The Interactional Impact of Defense Expenditure and Arms Importation on Economic Growth in Nigeria: An Autoregressive Approach

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ABSTRACT

Little is done on the empirical analyses of the impact of defense expenditure on arms and economic growth. The few conducted concentrated on developed countries, which are exporters of arms. This study examines the short-run and long-run impact of arms importation on the economic growth in Nigeria, using autoregressive distributed lag model. Literature on defense expenditure and economic growth are often conflicting and inconclusive. These outcomes are due to the non-linear growth effects of defense and incorrect model specifications. The crucial growth effects of defense expenditure can be traced by properly controlling the interaction term. This paper examines the defense-arms interaction on Nigeria in the context of Aizeiman and Glick (2006) models. The result reveals that defense-arms interaction in Nigeria exerts negatively on the economic growth. It therefore recommends that defense R and D as well Defense Industrial Cooperation of Nigeria should be properly financed and managed for efficiency and self-reliability.

Keywords: Defense Expenditure, Arms Importation, Economic Growth
JEL Classification: H5, H56, H57, Q36

1. INTRODUCTION

Volume of researches are conducted on the economic effects of defense expenditure on growth. The economic impacts of arms production and importation as well as trade continue to be quite unexplored especially in the developing countries like Nigeria. Big economies today spend much on defense and export more arms. While developing countries spend less on defense and imports more arms. Arms purchases are not cheap, in fact some countries have to alternate to external borrowing in order to pay for arms importation or use significant portion of their defense budget in general. Of course, foreign borrowing does not necessarily lead to slower economic growth, but might even increase economic activities (Yakovlev, 2007). Nonetheless, if the borrowed funds are spent on arms imports instead of investments on goods that are essential for self-sustaining growth, then the effect of external borrowing on growth would likely be negative. On the contrary, arms imports may help importing countries transfer new technology through the necessary trainings of defense personnel as required for operating high-tech weaponry and attach systems. In some cases, arms imports may result to bilateral technological transfers if they take a form of a licensed production of defense ordinances.

2. ARMS PROCUREMENT IN NIGERIA

Nigerian established Defense Industrial Corporation (DICON) aiming to “operate the ordnance factories for the manufacture and supply of arms and ammunition as well as inspecting, testing and recommending ordnance materials for the Armed Forces and other security organizations while using the excess capacity to support the development of local industries.” Despite the fact that DICON was established for this purpose of making Nigeria self-sustaining in arms and ammunition, still Nigeria defends on the foreign sources. This has brought a desperation and over reliance on the foreign economies (Magbadelo, 2012). In September 2014 $9.34 million meant for the arms procurement from Nigeria was seized
by the South African authority. Two Nigerians and a foreigner (an Israeli) on behalf of the Nigerian government travelling with the plane’s crew with the said amount of money were arrested and detained by the South African government. For what the South African authorities claimed non-declaration of the funds in question while in South Africa. Such action has tarnished the image of Nigeria in the eyes of the world. The Nigerian government in 2014 borrowed $1 billion US to procure additional arms and ammunitions in its fight against Boko Haram. That was an addition on what was already budgeted for defense (The Nation, 2015).

It is on this note this study examines the effects as well as the magnitude of the defense arms importation on economic growth in Nigeria both in the short-run as well as the long-run. Subsequently the study gives policy recommendations base on the findings. The subsequent sections are arrange in five headings. Section two presents a brief history on arms procurement in Nigeria. Section three reviews both the empirical as well as the theoretical literature. Section four describes the methodology and the data used in the study. Section five presents the empirical result. Lastly section six presents the conclusion and the recommendations.

3. EMPIRICAL AND THEORETICAL LITERATURE REVIEW

Arms importation has both positive and negative impacts on growth. In a case arms importation helps importing countries transfer new technologies through the necessary training of personnel, then importation may have positive impact on growth. Where the scarce resources are spent on the arms importation instead of investing on goods that are essential for self-sustaining growth, the effect of such expenditure on growth may likely be negative. Ando (2009) reveals that domestic defense industries in countries that import arms tend to exhibits a positive economic impact. Although developing countries have no choice but to import arms, the study suggests that defense outlay for this countries has a positive effect on their economies if consider the internal threats, only by excluding arms imports. Additionally (Lai et al., 2002) added that defense R and D experiences and imitations generated due to arm importations have positive impacts on private productions. On the contrary Looney (1989) investigates how expenditure on defense and arms imports affect debt in resource-constrained countries and unconstrained countries. His findings revealed that arms imports tends to be a significant contributor to third world indebtedness. Another empirical study by Looney and Frederiksen (1986) revealed that the unconstrained developing countries are able to support higher level of arms imports. Günlük and Sezgin (2002) find that the growth in arms imports has a significant positive effect on external debt, while no such effect is found for the growth in defense spending.

