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Revisiting Military Expenditure and Economic Growth Nexus in Nigeria: A Wavelet Approach

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Abstract

This study examined the relationship between defence expenditure and economic growth in Nigeria. The ARDL model and wavelet coherence test were applied using time series data covering 1960 to 2018, obtained from the World Bank. Military expenditure has a negative short-run impact on economic growth. Arms import and the military regime increased economic growth rate in the short run but the growth rate declined in the long run. Wavelet Coherence result shows that military expenditure leads economic growth, in other words, the growth impact of military expenditure is temporal. The benefits of increased military expenditure are in the long run not the short run. The military regime has a negative long-run impact on the economic growth rate. The role of the military in governance should be minimized. Military should concert effort in national defense and not governance.

Keywords: *Military expenditure, Arms imports, Wavelet coherence, Economic growth, ARDL, Military regime.*

Introduction

Economic growth is an important objective of governments in both developed and developing economies. The economic ramifications of military spending remain a contentious topic in scholarly discourse, lacking a definitive consensus. Despite the significant investments by the Nigerian government in the Military to ensure peace and security, the country continues to grapple with insecurity, and ranked as the 6th most terrorized nation globally in 2020. Nigeria's democratic stability has been marred by multiple unexpected military interventions which can induce structural breaks in the timeseries. Despite substantial budgetary allocations to the military across regimes, the impact of military spending on Nigeria's economic growth remains uncertain. This study aims to revisit the nexus between defense expenditure, arms import and economic growth, and further investigate the influence of military rule and terrorism in Nigeria.

Since Benoit (1973) there is growing research attention on the relationship between military spending and economic growth, yielding mixed findings . While some studies show that military investment boosts capital formation (Cappella Zielinski et al., 2017; Tao et al., 2020), others show that higher military spending would slow growth (Azam, 2020). It is essential to underscore that the relationship between defence spending and economic expansion is complex and subject to fluctuation based on individual nations and contextual variables (Robinson, 2019. The variance in growth impact of military expenditure may be attributed to inadequate consideration of time horizons in econometric modeling, overlooking structural breaks in time series data, and inconsistent utilization of estimation techniques across various study scopes.

In economic theory, short- and long-term growth determinants are differentiated. Short-run growth is disrupted by sudden shocks, temporarily veering the economy off its long-term trajectory (Andersson & Karpestam, 2013). long-term economic growth is propelled by factors such as technological advancement, heightened employment rates, capital accumulation including infrastructure development, and enhanced

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productivity, among other contributors. Short-term effects may diverge from long-term outcomes, necessitating the incorporation of varying time horizons in econometric modelling to prevent erroneous conclusions and ineffective policy formulation (Khalid & Habimana, 2021).

To investigate the connection between military expenditure and economic growth in Nigeria, this study employed the Autoregressive Distribtuted Lag (ARDL) model and wavelet choherence analysis, considering the significance of time horizons. Several studies examined the relationship among different economic variables using both wavelet analysis and conventional regression methods (Aziz & Khalid, 2019; Khalid & Habimana, 2021). Wavelet analysis unveils aspects of time series relationship between variables that are otherwise unobservable (Ramsey, 2002). This study covers 1960 to 2022 within which two notable regimes are identified. First is the Military regime (1963-1999) with the military truncation of democracy for decades (Zangina & Hassan, 2020). The second regime is of Terrorism – Boko-Haram (2009-2018) with the rise of terrorist organizations like Boko-Haram and clashes between Herdsmen and farmers, among other internal crises which occurred during the civilian government. The period of military government has the largest defence spending in Nigeria. The two identified regimes can cause structural breaks in the time series which may have implications for the estimation outcome if not accounted for in modelling the relationship between military expenditure and economic growth.

There are notable spikes in Nigeria's defense expenditure during the military regime between 1963 and 1999. Defense expenditure as a percentage of the total Federal Government budget fluctuated over the years. It was 10.13% in 1974, increased to 11.99% in 1975, dropped to 9.79% in 1986, and fell sharply to 2.45% in 1992. During civilian administration in 2002, it rose to 9.10%, maintaining levels around 7.23% and 7.74% in 2005 and 2006, respectively. In subsequent years, it peaked at 9.7% in 2011 and 9.8% in 2012, but declined to 9.3% in 2013, and reached 9.8% again in 2015, showing ongoing fluctuations. According to the Stockholm International Peace Research Institute (SIPRI), defense expenditure grew by 1.8 billion dollars in 2018, the largest since the Cold War's ended. Military spending in Africa increased to 22.2 billion dollars in North Africa and 18.4 billion dollars in Sub-Saharan Africa. In 2018, Nigeria overtook South Africa as the continent's second-highest military spender. Nigeria became the largest defense spender in 2021 with a 56% increase in spending to combat activities of Boko-Haram and separatist insurgents and enhance investor, and consumer confidence and boost economic growth.

