (2005). *Decomposing the co-movement of the business cycle: a time-frequency analysis of growth cycles in the euro area* (No. 12/2005). Bank of Finland Research Discussion Papers.
- Darrat, A. F. (2002). Budget balance through spending cuts or tax adjustments? *Contemporary Economic Policy*, 20(3), 221–233.

- Debnath, S., & Mazumder, R. (2016). Investigating Short Run Causality between Real GDP and Government Expenditure in India Since 1950s. *Journal of economics and sustainable development*, 7, 61-71.
- Dritsaki, C. (2018). Causality between spending and revenue in case of Greece through Toda and Yamamoto methodology. *Journal of Business, Economics & Policy*, 5(1), 9-21.
- Egbunike, F. C., Emudainohwo, O. B., & Gunardi, A. (2018). Tax Revenue and Economic Growth: A Study of Nigeria and Ghana. *Signifikan: Jurnal Ilmu Ekonomi*, 7(2), 213-220.
- Eneche, E. O., & Stephen, I. A. (2020). Tax revenue and Nigeria economic growth. *European Journal of Social Sciences*, 3(1), 30-44.
- ERGP. (2017). *Economic Recovery and Growth Plan*. Abuja: Federal Ministry of Budget and Planning.
- Furceri, D., & Karras, G. (2008). Tax changes and economic growth: Empirical evidence for a panel of OECD countries. *Manuscript, University of Illinois*, 1, 1-29.
- Gaouda, A. M., Salama, M. M. A., Sultan, M. R., & Chikhani, A. Y. (2000). Application of multiresolution signal decomposition for monitoring short-duration variations in distribution systems. *IEEE Transactions on Power Delivery*, 15(2), 478-485.
- Gebreegziabher, S. (2018). Effects of Tax and Government Expenditure on Economic Growth in Ethiopia. *Springer, Singapore*. doi:10.1007/978-981-10-8126-2_5
- Gurdal, T., Aydin, M., & Inal, V. (2020). The relationship between tax revenue, government expenditure, and economic growth in G7 countries: new evidence from time and frequency domain approaches. *Economic Change and Restructuring*. doi:10.1007/s10644-020-09280-x
- Hondroyannis, G., & Papapetrou, E. (1996). An examination of the causal relationship between government spending and revenue: a cointegration analysis. *Public Choice*, 89(3-4), 363-374.
- Inoykwe, O. S. (2018). Economic Recovery and Growth Plan and Nation Building in Nigeria: Matters Arising. Available at SSRN 3225997.
- Irlandoust, M. (2018). Government spending and revenues in Sweden 1722–2011: Evidence from hidden cointegration. *Empirica*, 45(3), 543-557.
- Kalagbor, S. B., & Harry, D. M. (2021). Development policy, plan and economic diversification in Nigeria: Perspectives on economic recovery and growth plan. *European Journal of Development Studies*, 1(3), 43-52.
- Karagianni, S., Pempetzoglou, M., & Saraidaris, A. (2011). Tax burden distribution and GDP growth: nonlinear causality considerations in the USA. *International Review of Economics & Finance*, 21(1), 186-194.
- Karras, G. (2019). Macroeconomic Effects of Tax Changes: Evidence from a Sample of OECD Countries. *SPOUDAI Journal of Economics and Business*, 69, 111-138.
- Karlsson, H. K. (2019). Investigation of the time-dependent dynamics between government revenue and expenditure in China: a wavelet approach. *Journal of Asia-Pacific Economics*, 16, 1-20.
- Kazungu, K. (2019). The nexus between government expenditure and revenue in Tanzania. *Asian Journal of Economics and Modelling*, 7(4), 158-170.
- King, R. G., & Rebelo, S. (1990). Public policy and economic growth; developing neoclassical implications. *Journal of Political Economy*, 98, S126-S1511.
- Kollias, C., & Makrydakis, S. (2000). Tax and spend or spend and tax? Empirical evidence from Greece, Spain, Portugal, and Ireland. *Applied Economics*, 32(5), 533-546.
- Kukk, K. (2007). Fiscal policy effects on economic growth: short run vs long run. *Tallinn University of Technology Working Paper*, 167, 77-96.
- Lahura, E., & Castillo, G. (2016). *Measuring the effect of tax changes on economic activity in Peru* (No. 2016-010).
- Leyria, C., Chukwuma, E., & Asian, U. (2012). Tax System in Nigeria: Challenges and the Way Forward. *Research Journal of Finance and Accounting*, 3(9), 51-65.

