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AN EMPIRICAL ASSESSMENT OF LONG RUN COINTEGRATION AND GRANGER CAUSALITY BETWEEN MILITARY EXPENDITURE AND ECONOMIC GROWTH IN NIGERIA (1987 – 2022)

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Abstract

Nigeria has witnessed a lot of security and developmental concerns in the last three decades which have engendered widespread perceptions that there may be some relationship between military expenditure and economic growth and development. This has led to a flurry of several investigations into discovering the nature of the relationship between defence spending and economic growth and development. To confirm the nature of the nexus, this study represents one of such enquiries that apply Johansen cointegration and Granger causality tests to scrutinise the long run equilibrium relationship and the causality between military expenditure (ME) and economic growth (GDP) for the instance of Nigeria. Annual time series data covering the period, 1987 - 2022 was used to conduct the experimental analysis. The findings of the study indicate that, military spending and economic growth are cointegrated in the long run. However, the results of the Granger causality test revealed that there is no directional relationship running from economic growth to military spending and vice versa. This means that the study did not observe any causality running from either military spending to economic growth or from economic growth to military expenditure within the study period.

Keywords: Economic Growth, Development, Military Expenditure, Security, Cointegration, Granger Causality Test.

1. Introduction

In contemporary world, a widely perceived and hypothesized narrative posits that economic growth and development are an essential concomitant of physical security of an environment which provides requisite serenity, stimulus, and confidence for economic players to engage in legitimate economic activities. Robert McNamara opined that "in an increasingly interconnected world, progress in the areas of development, security and human rights must go hand in hand. There will be no development without security and no security without development. And both development and security also depend on respect for human rights and the rule of law", (Tchirgi, 2005). Sayar (2012) added that development is required before security can be stabilized, and that a shift in focus from security oriented to economic driven efforts can lead to improved outcomes. And that the nexus between security and development should help define strategies, policies, and programmes for smooth administration of an economy. This means that at policy and operational levels, the linkages between security and development should be considered.

Furthermore, according to Nwanegbo and Odigbo (2013), "the concept of security is not alien and has been central even in the primitive societies. The need for security necessitated the social contract in which people willingly surrender their rights to an organ (government) to oversee the survival of all". Hence, the relevance of security in development as well as development in security cannot be overemphasised. Development, be it economic or otherwise, must flow alongside security, one reinforcing each other all the way through. In the same analogy, physical security that begets the secure environment is dependent on the presence of the military whose constitutional role is to provide national security against external aggression and maintain law and order

within the territorial integrity of sovereignty, in collaboration with other security agencies.

The Nigerian military, also known as the Armed Forces of Nigeria, is not an exception. According to Section 217 (1) of the 1999 Constitution of the Federal Republic of Nigeria, "there shall be armed forces for the Federation which shall consist of an army, a navy, an air force, and such other branches of the armed forces of the Federation as may be established by an Act of the National Assembly. Furthermore, the Federation shall, subject to an Act of the National Assembly made in that behalf, equip and maintain the armed forces as may be considered adequate and effective for the purpose of defending Nigeria from external aggression". Consequently, the distinct roles and responsibilities of the Nigerian Military as spelt out in the Constitution are clear and unambiguous. Thus, the Nigerian Military's involvement in the Nigerian Civil War and the Bakassi Peninsula conflicts are classic instances of the defence of the territorial integrity of Nigeria.

Additionally, the drafting of the Armed Forces of Nigeria into the aid of civil authority abounds in recent times due to prevalent internal security challenges that have pervaded virtually all the geo-political zones of Nigeria. These range from the issues of militancy in the Niger Delta, Boko Haram terrorism/insurgency in the North-Eastern Nigeria, to the agitation for secession by the MASSOB/IPOB in the South-Eastern region as well as widespread cases of kidnapping, armed robbery, cyber related crimes, cattle rustling and herdsmen/farmers conflicts amongst others, (Buratai, 2017). The Nigerian military involvement in internal security operations is essentially in the form of stabilization operations, supporting government economic stabilization efforts, creating an enabling environment for economic activities, employment generation, various civil-military operations as well as protection of VIPs and critical economic installations such as NITEL, NNPC, etc.