This study examined the relationship between defense expenditure and economic growth, alongside the impact of military regimes and terrorism on economic growth. It diverges from prior research in two key aspects: firstly, by employing wavelet analysis to address temporal aspects overlooked in Nigerian literature on defense expenditure and economic growth; and secondly, by considering structural breaks in modeling the relationship between defense expenditure and economic growth, recognizing their potential to distort estimated results and misinform policy decisions. The findings suggest that defense expenditure, military regimes, and terrorism impede economic growth in Nigeria. Notably, no prior study has addressed the influence of military regimes and terrorism when investigating the connection between defense expenditure and growth in Nigeria. The primary contribution of this study lies in the utilization of the wavelet coherence approach for time analysis, coupled with the innovative ARDL model, to account for both long-run and short-run effects of defense expenditure on economic growth.

The subsequent sections of this paper are structured as follows: Section 2 provides a literature review, while Section 3 outlines the research methodology. Section 4 presents the findings and their implications for policy, and finally, Section 5 offers conclusions drawn from the results.

Literature

Theoretical Review

According to Wagner's law, the achievement of industrialization will increase government spending. When a larger industrial economy is achieved, there will be an increase in population, urban centres, and criminal activities will rise as well. This would require more government expenditure to provide important services like education and health care, as well as increased security investment to combat crime. Since defence

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personnel and conscripts receive excellent physical training and a variety of skills, particularly in developing nations, it is also likely that defence expenditure contributes to the development of human capital in the fields of education and health (Yildirim & Sezgin, 2002). Similarly, the Keynesian theory maintains that greater defence expenditure will enhance aggregate demand, resulting in a rise in purchasing power and aggregate production, as well as positive externalities. As a result, there is a positive link between economic growth and government expenditure (Musgrave 1969).

Increased defense expenditure will leave fewer resources available for development, reducing the state's economic potential. Defense expenditure, according to the Keynesian theory, is a component of government consumption which fosters economic development by increasing the demand for goods and services. Increases in defense expenditure tend to increase capacity utilization, improve profits, and hence boost investment and aggregate production when aggregate demand is lower than anticipated supply (Joerding, 1986). On the other hand, Terrorism and political instability has the potential to reduce consumer and investor confidence which will bring about reduced household and business investment and consequently, less economic growth. The same outcome is true when military government takes over power from a civilian government, the constitution is suspended, human rights are suppressed with a high level of corruption. These tendencies will Evidence from previous studies is congruent to the Keynesian perspective of a positive influence of military spending on the national economy (Benoit, 1978).

According to classical theory, an increase in government expenditure, particularly military spending, would result in a decrease in private investment, a decrease in national savings, and a decrease in consumption. As a result, higher defense expenditures will boost borrowing rates and crowd out private sector investment, resulting in a negative link between military spending and economic development. Peacock's displacement effect theory, first in 1961, noted that peaks in government spending correspond with societal upheavals such as war or preparation for war. This viewpoint is comparable to the neutrality theory, which holds that defense expenditure is affected by rising conflicts and internal and foreign threats rather than economic development. For economists, recent empirical data on the link between defense expenditure and economic development in emerging nations presents an intriguing dilemma. National defense is a consumption good, according to conventional reasoning, and as such, it decreases saving and capital investment, lowering economic development.

Empirical Review

Military spending and economic development literature are in three major strands focusing on supply effects security, demand effects (dunne and willenbockel 2005). The supply effects literature started with Benoit (1973). This study gave rise to several others and was based on the classical model arguing that an increase in defense expenditure will facilitate improvement in infrastructure, and modernization of administration, infrastructure improvement which will have a multiplier effect on the economy (Dunne, Nikolaidou, and Vougas 2001). Military expenditure can induce economic growth after a change in regime from military to civilian government by increasing in productivity of labour through training and education.

This strand of literature emphasized a positive link between military spending and economic growth. Njifen & Anemann, (2023) showed that military investment has a significantly favourable impact on sub-Saharan Africa's education spending. Dizaji & Farzanegan, (2023) Democracy plays a major role in reallocating nonmilitary spending over defence spending, as demonstrated by variance decomposition studies, impulse response functions, and a panel vector autoregressive model. Nonmilitary spending have no appreciable effect on democratic systems or democracy indices, positive shocks in military spending cause negative and substantial reactions from a variety of democracy measures.

Asongu & Ndour, (2023) evaluates the contribution of sound governance to reducing the effect of military spending on carbon emissions in forty African nations between 2010 and 2020. The Generalised Method of Moments (GMM) is used to calculate military spending per person, while CO2 emissions per person are used to calculate environmental damage. Degradation of the environment is a result of military spending and governance metrics.

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In the second literature strand, the demand effect is transmitted through the composition and level of expenditure. This literature strand is based on the Keynesian multiplier (model). Majority of this literature emphasized that military expenditure has a positive impact on growth. An increase in military spending will increase aggregate demand and bring the economy closer to full employment if the economy had spare capacity. The underconsumption theory emphasized a negative impact. The keynsian theory argues that military spending depleats private investment, increases inflationary pressure and moves resources from the productive public sectors as education, healthcare and infrastructure and consequently hinders growth.