Theoretically for any empirical study, there must be a theory that establish its argument. For the impact of defense activities on the economic growth, this is very unclear to the fact that the main economic theories do not have an explicit role of defense as a distinctive economic activity. The classical and neoclassical economics recognize defense spending as purely public and exclusively provided by the state. Though necessary, but of course has security benefit and opportunity cost. For this therefore, assessment of some theoretical positions regarding defense expenditure is very necessary. This study uses three theories to establish its theoretical bases.

3.1. Keynesian
The Keynesian see a proactive state which uses defense expenditure as one aspect of state spending to stimulate output through multiplier effects in the existence of ineffective aggregate demand. In this way increased defense expenditure can lead to increased capacity utilization, increased profits, saving and hence increased investment and therefore increase growth (Stewart, 1991). This argument has been criticized for its failure to address supply side issues, this led to many researchers to include explicit production functions in their Keynesian models (Deger and Smith, 1983). On the other hand neoclassicals see a state as a rational actor that balances the opportunity costs and security benefits of defense expenditure in order to exploit a well-defined national interest. To neoclassicals defense is a pure public good and the economic effects of defense expenditure is determined by its opportunity cost, as well as the trade-off between defense and other spending. This approach has the benefit of allowing the development of formal models for the empirical analysis. However, one of it weaknesses is that, it a historic, it concentrates on the supply side, ignoring the internal role of defense and defense interests, The most influential neoclassical model is Biswas and Ram (1986), developed from Feder (1983).

Further the new-classical employ defense expenditure as an important shock to the economy, which has dynamic real effects on output. The theory differed from the neoclassical theorists in the sense that it gave support to the argument that fiscal policies enhance economic growth. The effect of government expenditure in the new growth models is endogenized as it has tax implications and income-generating effects. The theorists seek to explain the size of the rate of growth of gross domestic product (GDP) that is left unexplained and exogenously resolute in the Solow neoclassical growth equation. The theory assumes that public and private spending on human capital generates external economies and productivity developments that offset the natural tendency for diminishing returns, endogenous growth theory seeks to explain the existence of increasing returns-to-scale and the divergent long-term growth patterns among countries (Todaro and Smith, 2003). Assuming increasing returns-to-scale implies that both the impact of physical capital and human capital would be larger than the one suggested by Solow. Another implication is that economies with increasing returns-to-scale do not necessarily reach a steady level of income as in the Solow framework. If the externalities from new investments are significant, diminishing proceeds to capital do not necessarily set in, so growth rates do not slow and the budget does not necessarily reach a steady state (Todaro and Smith, 2003). The new growth theory therefore, argue that defense expenditure like all other public expenditure can generates positive externalities that affect efficiency parameters on the factor input (Labor and Capital) which have stimulating impact on output. Security from both external and internal threats stimulates and environment that stimulates investment by both foreign and domestic investors.
4. METHODOLOGY AND DATA

Data on defence expenditure, GDP, arms importation, school enrolment, capital formation, population growth rate are sourced from the world development indicators and Stockholm International Peace Research Institute. Spanning from the first quarter of 1984 to the last quarter of 2014.

4.1. Model Specification

4.1.1. Barro growth model

Aizeinan and Glick (2006), Yakovlev (2007) and Araujo and Shikida (2008) conclude that the mainstream models of growth like that of Solow and Barro are more suitable in analyzing defense-growth issues. The models depict non-linear effects on growth using interaction between growth enhancing and tax distorting impacts of government expenditure. The theory suggests variables should be unrestricted in a growth regression. Same approach is adopted in this study to examine the joint impact of arms trade and defense expenditure on growth. The basic growth equation specification is as follows:

\[ g_Y = \alpha_0 + \alpha_1 DE + \alpha_2 AI + \epsilon \]

Where, \( g_Y \) is gross domestic product it is used as proxy for growth, \( DE \) is defense expenditure as a ratio of GDP, \( AI \) denotes arms importation, while \( AI*DE \) is the interactive term between arms importation and defense expenditure \( X' \). Vector of control variables (education proxy using school enrolment, population growth, Investment proxy using capital formation).