In addition, the categorization of the military as one of the DIME instruments of national power underscores the ever-increasing propensity to amass formidable military capabilities and competences by modern state key actors in international community, (Norman, 2023). National power is defined as the sum of all resources available to a nation in the pursuit of national objectives. The DIME is the acronym for Diplomacy, Information, Military and Economic, which together are instruments used by governments to achieve their objectives in the international arena. Diplomacy is the art of negotiating with other countries to achieve a common goal. Information is the use of media and other communication channels to influence public opinion. Military power is the use of force to achieve political objectives. Economic power is the use of economic resources to achieve political objectives. The ultimate end-state is encapsulated in their capacities as ready-made means of projecting national power, interest, and image in international arena. According to Lightning Press (2018), "the United States employs the military instrument of national power at home and abroad in support of its national security goals". The military instrument of national power can be used in a wide variety of ways that vary in purpose, scale, risk, and combat intensity.

These various ways can be understood to occur across a continuum of conflicts ranging from peace to war. Inside this continuum, it is useful from a strategic perspective to delineate the use of the military instrument of national power into different categories. Consequently, the extent to which a state can secure her borders, maintain her territorial integrity, contain internal security challenges as well as influence issues and be respected in the international community reasonably depends on her military might, capability and effectiveness. Hence, raising and maintaining a standing military with an acceptable military might, capability and effectiveness by a state is contingent upon her level of economic growth and development which translates into the magnitude of resources at her disposal.

Beside**s**, the military all over the world plays many economic roles as itself and its members themselves are consumers and producers alike. These include employment generation and large-scale production of goods and services**;** being itself a subset of business and economic superstructure of the economy. Like in other

climes, it is a common knowledge that the Nigerian military owns some industrial complexes across the nation such as the Defence Industrial Corporation (DICON) Kaduna, Special Vehicle Plant (SVP) Bauchi, Nigerian Army Workshop Kaduna, Nigerian Navy Dockyard Lagos, Nigeria Air Force Institute of Technology, and various post service housing estates across the country amongst others. Also, the Nigerian military in collaboration with other agencies often engage the services of professionals and youths in the operation areas to carry out some reconstruction, rehabilitation and provision of some basic infrastructure and other services to effectively engaged them. These are in form of quick impact projects and other endeavours. The focus is always on the provision of immediate and temporary employment in the post-conflict period with the ultimate objective of establishing the foundation for future economic development in Nigeria, (Buratai, 2017).

In addition, the Barracks Investment Initiative Programme initiatives are massive productive ventures including bakeries, bottled water production factories, etc. as well as farming and life stock agriculture, amongst others. Also, the regular recruitment and commissioning exercises as well as establishment of nursery, primary, secondary, and tertiary institutions across the length and breadth of the country where they employ academic and admin staff, enable the military to reduce the level of unemployment in Nigeria. The Nigerian military's involvement in the UN and AU peacekeeping missions over the years have attracted foreign exchange earnings from contingents-owned-equipment and personnel into the country and to individual participants as well.

The foregoing is a clear testimonial that the defence sector is at the front burner amongst the sectors that are fanning the embers of economic growth and development. However, the entire security responsibilities and its involvement in economic activities are contingent upon the availability of financial resources to function well. The advanced economies like the US and China boast of very formidable military strength and capability as well as massive military installations which are strong economic determinants of the sizes of their GDP/GNI. It is therefore a cyclical merry-go-round interdependency phenomenon, where their economies reasonably depend on their militaries to provide the requisite physical security for economic activities to strive. On the other hand, their militaries depend on economic growth and development to draw their financial expenditure requirements which also depend on the sizes of their GDP/GNI.