Lanrui et al. (2022) ascertain that heightened military expenditure does not significantly foster prolonged economic development. Conversely, reducing military outlays may stimulate economic expansion. Selvanathan et al. (2021) corroborate Wagner's rule and the Keynesian hypothesis over the long term, indicating positive impacts on both short- and long-term economic growth through capital and continuous expenditures in Sri Lanka. Conversely,

Hirnissa & Baharom, (2009), employing ARDL and Dynamic Ordinary Least Squares (DOLS) methodologies across five ASEAN nations, reveal an inverse association between defense spending and GDP in Indonesia, Singapore, and Thailand. In Singapore, a bidirectional causal relationship exists, with defense spending unilaterally influencing growth. Similarly, Lai et al. (2005), utilizing the Generalized Method of Moments (GMM) across various global regions, elucidate that augmenting military expenditure tends to hinder economic growth, particularly in low-income countries.

Some studies focused on causality. Hirnissa, Habibullah, & Baharom (2009) found a bidirectional causal relationship is identified, with defense expenditure having a unidirectional impact on growth in Singapore. Wang et al., (2021) showed that that the effects of causality vary, and that the treadmill theory of destruction and the Environmental Kuznets Curve (EKC) hypothesis is supported in South Africa. (Madden & Haslehurst, 1995) found no evidence of causality between military expenditure land economic growth in Australia.

The third literature strand emphasizes the significance of defense expenditure in protection of lives and property and from external algression. In the absence of peace and security, investor's confidence and incentive to invest and innovate is depleted (dunne and willenbockel 2005). Conflict, terrorism or insecurity can obstruct economic growth and progress and can be partially mitigated with increased military expenditure (dunne and willenbockel 2005) and excessive accumulation of military assets provoke arms races or lead to conflict followed by negative implications (Dunne, Smith, and Willenbockel 2005).

Iheonu & Ichoku, (2023) African countries' economic development is adversely impacted by terrorism. Moreover, there is a strong beneficial interaction between terrorism and military spending on economic development. When the number of terrorist occurrences is used as a proxy for terrorism, the net effect of military spending on this relationship is positive; however, when the number of terrorist deaths is used as a proxy for terrorism, the net effect is negative. Maher & Zhao, (2022) investigated how Egypt's economic development was affected by both military spending and political unrest between 1982 and 2018. The results show a substantial negative link between political instability and economic development in both the short- and long-term. Qayyum et al., (2021) showed evidence via meticulous panel data analysis, that military spending and internal and foreign wars have a major short- and long-term impact on the ecological footprint.

Khan et al., (2021) This study examines the relationship between military spending and foreign debt in 35 nations that buy weapons between 1995 and 2016. Foreign debt tends to rise in direct proportion to military spending. A notable exception, meanwhile, is shown in Europe and Central Asia, where military spending reduces foreign debt. Additionally, with the exception of the upper-middle class, the Middle East and North Africa, and Latin America, the interaction between military spending and growth rate has a positive and substantial influence in the majority of sub-samples.

The variegated empirical outcomes in the literature are theoretically explicable, contingent upon economic, security, and political contexts. Factors such as the financing mechanism of military expenditure, the extent

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to which military expenditure externalities are utilized, and the efficacy of such expenditure in deterring conflict or terrorism can contribute to disparate findings. Crucially, extant literature has overlooked the temporal dimension wherein effects may vary. This study addresses this gap by considering the time horizon and acknowledging the presence of structural breaks or regime changes.

Methodology and Data

Annual time-series data from 1960 to 2018 were gathered from the Stockholm International Peace Research Institute (SIPRI) and the World Bank website. The variables in the study include Gross domestic product per capita (GDPPC), defence expenditure (lMilExp), arms importation (arms import) and military regime proxied dummy variables. The dummy variable assumes a value of 0 for the period of the military regime and a value of 1 for the period of civilian government in Nigeria. To account for exising structural breaks in the data, Bai and Perron test was implement and 3 break dates were identified. We generated Dummy variables for the break dates and were incorporated into the ARDL model specification.

Model Specification

To examine the effect of military spending on economic growth in Nigeria, we specified an Autoregressive Distributed Lags (ARDL) model. The ARDL model is best when variables exhibit a mixed order of integration. This means some variables are stationary at a level while others at first difference. Secondly, The ARDL method enables the derivation of a dynamic error correction model (ECM) via straightforward linear transformation. This facilitates the incorporation of short-term dynamics alongside long-term equilibrium, preserving crucial information regarding long-run relationships (Manamperi, 2016). The study implements the ARDL model specification to analyze the cointegration relationship between economic growth, military expenditure, population growth Arms Importation, and Regime of Military government in Nigeria. A similar was implemented in (Kwarbai et al., 2020; Schmidbauer & Rösch, 2012)

$$\Delta lgdppc_t = \beta_0 + \beta_1 lgdppc_{t-1} + \beta_2 lMilExp_t + \beta_3 larmsimp_t + \beta_4 Regime_t + \beta_5 Dummy_t + \beta_6 Dummy_t + \sum_{i=1}^{P} \pi_1 \Delta lgdp_{t-1} + \sum_{i=1}^{q} \pi_2 \Delta lMilPExp_{t-1} + \sum_{i=1}^{r} \pi_3 \Delta larmsimp_{t-1} + \sum_{i=1}^{t} \pi_4 \Delta Regime_{t-1} + \sum_{i=1}^{t} \pi_5 \Delta Dummy_{t-1} + \sum_{i=1}^{t} \pi_6 \Delta Dummy_{t-1} + \varepsilon_t \quad (1)$$