4.2. The Autoregressive Distributed Lag (ARDL) Estimation Procedure

For the interactional relationship between defense arms procurement and economic growth, in the short-run and the long-run, Pesaran and Shin’s (2001) model of ARDL is used in this study. The model examines the long-run relationship irrespective of the variables stationarity, different or fractionally integrated (Bahmani-Oskooee and Ng, 2002). The model guarantees efficient and unbiased estimation even if the sample size employed is small (Narayan, 2005). The following steps are followed in the estimation process of the ARDL model.

4.2.1. Unit root test

The ARDL framework does not necessarily require the variables to be tested for unit root at the same time, but necessary for testing for the order of integration and essential to determine whether ARDL approach is suitable or not (Pesaran and Shin, 1998). The augmented Dickey–Fuller (ADF) test is conducted on three different equations specified below:

\[ \Delta Y_t' = \delta + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \epsilon_t \]

(2)

\[ \Delta Y_t = \delta + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \epsilon_t \]

(3)

\[ \Delta Y_t = \delta + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \epsilon_t \]

(4)

Where, \( \Delta \) depicts the first difference, \( Y \) is the series under test, \( \delta \) is the intercept term, \( t \) is the time trend, \( \epsilon \) is the white noise process with \( \epsilon_t \sim iid(0,\sigma^2) \). The term \( k \) in this test is automatically determined by Schwarz information criterion or Akaike information criterion to get the optimal lag length and ensure white noise process of the residual \( \epsilon \).

4.2.2. ARDL bounds testing approach

The cointegration among the variables specified would be examined using ARDL model developed by Pesaran et al. (2001) as shown below:

\[ \Delta \ln y_t = \beta_0 + \sum_{i=1}^k \alpha_i \Delta \ln x_{it-i} + \sum_{j=1}^k \delta_j \ln x_{jt-i} + \mu_t \]

(5)

Where, \( \ln y_t \) is a vector of endogenous variables defined under section 1.1 (defence expenditure and economic growth model). \( i = (1,2,\ldots,7) \) and \( j = (1,2,\ldots,7) \). The symbol \( \Delta \) is the difference operator. The long-run relationship between the variables is determined by the joint significance test of the following hypothesis: \( \delta_i = \delta_j = 0 \). If the upper bound critical value falls below the calculated F-statistic values, the null hypotheses of no relationship are rejected, and co-integration exists among the variables that give the opportunity to estimate both long- and short-run coefficients. The null hypotheses cannot be dismissed if the lower bound is above the F-statistic. Furthermore, co-integration can only be determined using other methods if the F-statistic falls between the asymptotic lower and upper critical values. However, Narayan (2005); and Dahalan and Jayaraman (2006) argued that the critical values generated by Pesaran and Pesaran (1997); and Pesaran et al. (2001) are for large sample size observations. Therefore, to avoid size distortion, this study will adopt a small sample size with critical values computed by Narayan (2005) for the bound testing process.

4.2.3. The long-run estimates

The long-run equation is estimated to determine the impact of the interactive effect of defense arms importation on the economic growth.

\[ \ln y_t = \lambda_0 + \sum_{j=1}^k \lambda_j \ln x_{jt-i} + \epsilon_t \]

(6)

Where, \( \ln \) represents natural log, \( \epsilon \) denotes white noise process whereas \( y \) remains as defined under Equations (1) to (5). \( i = (1,2,\ldots,7) \) and \( j = (1,2,\ldots,7) \). The covariance of the coefficient estimates can only be asymptotically uncorrelated in a situation where the regressors are known to be integrated of order one without co-integration in the long-run. A dynamic error correction model (ECM) is estimated to determine the long-run and short-run causal relationship among the integrated variables (Engle and Granger, 1987). While the long-term dynamism is explained by the error correction term (ECT) which further proves the existence of long-run relationship by its significant negative value. The
short-run behavior is described by the lagged terms' individual coefficients of the estimate.

