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ANALYSIS OF CAUSAL NEXUS BETWEEN DEFENSE SPENDING AND ECONOMIC GROWTH IN NIGERIA: A TODA-YAMAMOTO APPROACH

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ABSTRACT

The research analysed the causal nexus between defense spending and growth in Nigeria. These were done with the aim to ascertain the causality direction between spending in defense sector and growth in Nigeria. Annual data from secondary sources spanning from 1980- 2017 were employed for the study. Defense spending data was gotten from the Statistical Bulletin of the Central Bank of Nigeria (CBN), whereas real Gross Domestic Product (RGDP) was gotten from World Bank Development Indicator (WDI). Toda-Yamamoto (TY) causality method was used to ascertain the causality direction between defense spending and economic growth. Lastly, empirical results using Toda-Yamamoto (TY) technique showed that there was no direction of causality between defense spending and economic growth within the research period since the probability value of LTOMILEX (0.38) and LRGDP (0.22) were higher than 0.05 level of significance. This denotes that defense spending did not granger cause economic growth and vis-a-ditto within the study. Therefore, the paper concluded that no direction of causality exist between defense spending and economic growth in Nigeria within the span of study.

Contribution/Originality: This study contributes in the existing literature on the causal nexus between defense spending and economic growth. The study uses new estimation methodology of Toda-Yamamoto (TY). It originates new formula for analyzing the causality. Hence, the study documents no direction of causality between the variables.

1. INTRODUCTION

In recent years, the world has witnessed new security crises such as global insurgency and major conflicts across continents such as the cases of Turkey, Syria, Iraq, Egypt, Tunisia, North Korea, South Korea, Sudan, South Sudan, Bosnia, Kosovo, Rwanda, Somalia, Nigeria, etc. requiring the use of military force. Also, it is in lieu of this global crises that have further confirmed United States military superiority and strength to build a strong military base and capability in terrorist affected countries and Nigeria inclusive so as to consolidate and back up its role in Africa, Middle East, Asia, etc. by safe guarding and championing its priorities, security and strategic objectives. Security threat could originate from other countries or group of countries or probably the shape of an asymmetrical threats.

The emergence of these new security challenges and threats have mounted pressures for modifications in defense composition and military hard wares as well as increase in defense expenditure in some countries and United States in particular. It is also assumed that contrariwise, if the causality direction is from expenditure in

military cycle to growth, this indicates the presence of aggregate demand and employment effect which may be connected to production of local weapons and spin-offs from Research and Development in the military cycle (Kollias, Mylonidis, & Paleologou, 2007).

Defense spending is a scenario in which a nation devotes financial resources to secure its national and international boundaries for its populace against domestic and foreign evasion. Also, it is a public good that competes with the rest public goods because needs and scarce inputs are unlimited. Furthermore, it is also regarded as an element of public expenditure that is employed as a fiscal instrument to address short term fluctuations as elaborated by military Keynesianism demonstrated by the nation's duty to seek the targets of territorial integrity and wellbeing (Muhammed & Abusufian, 2014). Over time, authorities across the globe has given paramount consideration to the ministry of defense in the budget as a result of domestic and international insurgency (Amjad & Muhammad, 2014). The pattern and structure of military spending has persistently increase annually as documented by SIPRI (2016) indicating that global spending in defense sector in 2011 jumped to $1.7trn signifying 2.6% of world GDP ($236 per capita). SIPRI (2016) documented trade of the 100 largest global arms-manufacturing and defense sector service industries was $370.7 billion (2015) which revealed an astronomical rise compared with a slight fall of 0.6% (2014) due to new dimension of insecurity worldwide. Therefore, the budgetary appropriation earmarked to ministry of defense varies considerably from each nation to another at each fiscal year based on public preference and resources available.