Where $\Delta lgdppc_t$ Indicates a change in the log of gross domestic product per capita (lgdppc); β_1, is the impact of one lagged period of log of gdppc on the log of gdppc in the current period. It is an autoregressive to show if growth in the previous period predicts growth in the current time, t. $\beta_2, \beta_3, and\ \beta_4$ show the longrun impact of military expenditure, arms importation and regime change, respectively, on economic growth in Nigeria. $\pi_1, \pi_2, \pi_3, and\ \pi_4$ are the shortrun impact of gdppc in the previouse period, military expenditure, armsimportation and regime change respectively, on economic growth.

Wavelet Analysis

We conducted additional analysis using wavelet coherence to examine the relationship between military expenditure and economic growth in Nigeria. We follow the procedure but do not intend to replicate Xu et al., (2020). Unlike Fourier analysis, wavelets allow for the localization of time and frequency domains, enabling the investigation of time-frequency dependencies between the two variables. This method is effective for analyzing data over a broad time frame, revealing correlations between defense spending and economic growth at different frequencies (Xu et al., 2020). Our study utilizes short-term and long-term time frames to analyze high-frequency and low-frequency interdependencies, respectively. Prior research has demonstrated the superiority of wavelet methodology over Fourier analysis for time-based analyses Xu et al., (2020) .

Wavelet analysis is based on wavelet transformations, a process of decomposing and superimposing information. The continuous wavelet transform $(\mathrm{CWT})W_x(\tau, s)$ is obtained by projecting a mother wavelet $\psi(t)$ onto a specified time series X(T). The mother wavelet is expressed as follows:

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$$\psi_{\tau,s}(t) = \frac{1}{\sqrt{s}}\psi\left(\frac{t-\tau}{s}\right) \quad 1$$

In the Continuous Wavelet Transform (CWT), τ represents the location parameter, indicating the time position, while the scale parameter, s, determines the stretching and dilation of the wavelet, inversely related to frequency.

$$W_x(\tau, s) = \int_{-\infty}^{+\infty} x(t)\psi^*_{\tau,s}(t)dt \quad 2$$

Where $\psi^*_{t,S}(t)$ represents the complex conjugate of the mother wavelet. The wavelet transform decomposes the time series $\mathrm{x}(t)$ into a set of base wavelets obtained through translocation and dilation of the mother wavelet $\psi^*_{t,S}(t)$. The Continuous Wavelet Transform (CWT) maintains the energy of the analyzed time series. We employ the Morlet wavelet as the mother wavelet (Rua, 2012).

$$R^2(\tau, s) = \tan^{-1}\frac{\left|S\left(s^{-1}W_{x,y}(\tau,s)\right)^2\right|}{S(s^{-1}|W_x(\tau,s|^2)S(s^{-1}\left|W_y(\tau,s\right|^2}, R^2(\tau,s) \in [-0,1] \quad 3$$

The smooth factor S(·) in equation 3 serves to normalize both time and scale, while $\mathrm{s}^{-1}$is utilized to convert to an energy density (Grinsted, Moore, and Jevrejeva, 2004). Wavelet coherence functions as a localized correlation coefficient within time–frequency space. Ng and Chan (2012) posit that wavelet coherence is devoid of bias issues owing to its inherent normalizing characteristics. Enhanced correspondence between $\mathrm{x}(t)$ and $\mathrm{y}(t)$ results in greater wavelet coherence.

Consequently, a coefficient of determination, $R^2(\tau, s) = 0)$ indicates complete lack of relationship between , $x(t$ $x(t)$ and $y(t)$, while $R^2(\tau, s) = 1)$ signifies a strong association between the two series. Evaluating the statistical significance of coherence between two indices involves testing the null hypothesis under the assumption that the wavelet power spectrum asymptotically conforms to a chi-squared distribution with two degrees of freedom (for further elaboration, refer to Torrence and Compo, 1998,).