### 4.2.4. The short-run estimates
The short-run relationship among the series is determined using ARDL *ECT* specified in Equation (7).

\[
\Delta \ln y_t = \beta_0 + \sum_{i=1}^{k} \beta_i \Delta \ln x_{t-i} + \phi_i ECT_{t-i} + \epsilon_t
\]  

(7)

Where \(\Delta \ln y_t\) represent change in natural logarithm of all the variables specified in defense arms expenditure and economic growth models. The *ECT* term represents *ECT* it determines the magnitude of speed of adjustment. The *ECT* measures the effectiveness or adjustment mechanism in stabilizing disequilibrium in the model specified. In other words, it describes how disequilibrium in the model will instantaneously converge to equilibrium after a given shock in the economy. Furthermore, the negative significant coefficient of the *ECT* term is required to ensure the existence of long-run relationship and adjustment of disequilibrium in the model (Narayan, 2005). The higher the magnitude of the *ECT* term the better is the speed of adjustment. The symbol \(\Delta\) denotes difference operator while the other variables were earlier explained in equations specified earlier.

## 5. EMPIRICAL RESULTS

### 5.1. Unit Root Result
The study examines the properties of the series, using ADF test. The table is made up two models; the constant without trend and constant with trend models. The result shows that all the variables less *LDE* are stationary at least at 10% significance level in the model (A). In the same way, all the variables are found stationary at least at 10% significance level with the exemption of *LEDU* in the model (B). Therefore, the unit root test rejects the null hypothesis of the non-stationarity of the series at least at 10% significant level. The result is presented in the Table 1.

### 5.2. Co-integration Results
Table 2 depicts the long-run co-integration result. It confirms the existence of the long-run relationship among the series. Three co-integrating vectors are gotten from the computed F-statistics for the equations of defense arms expenditure and growth. The vectors values are greater than the upper bound critical value by Narayan (2005) and Pesaran et al. (2001) at 1% and 5%.

From the Table 2, the co-integration results uphold the existence of the long-run relationship among the series. There are three co-integrating vectors from the computed F-statistics results. The three co-integrating vectors *LGD*, *LDE* *LAI* and *LIN* are greater than the upper bound critical value by Narayan (2005) and Pesaran et al. (2001) at 1% and 5%. This result provides the evidence of the existence of long-run relationship between the interactional term and the economic growth in Nigeria. Therefore, the result of the long-run relationship between economic growth, defense expenditure and political instability in Nigeria can be further interpreted.

### Table 1: ADF unit root test

<table>
<thead>
<tr>
<th>Series</th>
<th>Constant without trend (A)</th>
<th>Constant with trend (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>First difference</td>
<td>Level</td>
</tr>
<tr>
<td>GDP</td>
<td>-2.691**</td>
<td>-3.731***</td>
</tr>
<tr>
<td>LDE</td>
<td>0.927</td>
<td>-2.640*</td>
</tr>
<tr>
<td>LAI</td>
<td>-1.491</td>
<td>-3.945***</td>
</tr>
<tr>
<td>LEDU</td>
<td>0.656</td>
<td>-2.135</td>
</tr>
<tr>
<td>LPP</td>
<td>0.084</td>
<td>-2.842**</td>
</tr>
<tr>
<td>LIN</td>
<td>-1.436</td>
<td>-3.795***</td>
</tr>
<tr>
<td>LDE_LAI</td>
<td>0.108</td>
<td>-5.627***</td>
</tr>
</tbody>
</table>

***, ** and * represent significance level at 1%, 5% and 10% respectively. The figures are the t-statistics for testing the null hypothesis that the series has unit root.

Source: Researcher’s computation. ADF: Augmented Dickey-Fuller, GDP: Gross domestic product, AI: Arms importation

### Table 2: ARDL bound test for co-integration relationship

<table>
<thead>
<tr>
<th>Model</th>
<th>F-statistics</th>
<th>Significance level (%)</th>
<th>Critical bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>4.497***</td>
<td>1</td>
<td>Critical A</td>
</tr>
<tr>
<td>LAI</td>
<td>1.446</td>
<td>5</td>
<td>I (0)</td>
</tr>
<tr>
<td>LDE</td>
<td>0.862</td>
<td>10</td>
<td>I (0)</td>
</tr>
<tr>
<td>LEDA_LAI</td>
<td>3.381**</td>
<td>10</td>
<td>I (0)</td>
</tr>
<tr>
<td>PPG</td>
<td>1.836</td>
<td></td>
<td>I (0)</td>
</tr>
<tr>
<td>LEDU</td>
<td>1.590</td>
<td></td>
<td>I (0)</td>
</tr>
<tr>
<td>LIN</td>
<td>5.599***</td>
<td></td>
<td>I (0)</td>
</tr>
</tbody>
</table>