In Nigeria, the nature of co-integration (magnitude) and direction (causality) of this relationship are not clearly known, particularly for the period under review. This is the gap that this study sets out to fill and it constitutes the high point of the investigation. This paper seeks to establish the nature of the nexus between defence spending and economic growth and development. A priori expectation is that there is a long run cointegration and that economic growth influences defence expenditure and vice versa. Therefore, the main objective of the study is to interrogate the nature and direction of the relationship between defence expenditure and economic growth in Nigeria and the policy concerns it engenders.

2. Literature Review

2.1 Empirical Literature

Laniran and Ajala (2021) investigated the relationship between military expenditure and economic growth in Nigeria using annual time series data from 1981 – 2017. In achieving this objective, the study adopted a simple growth model that incorporates military expenditure as a share of government expenditure for the period of study. The autoregressive distributed lag (ARDL) estimation technique was used in testing the relationship between the variables in the model. The result of the study showed that there is a significant positive long-run relationship between military expenditure and economic growth.

Raju and Zobayer (2019) reassessed the current evidence of India, Pakistan, and China with renewed data on the effect of military expenditure on economic growth. Econometric approaches analysed the short and long run nexus between GDP growth and military expenditure.

Empirical studies were done using cointegration analysis and causality test to justify the relationship and causality of the variables. Interestingly, study obtained positive long-run relation relationship and unidirectional long run causality in all cases, but with different degrees of relationship. The results were robust and significantly passed necessary diagnostic tests.

Charles and Nicholas (2019) investigated the causal relationship between military expenditure and economic growth using balanced panel data of 35 African countries from 1990 to 2015. It also used the recently developed bivariate heterogeneous panel causality, GMM and SGMM estimation techniques. The country-by-country causality results revealed that no causal relationship between military expenditure and growth in seven countries; unidirectional causality from military expenditure to growth in two countries; unidirectional relationship from growth to military expenditure in fourteen countries; and bidirectional relationship in twelve countries. Amongst these findings, the most relevant is the bidirectional causality in the 12 countries which implies that both growth and defence policy objectives can be pursued together. The GMMs results show that military expenditure has a significant negative impact on growth in Africa.

Korhan et al., (2015) applied Johansen co-integration and Granger causality tests to examine the long-run equilibrium relationship and the causality between military expenditure (ME) and economic growth (GDP) for the case of Turkey which has been a rapidly developing economy for the last decade. Annual data covering 1988-2013 periods was used to conduct empirical investigation. The findings of the study indicated that in the long-run, military spending and economic growth are co-integrated. The results of Granger causality test suggests that there is a unidirectional relationship running from economic growth to military spending, however any causality from military spending to economic growth wasn't observed in the present study.

Na and Bo (2012) assessed the effect of military expenditure on economic growth in developing countries with many empirical literatures. However, there was little consensus of that effect, and the diversity seems to come from the use of different models and different estimators. This article applied the Augmented Solow Growth Model to examine the influence of military expenditure on economic growth for 35 developing countries over the period of 1975–2009. By using the system Generalized Method of Moments (GMM) estimators, empirical results indicated that defence has a negative and significant effect on economic growth in the sample countries.

3. Methodology

3.1 Research Methods

This study applied Johansen Co-Integration and Granger Causality Tests to examine the long-run equilibrium relationship and the causality between ME and GDP in Nigeria for the period covering 1987 to 2022. Specifically, the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit-root tests were performed to determine the order of integration of the variables and Johansen test to estimate the possible long-run equilibrium relationship between these variables. Lastly, Granger causality test was used to analyse the direction of the causal relationship between the variables. The time series data were analysed using the Stata Version 17 software package. Different test statistics were obtained and used to determine the statistical validity of the results and decision rule for hypotheses testing using 0.05 level of significance.