Phase Difference

The wavelet phase difference between x(t) and y(t) measures the lead–lag relationship between the two indices (Bloomfield et al. 2004)

$$\phi(\tau, s) = \tan^{-1}\left(\frac{\mathcal{J}\left(W_{xy}(\tau,s)\right)}{\mathcal{R}\left(W_{xy}(\tau,s)\right)}\right), \text{where}\phi(\tau,s) \in [-\pi, \pi] \quad 4$$

The imaginary component $\mathcal{J}\left(Wxy(r,s)\right)$ in equation 4 and the real component $R\left(Wxy(r,s)\right)$of the cross-wavelet transform are utilized. A phase difference of zero $\phi(r,s) = 0)$ indicates complete synchronization between $x(t)$ and $y(t)$ at a particular frequency, visually depicted by a right-pointing arrow. A phase difference of π (or $-\pi$) signifies anti-phase relationship between the two time series, with the arrow pointing left. A phase difference of $\pi/2$ (or $-\pi/2$) results in an upward (or downward) pointing arrow, indicating that $y(t)$ leads $x(t)$ *or* $x(t)$ leads $y(t)$. Typically, these scenarios are combined. For instance, if the arrow points northeast, $\phi(r,s) \in (0, \pi/2)$, suggesting positive lead of $y(t)$ over $x(t)$.

Results

In this section, the result from estimation of models 1 is presented and discussed. In Table 3 is the descriptive statistics for the variables in the study. Descriptive statistics for the variables are reported in Table 1 The descriptive statistics table presents key characteristics of four variables: GDP growth rate, military expenditure as a percentage of GDP, arms imports, and population growth rate. On average, GDP grows at 3.741%, while military spending constitutes 2.046% of GDP. Arms imports average approximately

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$95.38 million, and the population grows at a rate of 2.561%. Notably, GDP growth exhibits considerable variability, with a maximum of 25.007% and a minimum of -15.744%. Military expenditure and arms imports are positively skewed, indicating a rightward tail in their distributions, while population growth shows slight negative skewness. All variables display kurtosis higher than that of a normal distribution, indicating heavier tails. Additionally, the Jarque-Bera test suggests non-normality for military expenditure and arms imports.

Table 1: Descriptive statistics

	GDPGROWTH	MILITARYPERGDP	ARMSIMPORTS	POPGROWTH
Mean	3.741	2.046	95381356.000	2.561
Median	4.230	0.849	42000000.000	2.576
Maximum	25.007	10.317	626000000.000	3.064
Minimum	-15.744	0.348	1000000.000	2.043
Std. Dev.	7.095	2.422	141000000.000	0.255
Skewness	0.147	1.705	2.343	-0.317
Kurtosis	5.042	5.101	7.899	2.714
Jarque-Bera	10.467	39.446	112.967	1.172
Probability	0.005	0.000	0.000	0.557

The Augmented Dickey-Fuller (ADF) test results in Table 2 indicate statistically significant evidence of stationarity for the first differences of all variables at the 1% level of significance. In levels, GDP growth, military expenditure as a percentage of GDP, and arms imports exhibit stationarity at the 5% significance level. However, population growth does not demonstrate statistical significance in either levels but at first difference. This suggests that after differencing, all variables become stationary, indicating that they are integrated of order one, or I(1). Since the variables exhibit mixed order of intergration, the Autogressive Distributed Lags (ARDL) model is appropriate technique if the variables are cointegrated. Bounds cointegration test result from Pesaran and Shin and Smith (PSS) is reported in Table 3 shows evidence of cointegration among variables.

Table 2: Augmented Dickey Fuller Test

Variable name	Level	First difference	Outcome	Conclusion
GDPGrowth	-4.663***	-7.292***	I(0)	Level stationary
MilitaryperGDP	-3.171**	-5.718***	I(0)	Level stationary
PopGrowth	-1.373	-5.138***	I(1)	First difference stationary
ArmsImports	-3.190*	-8.219***	I(1)	First difference stationary

* , **, *** indicate statistical significance at 10%, 5%, and 1% respectively. I(0) and I(1) indicates the corresponding variable is stationary at level and first difference respectively

The Auto regressive distributed lags (ARDL) model and the wavelet coherence approach were implemented to investigate the impact of military expenditure on economic growth in Nigeria over the period from 1960 to 2017.

The long-run ARDL result reported in Table 3 indicate that a 1% increase in military expenditure as a percentage of GDP leads to an increase in economic growth by 1.828%. This finding is consistent with the notion that military expenditure may have a positive impact on economic growth by creating employment opportunities, spurring technological innovation, and contributing to economic security. Moreover, this result is statistically significant at the 1% level. This result is similar to the findings from (Cappella et al., 2017; Dizaji & Farzanegan, 2023; Liu & Zhang, 2015).

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Although earlier research indicates that military spending and economic growth are positively correlated, the World Bank and IMF hold that higher military spending has an opportunity cost and may impede output and economic growth (Knight et al., 1996). This viewpoint is based on the idea that spending limited resources on military readiness takes those resources away from more productive areas of the economy.