From Nigeria, it is observed that larger percentage of budget is appropriated annually for defense reasons denoting the alternative sacrifice for civil spending amidst present security crises (Perlo-Freeman, Solmirano, & Wilandh, 2013). Data reveals the nation's military spending in the last 10 years is accelerating than expenditure on other key ministries like education, agriculture and health in the economy according to Adebakin and Raimi (2012). The rise in the budget appropriation to the defense ministry in Nigeria is as a result of communal conflicts, terrorism, insurgency, militancy, abduction, oil bunkering, trafficking, smuggling and various kinds of violence to nationwide integration in which appropriated resources invariably causes huge defense burden. Following the return to democratic administration in 1999, Nigerian lives and properties have been oppressed by varied armed sects. These dreaded sects spans from tribal militias to government motivated terrorism such as Movement for the Survival of Ogoni People (MOSOP), Movement for the Actualization of the Sovereign State of Biafra (MASSOB), Bakassi Boys, Egbesu Boys, Oodua People Congress (OPC), Movement for the Emancipation of Niger Delta (MEND), Arewa Consultative Forum (ACF), ethno-religious extremists in states like Jos, Kaduna, Kano, Bauchi and the Boko Haram sect.

Currently, resistance within and threat particularly that of the rising dreaded group called Boko Haram is forcing rising financial burden on public spending towards defense sector. SIPRI (2016) showed that Nigeria's defense spending rose from ₦1.2b in 1988 to ₦7b in 1994 and subsequently, increased to ₦45.4b, ₦108b and ₦224b in 1999, 2002 and 2009 respectively. As a result, the rate of growth in defense spending in relation to rate of growth of RGDP is enormous. For instance, the defense spending proportion of Nigerian GDP stood at 0.78 (2008), 0.89 (2009) and 1.0 (2010) hence making its bill on security to increase by 4% (16% to 20%) of expenditure in the budget of 2010. This resulted to misappropriation of the financial resources required for infrastructural development and amendments of industrial and social sectors of the economy that would have improve the country. Expenditure on electricity supply, health, education and infrastructure put together received lower appropriation relative to defense in the budget of 2012. Furthermore, the direct security cost is about 2% of $250 billion of Nigerian economy, estimated by the share of spending to Gross Domestic Product (2012). The misappropriation of financial resources have economic consequence as some social sectors may perform low in Nigeria particularly during critical time of struggling to realize poverty alleviation, and lowest point of per capita income. Rising expenditure on defense is linked to a decline in welfare. This negative impact of risen military expenditure in a developing nation as Nigeria

will probably aggravate the existing level of poverty since virtually the whole military equipment are imported (Olofin, 2012).

The overview of the Nigeria budget (2016) showed some of the key total budgetary allocations to some sectors of the economy which are; Power, Works and Housing (₦456.93b), Transportation (₦202.34b), Defense (₦443.07b), Interior (₦513.65b), Education (₦403.16b), Health (₦250.06b), Agriculture and Rural Development (₦75.80b), Solid Minerals (₦16.73b), Youth and Sports Development (₦75.79b), Water Resources (₦53.30b) and Special Intervention Programmes (₦500.00b). This budget break down shows clearly the preference for security (defense; military and interior; paramilitary) which received highest allocation contrary to the real sectors of the economy that would have boosted and positively impacted directly on the wellbeing of Nigerians. Therefore, from 2009 till date, it was observed that large budgetary appropriation to military and local security has shifted concern from education, agriculture, health, construction and key sectors which would have boosted growth in Nigeria amidst recent financial meltdown.

Recent rise in defense expenditure in Nigeria, as a result of hike in resistance and threat within by armed opposition groups and ethnic militias is a burning issue to most Nigerians and other stakeholders alike. Each year, the government spends huge financial resources on the military in the area of troop's trainings, remuneration, arms, ammunitions and other military hard wares which have in turn led to high military burden in the nation's national debt. Following this huge defense costs bare inadequate macroeconomic indexes such as fall in rate of investment, skyrocketed inflation rate, oil price shocks, exchange rate fluctuation, etc. as most of times scarce foreign exchange resource to procure ammunitions are expended more on defense than on the populace's education and wellbeing.