3.2 Sources of Data and Method of Data Collection

The research work was based mainly on secondary data which are the time series data covering the period 1987 – 2022 using two cardinal variables for the analysis. These variables are the Gross Domestic Products (GDP) value as the indicator of economic growth and the value of Military Expenditure (ME), as a percentage of GDP. To ensure the robustness of the studies in terms of the source and reliability, the time series data covering a period of 35 years as the number of observations for each variable were collected from the World Bank (July 16, 2023). Other sources include the internet, Nigerian Army Resource Centre and Nigerian Defence Academy

libraries, seminar papers and books on Defence Economics, etc.

3.3 Model Specification

In this research, the index of the annual budgetary allocation to Defence Sector as a % of GDP value represents the dependent variable (Y_t), while the GDP (X_t) represents the independent variables. A priori conceptualization was that there is a positive correlation flowing from current economic growth to the Defence Sector. Although there is a possibility of defence spending having a positive influence on the level of economic growth, but it is much more pronounced amongst the developed economies according to existing literature. Hence, the main objective of this research is to establish the correlation between the dependent variable, ME, and independent variables (GDP) using annual time series data for the empirical analysis. To achieve this, the OLS Econometric Equation which follows the theoretical conceptualisation that ME might be affected by GDP in the case of Nigeria. Thus, the underlying equation for this study can be shown as follows:

$$\mathbf{ME_t = f(GDP_t)} \qquad \mathbf{(1)}$$

Where:

$\mathbf{ME_t}$ = Current Military Expenditure, as a % of current GDP, is the function of current Gross Domestic Products (GDP).

$\mathbf{GDP_t}$ = Current Gross Domestic Products.

The variables in the formula were transferred into the logarithmic form in order to capture impacts of growth in the relationship, as follows:

$$\mathbf{Log\ ME_t = \beta_0 + \beta_1\ Log\ GDP_t + \varepsilon_t} \qquad \mathbf{(2)}$$

Where at time **t, log ME** and **log GDP** are the logs of market value of military spending and of GDP respectively. $\boldsymbol{\varepsilon_t}$ represents the error term, $\boldsymbol{\beta_0}$ is constant coefficient which is the intercept of the equation and $\boldsymbol{\beta_1}$ is the coefficient of log GDP and represents the slope of the equation.

3.4 Unit Root Tests

Unit root tests were used to check whether time series variables are stationary. The study employed two widely used unit root tests, namely Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) to determine the level of integration of the variables under investigation. The PP procedure is an alternative to ADF unit root test and computes a residual variance that is robust to autocorrelation. Enders (1995) suggests the most common model for unit roots with trend and intercept which is the initial point of our analysis. In addition, it is further theorized that the previous levels of military expenditure and GDP levels also influence the current expenditure as well, hence the introduction of the lagged values of Y_{t-1} and X_{t-1} respectively. The formula does read as follows:

$$\mathbf{Dy_t = \alpha_o + \lambda yt\text{-}_1 + \alpha_2 t + Dy_{t\text{-}i\text{-}1} + \varepsilon_t} \qquad \mathbf{(3)}$$

$$\mathbf{Dx_t = \alpha_o + \lambda xt\text{-}_1 + \alpha_2 t + Dx_{t}\text{-}_{i\text{-}1} + \varepsilon_t} \qquad \mathbf{(4)}$$

Where **y** and **x** are the dependent variables, **α** is the drift, **t** is trend, **ε** is a Gaussian white noise and **p** represents the lag levels in equations **3** and **4**. In order to ensure that the errors are white noise, the number of lags "**p**" of the dependent variable were determined by using the Akaike Information Criteria (AIC). PP and ADF tests apply t-test for **λ**. Null hypothesis of these tests in the series is non-stationary. If the series is stationary at level, the series is called integrated of order zero, I(0).When the series is stationary at first difference, it is called integrated of order one, I(1).