Table 3: Long-run and Short-run ARDL Result (2 1 2 1 2 1 2)

D.GDPGrowth	Coef.	Std. Err.	t	P>t
ADJ				
L1.GDPGrowth	-1.073***	0.122	-8.810	0.000
Long Run Results				
MilitaryperGDP	1.828***	0.497	3.680	0.001
PopGrowth	-9.694**	4.228	-2.290	0.027
lArmsimports	-2.132***	0.686	-3.110	0.004
RegimeMil	-6.874***	1.702	-4.040	0.000
Regime1960_65	-6.012*	3.156	-1.900	0.064
Regime1979_86	0.258	2.821	0.090	0.928
Short -Run Results				
LD.GDPGrowth	0.127	0.095	1.340	0.189
D1.MilitaryperGDP	-3.670***	0.534	-6.870	0.000
D1.PopGrowth	28.894***	8.395	3.440	0.001
LD.PopGrowth	13.260	9.174	1.450	0.157
D1.lArmsimports	1.700***	0.510	3.330	0.002
D1.RegimeMil	8.825**	4.184	2.110	0.042
LD.RegimeMil	6.467	4.260	1.520	0.137
Dummy1960_65	-11.639*	6.176	-1.880	0.067
Dummy1979_86	-7.914**	3.736	-2.120	0.041
_cons	73.164***	15.036	4.870	0.000
Diagnostics				
Adj R-	0.7369			
Bounds	17.605			
LM	0.498			
White	56			
Mean VIF	2.28			

Note: ***, **, * indicate statistical significance at 1%, 5% and 10% level respectively. Dummy1960_65 and Dummy1979_86 are dummy variables for break dates detected by Bai and Perron test.

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Although earlier research indicates that military spending and economic growth are positively correlated, the World Bank and IMF holds that higher military spending has an opportunity cost and may impede

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output and economic growth (Knight et al., 1996). This viewpoint is based on the idea that spending limited resources on military readiness takes those resources away from more productive areas of the economy. Therefore, a negative correlation between military spending and economic growth is anticipated, especially in low-income countries, unless increased military spending in developed nations results in notable advances in research and development that translate into profitable commercial activities in the future. Our result differs from the World Bank and IMF's position. On the other hand, the long-run analysis also reveals that population growth rate has a negative impact on economic growth. Specifically, a 1% increase in population growth rate reduces economic growth by 0.315% in the long run. This finding suggests that rapid population growth may hinder economic growth by increasing pressure on natural resources, infrastructure, and public services.

Furthermore, the analysis reveals that arms importation has a negative impact on economic growth in the long run. A 1% increase in arms importation decreases economic growth by 2.132% in the long run, indicating that increasing arms importation is likely to bring about a decline in the GDP growth rate. This finding is consistent with the notion that arms importation may divert resources away from productive activities, such as education, healthcare, and infrastructure development, and may contribute to economic instability.

Our analyses also reveals that a military regime has a more pronounced negative longrun impact on economic growth than a civilian regime. Specifically, a significant structural break point was identified in 1969-65, during which the military regime was in power. The break date has a negative coefficient, indicating that the military regime has a negative impact on economic growth in the long run. This finding suggests that military rule may be detrimental to economic growth, possibly by undermining democratic institutions, weakening property rights, and discouraging foreign investment.

The short-run impact of military expenditure one economic growth is negative and statistically significant at a 1% level. In the short run, increasing military expenditure will bring about less economic growth. However, this impact became positive in the longrun. This means that the negative impact is temporal as the benefit if increased military expenditure is experienced in the long term. In the short term, resources are diverted from productive sectors of the economy to finance the military. This will have some negative consequences in the economy in the temporarily but the in the longterm, after stability is attained, the economy revives and grows.

In the short run, population is positively related to economic growth rate. An increase in population by 1% will bring about an average increase of 28.89% in economic growth rate. However, this impact

becomes negative in the longrun. Arms import has positive shortrun impact on economic growth. An increase in armsimportation by a unit will bring about a short term increase of 1.7% in economic growth

rate.

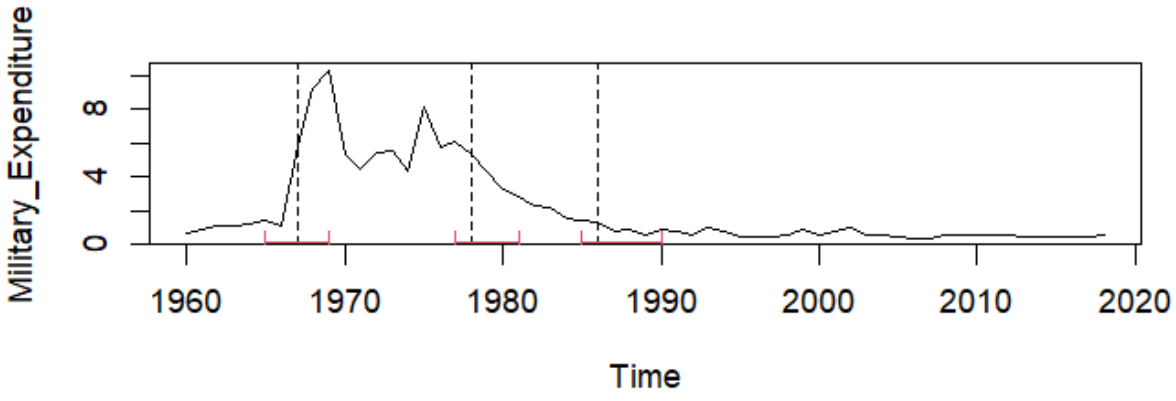

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Figure 1: Bai and Perron Structural Breaks in Military Expenditure