***, ** and * represent significance level at 1% and 5% respectively. The F-statistic. The critical values A and B are critical values for the F-statistics obtained from cases III for unrestricted intercept and no trend reported Pesaran et al. (2001, p. 300) and Narayan (2005, p. 1988) Source: Researcher’s Computation, GDP: Gross domestic product, AI: Arms importation, ARDL: Autoregressive distributed lag

### 5.3. Long-run Relationship
Equation (8) shows the long-run relationship between defense expenditure-arms import interaction and economic growth. The result confirmed that *LAI* has a negative as well as significant effect on economic *GDP* at 5%.

\[
LGDPG = -2.273 - 0.944 LAI - 1.278 LDE - 2.395 LDE*LAI - 0.849 PPG + 0.715 LEDU + 0.067 LIN
\]  

(8)

The coefficient for *LAI* –0.944 signifies that a million naira increase on *LAI* reduces *GDP* by 0.944%. Similarly, *LDE* as well as *PPG* coefficients –1.278 and –0.849 indicates that 1% increase in *DE* as well as *PPG* decreases *GDP* by 1.278% and 0.849% respectively. The result further shows that the defense-arms (*LDE*LAI) interaction term has a significant as well as negative effect on *GDP* at 5%. The coefficient of the interactive term –2.395 means a one million naira increase in defense arms importation leads to 2.395% decrease on *GDP* in Nigeria.

### 5.4. Short-run Relationship
Table 3 offers the short-run dynamics of the regression result. The *ECT* coefficient –0.632 is statistically significant at 1%. The result shows the existence of the long-run co-integration. It equally depicts that the disequilibrium which occurs in the short-run is automatically adjusted back to the equilibrium position in the long-run. The coefficient of the *ECT* term -0.632 suggests a
Table 3: Short-run results

<table>
<thead>
<tr>
<th>Dependent variable: ΔlnGDP</th>
<th>Coefficient</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.2025</td>
<td></td>
</tr>
<tr>
<td>ΔLGDPL</td>
<td>0.095**</td>
<td>0.082</td>
</tr>
<tr>
<td>ΔLAGI</td>
<td>−0.011*</td>
<td>0.111</td>
</tr>
<tr>
<td>ΔLDE</td>
<td>−0.018*</td>
<td>0.035</td>
</tr>
<tr>
<td>ΔLPPG</td>
<td>−0.045***</td>
<td>0.335</td>
</tr>
<tr>
<td>ΔLDE_LAI</td>
<td>0.043***</td>
<td>0.003</td>
</tr>
<tr>
<td>ΔLEDU</td>
<td>0.208**</td>
<td>0.062</td>
</tr>
<tr>
<td>ΔKFG</td>
<td>0.031**</td>
<td>0.012</td>
</tr>
<tr>
<td>ΔECM_{t-1}</td>
<td>−0.633***</td>
<td>0.009</td>
</tr>
</tbody>
</table>

*, ** and *** represent significance at 1%, 5% and 10% respectively. The critical values are obtained from the Table 1. Unrestricted intercept and trend. Source: Researchers computations. GDP: Gross domestic product; AI: Arms importation, ARDL: Autoregressive distributed lag.

Table 4: Diagnostic test

<table>
<thead>
<tr>
<th>Test statistics</th>
<th>Test statistic</th>
<th>Source: Author’s computations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ρ autocorrelation</td>
<td>0.116</td>
<td></td>
</tr>
<tr>
<td>ρ Normality</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>ρ Functional form</td>
<td>0.106</td>
<td></td>
</tr>
<tr>
<td>ρ Heteroskedasticity</td>
<td>0.150</td>
<td></td>
</tr>
<tr>
<td>Ramsey test</td>
<td>0.432</td>
<td></td>
</tr>
</tbody>
</table>

Moreover, high arms importation can mounts more pressure on the government, therefore a considerable extent of social services funding will go for importation of arms importation.

The study recommends that defense R and D in Nigeria has to be properly financed and managed for efficiency and self-reliability. There is a need for more efficient, sound management and sufficient financing for DICON, and other defense institutions and collaborations. Training and doctrine should to be made a defense tri-service institution, and a center for defense R and D.

6. CONCLUSIONS AND RECOMMENDATIONS

This paper examines the impact of the defense arms importation on the Nigeria’s economics growth. The finding reveals that the impact of defense-arms interaction on economic growth in Nigeria has exerts negative impact on the economic growth.

REFERENCES