On the issue of causal nexus between defense expenditure and growth which is the central focus in this study, there is yet to be a consensus agreement among scholars following the pioneering research of Benoit (1973); Benoit (1978); Benoit, Dorfman, and Hagen (1972) to date. Some scholars such as Manamperi (2016); Pan and Chang (2014); Safdari (2011); Kollias, Manolas, and Paleologou (2004); Dunne and Perlo-Freeman (2003); Kalyoneu and Yucel (2005) and Kusi (1994) discovered a one-way directional causal nexus between military expenditure and growth in their sampled study. Others such as Masih (2017); Muhammed and Abusufian (2014); Kollias et al. (2004); Chang, Kaltani, and Loayza (2009) and Dakurah, Davies, and Sampath (2006) found a bidirectional causality between these two variables under study. Finally, scholars such as Topeu and Aras (2015); Dunne and Uye (2014); Heo (1999); Payne and Ross (1992) and Alexander (1990) found no causal nexus at all. From the foregoing, these contradictory results reveal that it is expedient that the causal nexus between military spending and growth be re-visited.

2. LITERATURE REVIEW

On the causality between military expenditure and growth nexus, there are several empirical evidences which reveal inconclusive results. The heterogeneity in the reported results may probably be as a result of varied samples, varied theoretical and economic specifications and varied periods (Chen, 1993). Hence, this paradox calls for a re-evaluation of the military spending and growth nexus.

In light of this, Hatemi, Chang, Chen, Lin, and Gupta (2017) adopted asymmetric causality test to investigate defense spending-growth relationship for the six top global military spenders from 1988 to 2013. Empirical findings revealed that the defense spending-led hypothesis was validated in Republic of China and Japan. Nevertheless, the growth-motivated hypothesis was corroborated in 4 nations which are France, Russia, Saudi Arabia and United States. It was also observed that except for Saudi Arabia, sound growth signifies instant rise in military expenditure.

Similarly, Masih (2017) conducted a study on causal nexus between defense expenditure and growth in Sub-Saharan Africa employing the dynamic vector error correction model (DVECM). The empirical findings from this research showed that Kenya and Niger as subject to defense expenditure while nations like Sudan, Mali and

Tanzania experienced bidirectional causality. Alluding to the Greece and Turkey as an example, Manamperi (2016) discovered a strong one directional causal nexus from defense expenditure to growth.

In contrast, Topeu and Aras (2015) employed standardized vector error model (VECM) and Toda and Yamamoto (1995) technique to analyse the defense-growth relationship among European Union (EU) spanning from 1973-2010. Their findings showed that none of the four hypothesis pertaining to causality of defense spending and growth dominated in the European Union (EU). For instance, Topeu and Aras (2015); Dunne. and Uye (2014); Heo (1999); Payne and Ross (1992) and Alexander (1990) studies reported that there exists no causal nexus between military spending and growth.

Empirically, Pan and Chang (2014) and Tiwari and Tiwari (2010) studies reported a unidirectional positive nexus between growth and defense expenditure. Pan and Chang (2014) examined the causal nexus between defense expenditure and growth in 10 Middle East nations using panel causality analysis. Their findings showed a one-way directional causal nexus from defense expenditure to economic growth in Turkey; one-way causality from growth to defense expenditure for nations like Egypt, Kuwait, Lebanon and Syria; two-way directional causality for nation of Israel and no causality in either direction for nations like Jordan, Oman and Saudi Arabia. Dunne and Uye (2014) employed full sample bootstrap granger non-causality technique and found that there was no causal nexus between defense expenditure and growth in Republic South Africa between 1951 and 2010.

On the contrary, Kollias et al. (2004) discovered a two-way directional causal nexus between military expenditure and growth on Cyprus between 1974-2011.