The short term impact of the period of military regime in Nigeria is positive, but became negative in the longrun. This suggest the increased growth observed during the military regimes was temporal and only in the shortrun. The regime has a negative longrun impact on economic growth in Nigeria. Three structural break dates were identified using Bai and Perron break test, 1960-65; and 1979-86 (see Figure 1). These break dates are negative and statistically significant at 10 and 5% respectively. the break date 1960-65 is negative in both longrun and short run. The break dates corresponds with the period of military regime in Nigeria and are consistent with the negative result for the dummy variable for military regime. Figure 2 shows military expenditure was unstable which corresponds to the period of military rule. It indicates the black line is not within the two red lines reflecting the breaks detected using Bai and perron test.

The short-run impact of military expenditure on economic growth is negative and statistically significant at the 1% level, indicating that an increase in military expenditure in the short term leads to a decrease in economic growth. This is due to the diversion of resources from productive sectors of the economy to finance the military, resulting in negative consequences in the short term. However, the impact of military expenditure on economic growth becomes positive in the long run, suggesting that the negative impact is temporary and that the benefits of increased military expenditure are experienced in the long term.

In the short run, population growth has a positive impact on the economic growth rate, with a 1% increase in population leading to an average increase of 28.89% in economic growth. However, this impact becomes negative in the long run, indicating that the positive impact of population growth on economic growth is not sustainable. Arms importation has a positive short-run impact on economic growth, with a unit increase in arms importation leading to a 1.7% increase in economic growth rate in the short term.

Regarding the impact of military regimes on economic growth in Nigeria, the short-term impact is positive, but it becomes negative in the long run, indicating that the increased growth observed during military regimes was temporary and only in the short term. The negative long-run impact of military regime on economic growth in Nigeria is consistent with the negative result for the dummy variable for military regime.

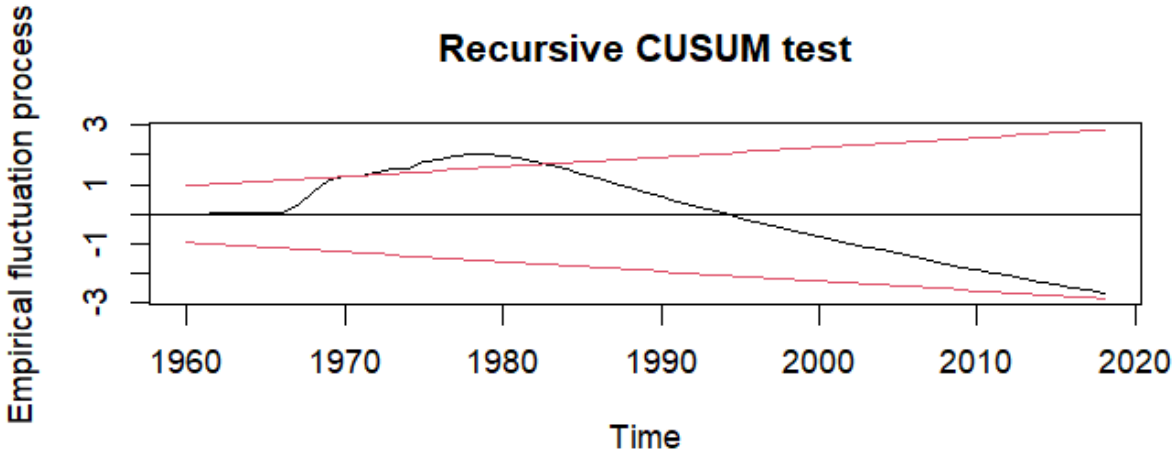

Figure 2: recursive Cusum Test

two structural break dates were identified using the Bai and Perron break test: 1960-65, and 1979-86. The dummy variable for these break dates are negative and statistically significant at the 10% and 5% levels, respectively. The break date 1960-65 is negative in both the long run and short run, and it corresponds with the period of military regime in Nigeria. Overall, the negative impact of military regime on economic growth in Nigeria is consistent with the negative result for the dummy variable for military regime.

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The wavelet coherence plot in Figure 3 displays the relationship between two time series in time-frequency space, with time on the horizontal axis and frequency on the vertical axis. The plot identifies regions of significant co-variation between the series, with warmer colors (red) representing stronger interrelation and colder colors (blue) indicating lower dependence. The thick black contour signifies significance at the 5% level, determined through Monte Carlo simulations using phase-randomized surrogate series with 10,000 repetitions. The dashed black line outlines the cone of influence, indicating areas impacted by edge effects. Coherency is represented on a grayscale spectrum, ranging from black (low coherency or values close to zero) to white (high coherency or values close to one).