3.5 Co-Integration Tests

In this part, the possible long-run equilibrium relationship between the variables was investigated. The present research was based on Johansen methodology that is used to test co-integration among variables that have the same order of integration. Minimum of one co-integrating vector is required in order to have co-integration between variables. Johansen test takes its initial point in the vector autoregression (VAR) of order **p** given by:

$$y_t = \mu + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t \text{ for } t=1, \ldots T \quad (5)$$

Where y_t, y_{t-1},…,yt-p vectors of level and lagged values of P variables respectively which are I(1) in the model; A_1,…, Ap represents coefficient matrices with (P X P) dimensions; μ is an intercept vector, ε_t is a vector of random errors. Johansen (1988) and Johansen and Juselius (1990) suggest that trace statistics are obtained by using the Eigen values. The trace statistic (λ trace) could be estimated by the formula below:

$$\lambda trace = -T\sum Ln(1-\lambda_i),\ i = r+1, \ldots., n-1 \quad (6)$$

3.6 Granger Causality Tests

This test was performed in order to identify the direction of the causal relationship between ME and GDP. The casual relationships can be either unidirectional or bi-directional. This test estimates the following equations assuming there is no correlation between u_{1t} and u_{2t}.

$$GDP_t = ME_{t-i} + GDP_{t-j} + u_{1t} \quad (7)$$

$$ME_t = ME_{t-i} + GDP_{t-j} + u_{2t} \quad (8)$$

The a priori expectation of the study was that in the long-run, military spending and economic growth are co-integrated and the Granger causality test result might be that there is a bi-directional relationship running from economic growth to military spending and vice versa or uni-directional relationship running from economic growth to military spending, and not the other way around.

4. Results and Discussion

4.1. Unit Root Test

The Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit-root tests were performed to determine the order of integration of the variables. Sequel to the ADF and PP tests on the logs of the variables such as GDP and ME as a % of GDP, the series were found to be stationary at the first differences, which means that the series were all integrated of order one, 1(1). After the test, the two variables assumed new status such as dlog GDP and dlog ME.

4.2. Co-Integration Analysis

After ensuring that the series were stationary, the study then applied Johansen co-integration analysis in order to check the possibility of existence of any long-run equilibrium relationship among the variables. According to the Johansen co-integration test requirements, all the variables must be stationary at the first differences, that is, integrated of order one. Since the variables were made to be stationary at first difference, the null hypothesis for the Johansen cointegration test is stated as follow:

H_0: There is no co-integration between the variables in the model.
H_1: There is co-integration between the variables in the model.

Table 1: Johansen Cointegration Test Results Showing Long Run Nexus between ME and GDP

Johansen tests for cointegration
Trend: Constant — Number of obs = 30
Sample: 1993 thru 2022 — Number of lags = 4

Maximum rank	Params	LL	Eigenvalue	Trace statistic	Critical value 5%
0	14	14.932648	.	14.2284*	15.41
1	17	19.79299	0.27677	4.5077	3.76
2	18	22.046841	0.13951		

Maximum rank	Params	LL	Eigenvalue — Maximum	Critical value 5%
0	14	14.932648	.	9.7207	14.07
1	17	19.79299	0.27677	4.5077	3.76
2	18	22.046841	0.13951		

* selected rank

Source: Author's Computation, (2023) STATA Version 17.

Table 1 represents the results of the Johansen Test for Cointegration using STATA Version 17. The criteria for rejecting or accepting the null hypothesis specify that when the Trace Statistic and/or Eigenvalue Maximum Value are greater than 5% critical value, we do not reject the null hypothesis. Otherwise, reject the hull hypothesis and accept the alternative hypothesis. According to the results, the Trace Statistic Value (14.2284) < 5% Critical Value (15.41) and Maximum Eigen Value (9.7207) < 5 % Critical Value (14.07) at maximum rank of 0 respectively. The null hypothesis is rejected, and the study therefore concludes that there is co-integration amongst the variables. In other words, there seem to be some long-run equilibrium relationship between military expenditure and economic growth in Nigeria.

4.3. Granger Causality Test

Having confirmed the presence of some long run co-integration relationship existing between the variables under review via the Johansen cointegration method, the next focus was on the Granger causality tests to find the causality of this relationship, (Granger, 1988). The null hypothesis for the Granger Causality Test is stated as follow:

H_0: GDP does not Granger cause ME.
H_1: GDP Granger causes ME.