In the same vein, Muhammed and Abusufian (2014) study on one hand showed a bidirectional direct nexus between defense expenditure spending and growth whereas on the contrary, Safdari (2011) study on the other hand revealed a one-way directional causal nexus running from real Gross Domestic Product (GDP) to defense expenditure in nations like Malaysia and South Korea whereas there was no causal nexus between these variables in Saudi Arabia and Iran.

Theories that have established some hypothesis on the causal nexus between defense spending and growth are;

i.   *Growth Hypothesis*

The hypothesis centres on guns and butter hypothesis and is recognised as the foundational works on the nexus between military spending and growth. Based on "growth hypothesis", there is a unidirectional positive causality nexus from defense expenditure to growth. Benoit (1973); Benoit (1978) argued that defense expenditure will expand the total demand level, put unutilized inputs into productive use particularly in less developed nations, expand investments and produce new opportunities.

ii.   *Growth Detriment Hypothesis*

This centres on the stance of "guns or butter" in the literature. This hypothesis argues that defense expenditure has adverse impacts on growth. Based on this, a unidirectional causality runs from defense expenditure to growth. However the causal nexus in the hypothesis is negative.

iii.   *Feed Back Hypothesis*

The hypothesis asserts that there is a bidirectional causal nexus between defense expenditure and growth. Considering this hypothesis, a rise (fall) in the defense expenditure will rise (fall) growth, and in the same manner, economically more (less) advanced nations will distribute more (less) resources for defense expenditure (Kollias et al., 2004).

iv.   *Neutral Hypothesis*

This hypothesis postulates a no causal nexus between defense expenditure and growth. Considering this hypothesis, while changes in magnitude of defense expenditure do not influence the economic productivities; growth does not influence the magnitude of defense expenditure either (Biswas & Ram, 1986).

However, in order to put this paper in right perspective, the theory used in the research is the Solow Growth theory propounded by Solow (1956). The theory is developed to reveal how growths in the stock of capital (K), labour force (L) and technology (A) relate in an economy and also how it influence a country's aggregate output. Also, Solow model reveals that sustained growth in income per labour should emanate from technological progress.

Production function with physical capital (K), Labour (L) and technology (A), $Y(t) = F\left[K(t), A(t)L(t)\right]$.

Furthermore, time influences output through K, L and A. Technology is improving on labour. AL is effective labour, land and natural resources are neglected (not taken as factors of production). The production function takes the Hicks-neutral form which is labour augmented;

$$Y_t = K_t^{\alpha}\left(A_t L_t\right)^{1-\alpha} \quad 0 < \alpha < 1 \tag{1}$$

In which the real output is Y, stock of capital is K, L is the raw material, technology is denoted by A which is used to boost the efficiency of labour. It is assumed that raw labour (L) and level of technology (A) grow exogenously as $L = L_0 e^{nt}$ and $A = A_0 e^{g}$.

In this study, we shall bring in defense spending as an advancement in the stock of technology; lack and availability of which could affect economic growth. Thus, defense spending comes in as an additional factor causing technology to change and would add to the growth of A. this is reflected in the technology growth equation as

$$A = A_0 e^{g + Z\theta} \tag{2}$$

Where A denotes level of technology, g reflects the exogenous development of technology, Z shows vector of defense spending proxy by Total Military Expenditure (TOMILEX), rate of inflation (INFR) and rate of exchange (EXCR) that could influence the technology level and efficiency in the economy and ultimately, θ is a vector of unknown coefficients related to the variables.