- Lee, Y., & Gordon, R. H. (2005). Tax structure and economic growth. *Journal of Public Economics*, 89(5-6), 1027-1043.
- Lien, N. P., & Thanh, S. D. (2017). Tax Revenue, Expenditure and Economic Growth: An Analysis of Long-run Relationships. *Journal of Economic Development*, 24(3), 04-26.
- Lincoln, I., & Hasan, M. (1997). Tax then spend or spend then tax? Experience in the UK, 1961-93. *Applied Economics Letters*, 4, 237-239.
- Lojanica, N. (2015). *Government Expenditure and Government Revenue - The Causality on the Example of the Republic of Serbia*. Management International Conference, Slovenia.
- Lupu, D., & Asandului, M. (2017). The nexus between economic growth and public spending in Eastern European countries. *Engineering Economics*, 28(2), 155-161.
- Mamatzakis, E. C. (2005). The dynamic responses of growth to tax structure for Greece. *Applied Economics Letters*, 12(3), 177-180.
- Mao, X., Yang, A. C., Peng, C. K., & Shang, P. (2020). Analysis of economic growth fluctuations based on EEMD and causal decomposition. *Physica A: Statistical Mechanics and its Applications*, 553, 124661.
- Mehrara, M., Abrishami, H., Boroujli, M., & Amin, M. (2013). Government expenditure and economic growth in Iran. *International Letters of Social and Humanistic Sciences*, 11, 76-83.
- Michael I., Ijuwo A. A., Tarsue A. (2024), Maximizing Revenue Generation Through Effective Tax Policies for Sustainable Economic Development in Nigeria; A Conceptual Review. *African Journal of Accounting and Financial Research* 7(1), 119-131. DOI: 10.52589/AJAFR-XJQQEGDR
- Miller, S. M., & Russek, F. S. (1990). Co-integration and error-correction models: the temporal causality between government taxes and spending. *South Economic Journal*, 57(1), 221-229.
- Odhiambo, N. (2015). Government expenditure and economic growth in South Africa: an empirical investigation. *International Atlantic Economic Society*, 43(3), 393-406.
- Obeng, S. (2015). A causality test of the revenue-expenditure nexus in Ghana. Retrieved from <https://mpira.ub.uni-muenchen.de/63735/>.
- Okonjo-Iweala, N. (2013). The federal government is losing over N80 billion monthly from registered companies that refuse to pay taxes. *Nigeria Newsdesk*.
- Okwori, J., & Sule, A. (2016). Revenue sources and economic growth in Nigeria: An appraisal. *Journal of Economics and Sustainable Development*, 7(8), 113-123.
- Olayungbo, D. O., & Olayemi, O. F. (2018). Dynamic relationships among non-oil revenue, government spending, and economic growth in an oil-producing country: evidence from Nigeria. *Future Business Journal*, 4(2), 246-260.
- Onakoya, A. B., & Afintinni, O. I. (2016). Taxation and economic growth in Nigeria. *Asian Journal of Economic Modelling*, 4(4), 199-210.
- Osinuga, T. A., Raji, O. A., Asiyambi, H. B., & Fadahunsi, O. A. (2025). New tax reforms and public debt management in Nigeria: challenges, opportunities, and policy recommendations. *British Journal of Interdisciplinary Research*, 2(3), 83-96.
- Payne, J. E., & Ewing, T. B. (1998). Government revenue-expenditure nexus: evidence from Latin America. *Journal of Economic Development*, 23(2), 57-69.
- Payne, J. E. (1998). The tax-spend debate: time series evidence from state budgets. *Public Choice*, 95(3-4), 307-320.
- Ray, S., Pal, K. M., & Ray, I. A. (2012). A causality analysis on tax-growth nexus in India: 1950-51 to 2011-12. *Journal of Expert Systems*, 1(4), 104-114.
- Reddick, C. G. (2002). Canadian Provincial budget outcomes: a long-run and short-run perspective. *Financial Accountability & Management*, 18(4), 355-382.
- Rosoiu, I. (2015). The impact of government revenues and expenditures on the economic growth of Romania. *Procedia Economics and Finance*, 32, 526-533.

- Saqib, S., Ali, T., Riaz, M. F., Anwar, S., & Aslam, A. (2014). Taxation effects on economic activity in Pakistan. *Journal of Finance and Economics*, 2(6), 215-219.
- Saunoris, J. W., & Payne, J. E. (2010). Tax more or spend less? Asymmetries in the UK revenue-expenditure nexus. *Journal of Policy Modeling*, 32, 478-487.
- Siami-Namini, S., Muhammad, D., Fahimullah, F. (2018). The short and long run effects of selected variables on tax revenue-a case study. *Applied Economics and Finance*, 5(5), 23-32.
- Solow, R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.
- Taha, R., Nanthakumar, L., & Colombage, S. R. (2011). The effect of economic growth on taxation revenue: the case of a newly industrialized country. *International Review of Business Research Papers*, 7(1), 319-329.
- Tosun, M. S., & Abizadeh, S. (2005). Economic growth and tax components: an analysis of tax changes in OECD. *Applied Economics*, 37(19), 2251-2263.
- Ugwueze, O. (2022). The Economic Recovery and Growth Plan (ERGP) as a Remedy to Nigeria's Economic Recession: An Introspection. *Available at SSRN 4333756*.
- Vamvoukas, G. A. (2012). Panel data modelling and the tax-spend controversy in the euro zone. *Applied Economics*, 44(31), 4073-4085.
- Wagner, A. (1883). *Finanzwissenschaft*, 1883. Leipzig, partially translated in *Musgrave and Peacock*.
- Widmalm, F. (2001). Tax structure and growth: Are some taxes better than others? *Public Choice*, 107(3-4), 199-219.
- Yinusa, O. G., Aworinde, O. B., & Oseni, I. O. (2017). The revenue-expenditure nexus in Nigeria: asymmetric cointegration approach. *South-East European Journal of Economics*, 15(1).
- Zapf, M., & Payne, J. E. (2009). Asymmetric modeling of the revenue expenditure nexus: evidence from aggregate state and local government in the US. *Applied Economics Letters*, 16, 871-876.
- Zeng, J., & Du, H. (2003). *Allocation of tax revenue and growth effects of taxation. Impulse response functions*. National University of Singapore, Singapore.