Table 2: Granger Causality Test Results Showing Causal Relationship ME and GDP

Granger causality Wald tests

Equation	Excluded	F	df	df_r	Prob > F
dloggdp	dlogmegdp	.90623	4	21	0.4783
dloggdp	ALL	.90623	4	21	0.4783
dlogmegdp	dloggdp	1.4567	4	21	0.2508
dlogmegdp	ALL	1.4567	4	21	0.2508

Source: Author's Computation, (2023) STATA Version 17.

According to the results, all the p-values are greater than 5% critical values. Therefore, the null hypothesis that GDP does not Granger cause ME is not rejected at 5% level of significance, which means economic growth of Nigeria does not Granger cause military expenditure. In other words, a change in economic growth in Nigeria may not lead to a change in military expenditure. This explicitly means that the federal allocation to defence sector has been rather rigid and political in nature, which does not depend on economic growth. Also, the Granger causality results revealed that there is no causal relationship running from military expenditure to economic growth. This means that military expenditure is rather too insignificant to engender economic growth in Nigeria. Hence, the overall assessment of the Granger Causality Test is that there is no directional relationship running from GDP to military expenditure and vice versa. Therefore, no bidirectional relationship was observed in this study.

4.4 Summary of Major Findings

At the end of the empirical analysis, the study found that both Trace Statistic Value (14.2284) and Maximum Eigen Value (9.7207) were less than 5% Critical Values (15.41 and 14.07) respectively. Hence, the null hypothesis was rejected, and the study therefore concludes that there is co-integration midst the variables. That is, there appear to be some long-run equilibrium nexus between military expenditure and economic growth in Nigeria.

Furthermore, the study also revealed that all the p-values were greater than 5% critical values in the case of Granger causality between ME and GDP. Therefore, the study concludes that economic growth of Nigeria does not Granger cause military expenditure. This means that a change in economic growth may not lead to a change in military expenditure and a change in military expenditure may not cause a change in economic growth. Hence, the general assessment of the Granger Causality Test is that there is no directional relationship running from GDP to military expenditure and vice versa. Therefore, no bidirectional relationship was observed in this study.

5. Conclusion and Recommendations

The study represents an attempt to empirically establish the nexus between military expenditure and economic growth in Nigeria. This was to confirm the perceived notion that economic growth and military spending are cointegrated in the long run and that there is bidirectional causality relationship in Nigeria. Sequel to these, the research undertook the ADF and PP tests on the logs of the variables and the series were found to be stationary at the first differences, which means that the series were all integrated of order one, 1(1).

Also, the study found out the Trace Statistic Value (14.2284) was less than the 5% Critical Value (15.41) and Maximum Eigen Value (9.7207) was also less than the 5 % Critical Value (14.07) at maximum rank of 0 respectively. Hence, the null hypothesis was rejected, and the study therefore concluded that there is co-integration amongst the variables. That is, there is some long-run equilibrium relationship existing between military expenditure and economic growth in Nigeria.

Finally, the research discovered that GDP does not Granger cause ME within the period under review in Nigeria. This indicates that economic growth of Nigeria does not Granger cause military expenditure. This means that a change in economic growth in Nigeria may not lead to a change in military expenditure. This obviously implies that defence sector appropriation has been rather rigid and politically motivated and does not depend on economic growth. The study further revealed that there is no causal relationship running from military expenditure to economic growth. This indicates that military expenditure may be perhaps too trivial to affect economic growth in Nigeria. Hence, the general assessment of the Granger Causality Test is that there is no directional relationship running from GDP to military expenditure and vice versa. And so, no bidirectional relationship was detected in this study within the study period.

Having examined and discovered the nature of cointegration and causality between military expenditure and economic growth, it is recommended that:

i. The Federal Government of Nigeria should embark on massive investment in military infrastructure and human resource development.

ii. The Federal Government of Nigeria should appropriate more budgetary allocation to Defence Sector to support research and development.

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