Solving for labour intensive form of Equation 3, we then have;

$$y = k^{\alpha} A^{1-\alpha} \tag{3}$$

In which y is output per worker, k is capital per worker and A is technology. Substituting Equation 4 into Equation 5 and solving further, we then have;

$$\log y = \phi + \alpha \log k + \lambda Z \tag{4}$$

Within the steady-state, it is surmised that the growth of capital is constant. Therefore, $\alpha \log k$ is a constant expression and we arrive at;

$$y = \phi + \lambda Z \tag{5}$$

Where Z is Total Military Expenditure (TOMILEX)

3. METHODOLOGY

Secondary annual data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin and World Bank Development Indicator (WDI) covering 1980 and 2017 were employed for the study. Defense spending which is the explanatory variable was proxied by Total Military Expenditure (TOMILEX) while economic growth which is the explained variable was substituted by real GDP. Toda-Yamamoto (TY) technique was used to analyse the causal relationship between defense spending and growth. This was done because it could correct the difficulties connected with the conventional Granger causality technique by neglecting any likely non-stationarity or co-integration between series when verifying for causality. The technique best fits a conventional vector autoregressive model in the levels of the variables rather than the first differences as the case with Granger causality test thereby limiting the risks connected with the tendency identifying wrongly the co-integration order of the variables (Mavrotas & Kelly, 2001).

The economic model specification was expressed such that growth is a product of Total Military Expenditure (TOMILEX). In the model too, Rate of Inflation (INFR) and Rate of Exchange (EXCR) were factored in as control variables because they had influence on the nexus between defense expenditure and growth. From the foregoing, exchange rate (EXCR) has an influence on defense spending which in turn has an influence on growth. Contrariwise, Rate of Inflation (INFR) has an influence on defense spending which then have an impact on growth. Hence, the nexus between defense spending and growth could be elaborated by the transmission mechanism of Rate of Exchange (EXCR) and Rate of Inflation (INFR). Therefore, the econometric model is specified thus;

$$GDP_t = \phi + \lambda_1 TOMILEX_t + \lambda_2 INFR_t + \lambda_3 EXCR_t + \mu_t \qquad (6)$$

Where growth is substituted by gross domestic product (GDP), defense spending proxy by Total Military Expenditure (TOMILEX) denotes independent or explanatory variable while the control variables are Rate of Inflation (INFR) and Rate of Exchange (EXCR) and μ is the error term.

In the paper, natural logarithm of GDP and Total Military Expenditure (TOMILEX), while Inflation (I $LGDP_t = \phi + \lambda_1 LTOMILEX_t + \lambda_2 INFR_t + \lambda_3 EXCR_t + \mu_t$) and Exchange (EXCR) were in rates and hence re-specify Equation 7 as;

$$LGDP_t = \phi + \lambda_1 LTOMILEX_t + \lambda_2 INFR_t + \lambda_3 EXCR_t + \mu_t \quad (7)$$

Granger and Newbold (1974) argued that problems may surface while conducting regression with explicitly non-stationary series thus causing spurious outcomes.

In view of the above, this study adopts the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) technique to tests for our unit root in order to attain stationarity.

4. DISCUSSION OF RESULTS

4.1. Unit Root Tests

So as to eliminate spurious regression, it is important to ascertain the integration order of the series employed. The paper employed the Augmented Dickey Fuller (ADF) and Philip-Perron (PP) unit root technique. These tests were carried out using one model of constant only, the results are shown in Table 1 and Table 2. Results as shown in Table 1 and Table 2 indicates that only Inflation Rate (INFR) is stationary at level, I[0], while Exchange Rate (EXCR), Log Real Gross Domestic Product (LRGDP) and Log Total Military Expenditure (LTOMILEX) are stationary at first difference, I[1]. Both tests reported the same results.

Table-1. Stationarity result for augmented Dickey-Fuller test of the variables (Constant only).

Variables	At levels ADF test statistic	Test critical values	At first difference ADF test statistic	Test critical values	Order of integration
EXCR	0.4355		-5.2209***	-3.639407	I(1)
INFR	-3.2167**	-2.948404			I(0)
LRGDP	1.6765		-4.8249***	-3.639407	I(1)
LTOMILEX	-0.1279		-8.0926***	-3.639407	I(1)

Addendum: ***, ** and * denote 1%,5% and 10% significance level.