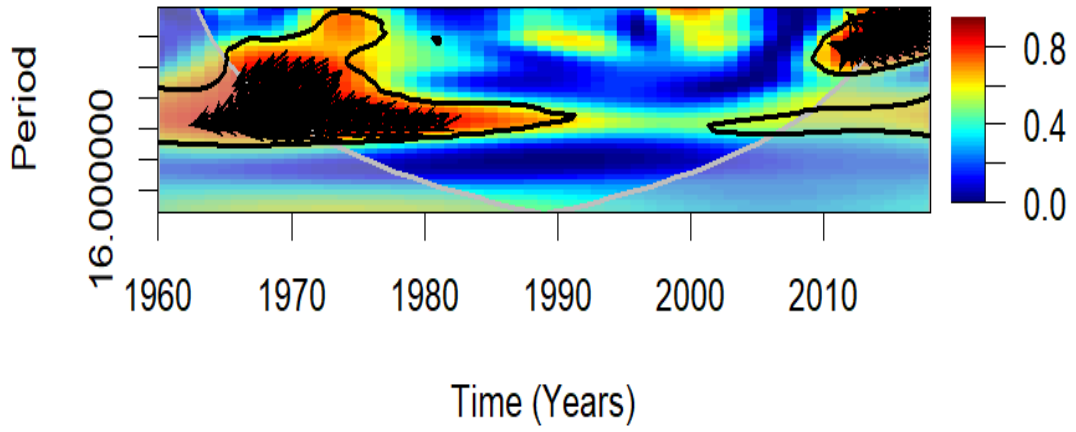

Figure 3: Wavelet Coherence for GDP Per Capita and Military Expenditure in Nigeria, 1960-2022

Note:: *Arrows pointing right and up indicate growth lagging behind military spending, while arrows pointing right and down suggest growth leading military spending. Conversely, left-pointing arrows signify growth leading or lagging military spending, with upward arrows denoting military spending lagging and downward arrows indicating military spending leading. Right-down or left-up arrows indicating that the first variable (growth) is leading, and right-up or left-down arrows suggesting that the second variable (military expenditure) is leading.*

Arrows denote the phase difference between the two series: right-pointing arrows suggest in-phase relationships (positive covariance or cyclical effects), while left-pointing arrows indicate out-of-phase relationships (negative covariance or anti-cyclical effects).

The phase difference between the two series is represented by arrows, with a zero phase difference indicating that they move together, while arrows pointing to the right (left) signify in-phase (anti-phase) movement. The direction of the arrow indicates which variable is leading, with right-down or left-up arrows indicating that the first variable (growth) is leading, and right-up or left-down arrows suggesting that the second variable (military expenditure) is leading. A positively correlated relationship between the two variables imply that military expenditure is positively influencing economic growth in the examined time-frequency scale.

The wavelet coherence plot shows two pockets within the 5% significance region, the first between 1960 and 1983 covering the period of military dictatorship or regime while the second pocket lies between the 2010 and 2020 is period the terrorist activities of Boko-haram. This terrorist group placed Nigeria high on the world terrorism ranking. Thousands of people were killed and displaced. The military regime and the period of terrorism under civilian government were accompanied by significantly high defense exependiture. The two notable pockets correspond with the break dates identified in bai and perron structural breaks test. The first pocket cove

Conclusion

Although numerous studies have explored the relationship between defense expenditure and economic growth in Nigeria, they have largely overlooked the significant structural breaks in defense expenditure

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trends. These breaks are notably associated with transitions from military to civilian regimes and the intensification of terrorist activities, both of which have led to substantial increases in defense spending in Nigeria. This study seeks to fill this gap by examining the impact of defense spending on economic growth in Nigeria, employing advanced time horizon models such as the Autoregressive Distributed Lags (ARDL) model and Wavelet coherence analysis to analyze annual time series data spanning from 1960 to 2018.

The results shows there is a link between military spending and economic growth. Increased military spending immediately hinders economic growth in the short run, most likely as a result of the opportunity cost associated with taking funds away from other profitable industries. Eventually, though, increased military spending has a beneficial effect in the longrun as shown in the result. This implies that the positive outcomes from increased defence spending, including improved security and stability, which might foster an atmosphere more favourable for economic activity, become increasingly apparent with time. The research also emphasises the negative effects of a protracted military rule on long-term rates of economic growth, notwithstanding this long-term benefit. Because of things like misallocation of resources, diminished investor confidence, and political instability, the long-term effects of military government may hinder economic growth.

The trade-offs involved in raising defence spending should be carefully considered by policymakers to make sure other important economic sectors are not sacrificed. The development and implementation of solutions aimed at mitigating the adverse effects of arms imports and protracted military government are important in order to promote sustainable economic growth. Nigeria may achieve long-term economic stability and prosperity by balancing defence spending to maximise its potential advantages and minimise its downsides

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