Table-2. Stationarity result for phillips-perron test of the variables (constant only).

Variables	At levels PP test statistic	Test critical values	At first difference pp test statistic	Test critical values	Order of integration
EXCR	0.4456		-5.2183***	-3.6394	I(1)
INFR	-3.2876***	-2.948404			I(0)
LRG DP	1.4175		-4.8220***	-3.6394	I(1)
LTOMILEX	-0.1909		-7.7209***	-3.639407	I(1)

Note: ***, ** and * denote 1%,5% and 10% significance level.

So as to analyse the causal nexus between defense expenditure and growth, the findings are shown in Table 3 after employing Toda-Yamamoto (TY) causality test. This method enables us to analyse the causal nexus using raw data without being differentiated as required by conventional granger causality technique. Hence, preservation of the original properties of the data and guarantee of the nature of causal nexus between the variables unlike the existing studies on the subject.

Adopting TY causality test involves investigating the optimum lag length and underlying VAR model. The optimal lag was derived using Schwarz Information Criterion (SIC) as our guide after running the initial underlying VAR model. From the SIC result, lag 2 was chosen from the maximum lag length specified as 7. The results are presented in Table 3. this indicates that past real GDP does predict or cause the present level of defense spending as the probability value is higher than 0.05 (0.3799). Similarly, past total spending on defense does not predict or cause the present economic growth because the probability value is insignificant as this is greater than 0.05 (0.2185). Hence, it is concluded that the direction of causality does not run in either direction of causality.

Table-3. Result of causal relationship between defense spending and economic growth.

Null hypothesis	Wald statistic	Probability	Direction of causality
LRGDP→LTOMILEX	1.935502	0.379	No
LTOMILEX→LRGDP	3.041485	0.2185	No
LRGDP↔LTOMILEX			No

The findings from Toda-Yamamoto granger causality revealed that LTOMILEX cannot granger cause economic growth (RGDP). That is, LRGDP (lag 1 and lag 2) jointly cannot granger cause LTOMILEX and vice versa. Therefore, since the probability value (0.3799) which is 37.99% greater than the 0.05 or 5% significance level, means null hypothesis acceptance and alternative hypothesis rejection. Similarly, from Table 3, it also depicts that LTOMILEX (lag 1and lag 2) jointly cannot granger cause LRGDP. Therefore, since the probability value (0.2185) which is 21.85% greater than the 0.05 or 5% significance level, means null hypothesis acceptance and alternative hypothesis rejection. Therefore, the result of the granger block exogeneity causality tests under Vector Autoregressive (VAR) environment reveals that there is no causality direction between military spending and growth. Hence, the causal results of this study validates the studies of Topeu and Aras (2015); Payne and Ross (1992); Kusi (1994); Ward and Davis (1992) and Biswas and Ram (1986) whose results revealed no causality between military expenditure and growth (GDP). The Toda-Yamomoto (TY) Granger causality result on this study also supports the Neutral Hypothesis which affirms the existence of no causal nexus between defense

spending and growth. Based on the hypothesis, while variations in the magnitude of defense spending do not influence the economic productivities; growth does not influence the magnitude of defense expenditure either (Biswas & Ram, 1986).

5. CONCLUSIONS

This research analysed the causal nexus between defense spending and economic growth in Nigeria between 1980-2017 using Toda-Yamamoto (TY) technique. However, based on the drawing from the different aforementioned results, the paper concluded that there is no direction of causal nexus between defense spending and economic growth in Nigeria within the time frame.

With the emerged findings, results of Toda-Yamamoto Granger causality showed a non- causality between defense expenditure and economic growth. It means absence of uni-directional causality or two-way directional causality between defense expenditure and growth within the time frame and this supports the neutrality hypothesis as stated in the paper. The policy implication hinges on the fact that defense spending cannot granger cause economic growth and vice versa.

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